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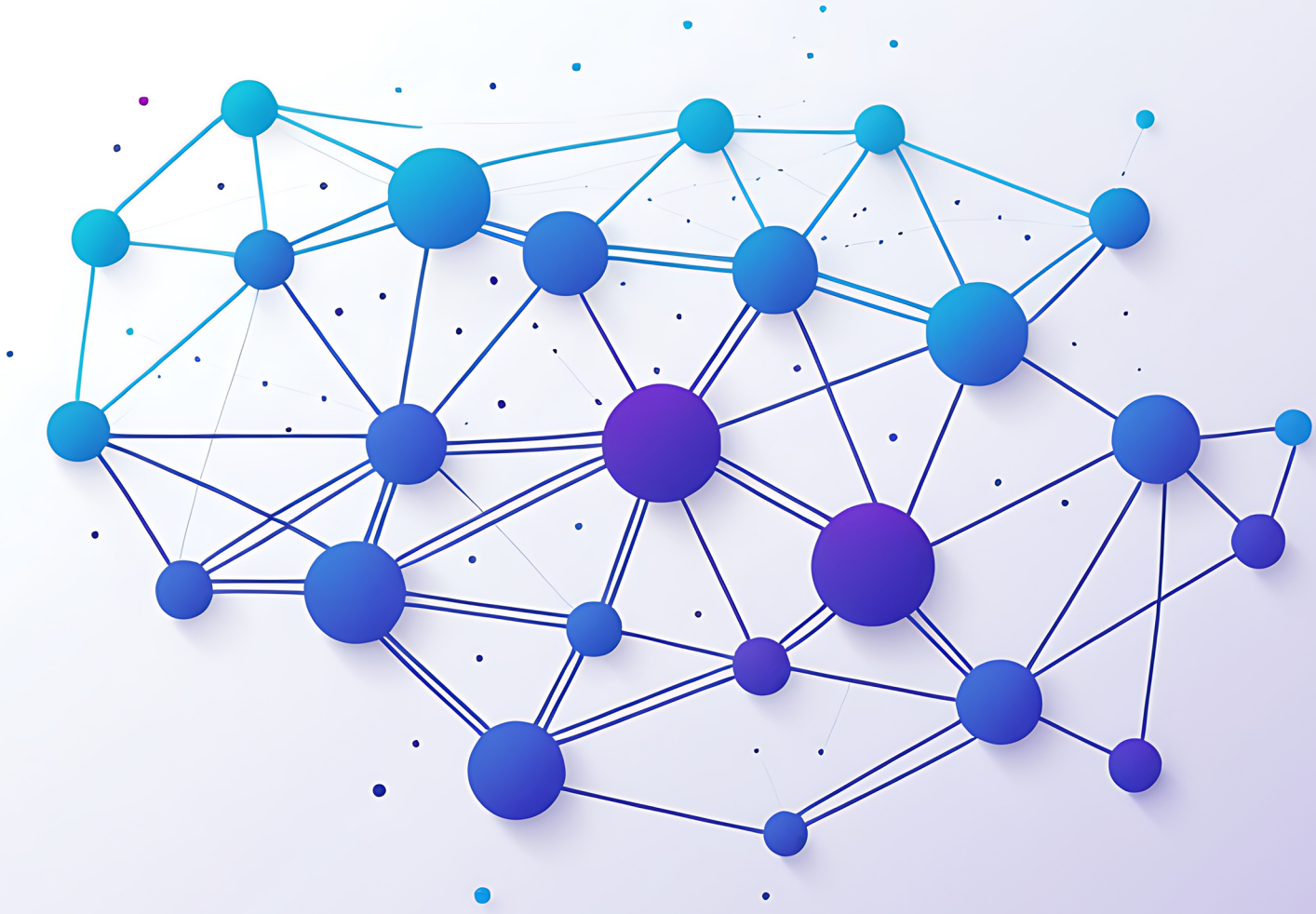
2024

SCIENCE AND CONNECTION

THE INTERDEPENDENCE OF DISCIPLINES



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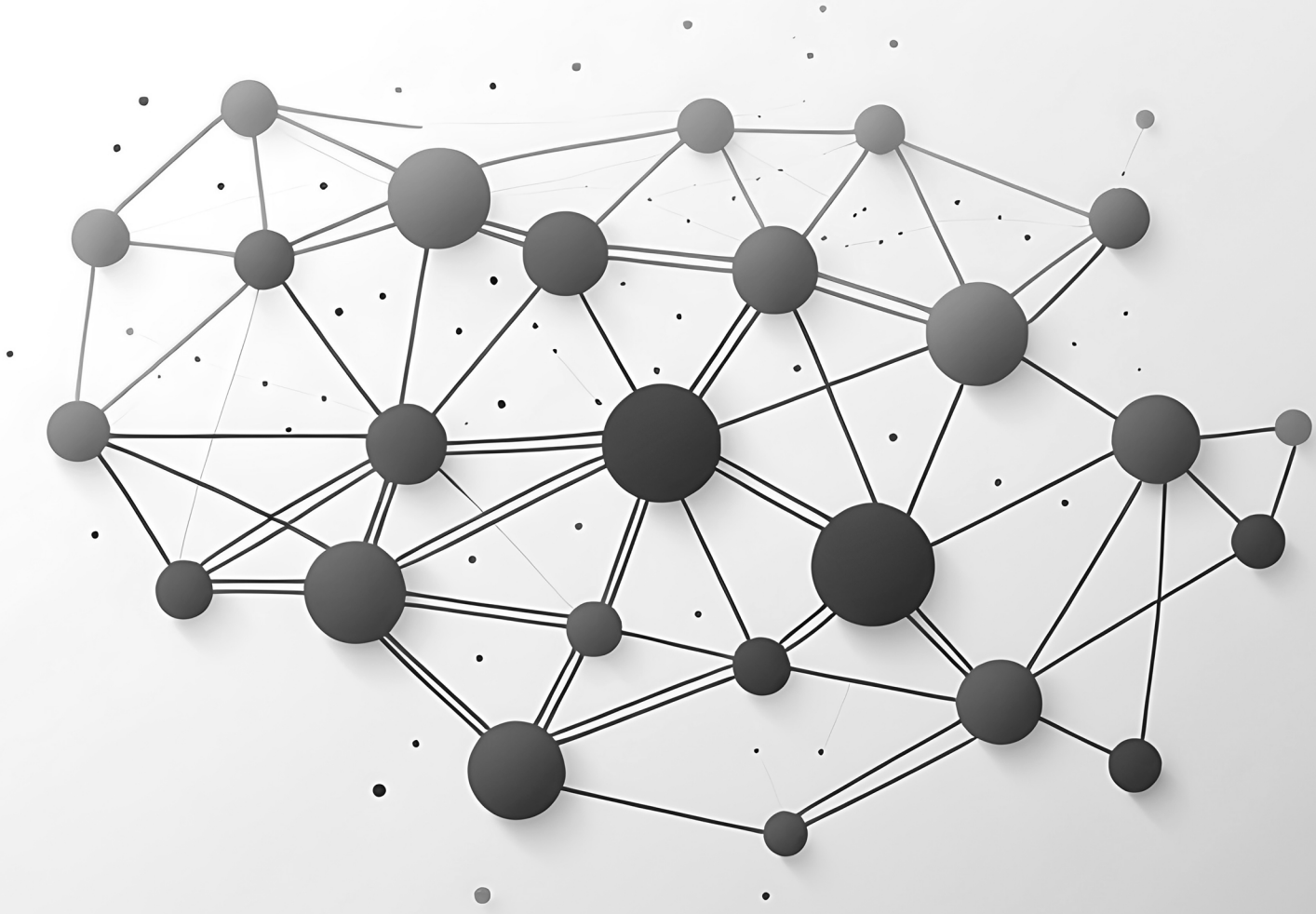

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PRESENTATION

Science is a field of knowledge in which different disciplines intertwine to form a greater whole. **Science and Connections: The Interdependence of Disciplines** is a work that expands this interconnection, bringing together 219 articles on various topics, written by experts from different areas of knowledge.

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MEMORY AND COLOR: CHROMATIC INTERVENTIONS IN THE HISTORICAL LANDSCAPE OF CURITIBA

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Ana Claudia Adamante[1]

ABSTRACT

This article analyzes the contemporary phenomenon of "rejuvenation" in urban landscapes, specifically through chromatic interventions, and its implications for the preservation of historical and cultural values. The study discusses the concern with cultural pasteurization and the degradation of historic centers, showing that chromatic interventions can result in disordered and questionable landscapes. In addition, the relationship between landscape and memory is addressed, emphasizing the social construction of collective memory. Color, understood as a constitutive element of the landscape, expresses historical and cultural values that connect history and local identity. Focusing on Largo da Ordem in Curitiba, the research reflects on how these interventions impact the symbolic identity of the historical space, questioning the role of a globalized aesthetic in the local cultural context. The methodology involves a bibliographic survey that explores the relationship between landscape, memory and color, analyzing the importance of color in the identity of historic centers. The article concludes that the contemporary desire for rejuvenation has profound implications for the preservation of historical heritage, challenging local identity in a world that values novelty over historical density. The analysis of chromatic interventions in the Curitiba landscape exemplifies the need to balance urban revitalization with the preservation of memory and local cultural identity.

Keywords: Landscape 1. Cultural Heritage 2. Color 3. Chromatic interventions 4.

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INTRODUCTION

Currently, a psychosocial phenomenon similar to "Dorian Gray Syndrome" is observed, characterized by a growing preoccupation with appearance and an aversion to aging. This phenomenon is not restricted to the individual level, but extends to cities, which begin to compete for a young and globally attractive aesthetic, driven by the search for an attractive urban identity and economic competitiveness (LIPOVETSKY; SERROY, 2013; SÁNCHEZ, 2010).

Kühl (2004) points out that this search for "rejuvenation" is reflected in urban renewal practices, which affect not only cultural assets, but also the authenticity and historical value of monuments and urban centers. Based on the contributions of Alois Riegl, who introduces the concept of "novelty value" in the appreciation of monuments, there is a tendency to give these elements a timeless appearance, contrary to the acceptance of the marks of time.

Cultural pasteurization, degradation of historic centers and the possible loss of urban identity are concerns discussed since the 1960s in documents from UNESCO, ICOMOS and the European Council. Despite reflections on color in historic buildings, practical results are limited. In addition, European articles such as Santopuoli (2012), Cardone (2017), Vitiello (2011, 2012) and Aguiar (2003) explore restoration, color and identity in historic centers, emphasizing the importance of color in cultural preservation. In Brazil, Ribeiro and Florenzano (2020; 2020a, 2020b, 2021) and Naoumova (2007; 2020) and Brendle (2012) address polychromy and urban identity, discussing the impact of chromatic interventions.

This article investigates the contemporary phenomenon of "rejuvenation" in historical landscapes, specifically through chromatic interventions, and its effects on the preservation of historical and cultural values, taking Largo da Ordem in Curitiba as a case study. The research reflects on how such interventions impact the symbolic identity of the historical space, questioning the role of a globalized and commercialized aesthetic in the local cultural context. The methodology consists of a bibliographic survey that explores the relationship between landscape, memory and color. National and international sources that highlight the importance of color in the identity of historic centers will be analyzed.

Chromatic interventions in historic centers can lead to decharacterization, resulting in questionable and disordered landscapes (SABATÉ, 2008). This contemporary desire for rejuvenation has profound implications for heritage preservation, challenging authenticity in a world that values only the new and immaculate.

RELATIONSHIP BETWEEN LANDSCAPE AND MEMORY

The palimpsest, like the landscape, presents superpositions, but they leave traces. These impressions are layers of life experience that stimulate investigation, a kind of archeology of the gaze, to obtain what is hidden, but which has left footprints, perhaps imperceptible, that need to be discovered (PESAVENTO, 2004).

In the same way as the landscape, memory has several meanings, depending on the discipline or individual who is using it. Individual perception is the result of the ordering of a culture based on the dynamics and uses of the space in which it is inserted. Thus, the relationship (positive or negative) with smells, noises, sights, textures and flavors is associated with cultural construction. For Duarte and Santos (2020), it is the memories, smells, and sounds of space, capable of arousing emotions in individuals. Accordingly, for Terraza (2015), memory is formed not only by the visual and spatial aspect, but also by the auditory and olfactory sphere.

All these aspects enable the identification of the subject with the landscape from an individual memory that is inserted in the collective memory, so the memory is full of individual interpretations. The seizure is carried out through the relationship between what is already known and what is being seized.

According to Pidner (2014), the relationship between the subject and the space can result in feelings of identity, belonging and affectivity as new meanings are attributed daily to the landscape. Memory has this individual dimension, but many of its referents are social, so the subject needs to resort to instruments provided by the social environment, such as ideas and words, which allow, in addition to individual memory, to have a shared memory, a collective memory.

For Halbwachs (1990), collective memory involves individual memories, but is not to be confused with them; it evolves according to its own laws. Thus, for the author, collective memory is not the union of several subjective memories, it is a social construction, constituted from the relationships maintained between individuals and groups.

The same author argues that individual memory depends on belonging to a social group. The isolated individual cannot form or maintain memories without the support of the testimonies of others. Individual memories are shaped by social interactions, resulting in a common heritage of memories. Although memory is collective, only the individual is capable of remembering. However, the subject is an instrument of collective memories, even when remembering individually. Thus, memory is social because every form of experience is also social.

The individual's participation in different groups results in fragmented memories, forming a mosaic. Rios (2014) supports the idea that the same process occurs with the landscape, being shaped in a unique way by each social group, thus reflecting its specific cultural identity. The groups project their image onto the landscape, which becomes a repository of their values and ways of life. The landscape allows groups to materialize their memories and identities, through monuments, historic buildings and architectural heritage. When a memory disappears, it means that the social ties that sustained it no longer exist, indicating that the group that cultivated this memory has ceased to exist.

The landscape also reveals the reality of the space at a certain moment in the process. The space built over the lifetime of people, considering the way they live, the type of relationship that exists between them and that they establish with nature. In this way, says Callai (2002, p. 97) "the place shows through the landscape, the history of the population that lives there, the natural resources it has and the way in which such resources are used". Therefore, an affective value is added to the landscape, an aesthetic sense capable of marking people's imagination and cultural identity, consequently affecting the collective memory.

Memories are constituted not only by directly lived experiences, but also by inherited and learned experiences transmitted by the groups during the socialization process. According to Pollak (1992), memories, both individual and collective, are composed of three elements: events, people (or characters) and places. The events can be experienced directly by the individual or "by table", through belonging to a group. The people who are part of the memories may have been from personal life or may be relevant public figures. As for the places, they may have been personally frequented for a period of time or have been indirectly incorporated into the subject's experiences.

Rios (2014) proposes that memory is a reconstruction of the past influenced by the interests and concerns of groups and individuals in the present. In this way, it becomes relative and changeable, subject to processes of reinterpretation and change. Although memory may vary, it is important that there is some level of agreement between the new representations and those already existing. Memories tend to work to preserve group representations. However, if the continuity between the new and the old is abruptly broken, an identity crisis can occur.

In this way, the relationship between the landscape and the collective and individual memory is reinforced. According to Andreotti (2012, p.8), the landscape "is logos, a discourse of memory, history and culture, and, as such, a paradigm of ethical and aesthetic values". In the landscape are represented the cultural values of a society, its styles,

customs, meanings, symbolic forms dense with values, experiences and memories (individual and collective).

CULTURAL LANDSCAPE, MEMORY AND COLOR

The relationship between landscape and color in the built heritage can be compared with the first reading of a person's face. This value judgment can cause impressions about aesthetic and beauty issues, or information about the person's state of conservation and health. The reading of the face – or landscape – reveals a lot about the style of "the soul(s) that inhabit this skin" (AGUIAR, 2003, p. 1).

Kühl (2004) goes further when he states that it is not only a "skin", which is an extremely important organ, but also a place that witnesses the passage of history. This cannot be dissociated from the architectural restoration process as a whole. It's not just a simple surface layer or a packaging design that can be easily changed. Ignoring the physical consistency, the formal structure of the building in its entirety and its historical context can seriously compromise the understanding of the work.

They are memories, scars, events and facts; a dense palimpsest of historical-cultural values, which, according to Fernand Braudel (1986-87 apud MENESES, 2002), must be carried and preserved on the skin – or in the landscape. The sum of these symbols makes cities, and landscapes, unique, bearers of a unique identity. No city has lived the same experiences or walked the same path.

Color is one of the constituent elements of the landscape, from which images and discourses express local culture and identity. Veiga and Tavares (2002) show that the color of the historic building is the aesthetic image of a monument, a street, a historic center, an urban landscape. It represents the heritage value of a given landscape and reflects the peculiarity of its identity and history.

In this way, the color in the landscape represents the character and identity of a culture and a region. Throughout history, color in Architecture was a reflection of the materials available on site. With these materials, there was a restricted range of colors, impossible to compare with the almost infinite possibilities of today. Aguiar (2003) goes on to observe that each city, each region, had its own colors, within specific tones, resulting from the different compositions of the minerals present in their soils. From these differences arose the effects of sfumatura, which are widely used in Italian treatises, so to speak, it is a slight variation of color that becomes unique to an urban place and its visual culture.

The colors of the urban landscape reflect the local identity and are directly associated with the cultural conditions of the region, called by Raimondo (1987 apud

BRENDLE, 2012) Colore Loci[2] They are extracts from history that connect its construction to sociocultural and technical conditions, composing the urban palimpsest.

THE LARGO DA ORDEM AND ITS COLORS

Largo da Ordem played a vital role in the economic and social development of Curitiba-PR, especially in the nineteenth century, when it became the center of the region due to the trade and transportation of cattle. Commercial activities intensified with the export of mate, attracting several foreign colonies to the outskirts of the city, significantly influencing its landscape (IPPUC, 1970).

In the 1950s, the Largo was a point of commerce, where settlers sold products, evolving over time to the trade of dry and wet products (GONZAGA; VIEIRA, 2010). Its historical importance was recognized in 1966, and concerns about preservation persisted in the following decades, highlighting the Revitalization Plan of the Historic Sector of Curitiba in the 1970s (IPPUC, 1970).

The transformation of Curitiba's landscape, centered on the creation of a Curitiba identity, was marked by the revitalization of traditional historical sectors in the 80s (IPPUC, 2023). The 2015 Master Plan and the 2019 Land Use and Occupation Zoning reinforce the concern with the preservation of urban identity and landscape, including guidelines for the identification and preservation of cultural assets, both material and immaterial (CURITIBA, 2015, 2019a).

Among the various historic buildings that make up the urban heritage of Largo da Ordem, there are some examples that illustrate the different historical strata that are imprinted in the local landscape.

RED HOUSE

The "Red House", built in 1891 by Wilhelm Peters, initially had a commercial function on the ground floor and residential function on the upper part. In 1919, the building acquired its striking characteristic when it was painted red and became the hardware house of Eurico Fonseca dos Santos & Cia. Between 1992 and 1997, it was rented by the Curitiba City Hall, serving as an exhibition space (PERIN, 2019). Currently, the ground floor houses, in part, the Bar do Alemão.

Next to the "Red House", two townhouses, one blue and the other beige, were residences of the painter Waldemar Curt Freyesleben. The blue townhouse, formerly known

[2] The term alludes to the idea of the concept of genius loci, according to Norberg-Schulz (2006), it is the essence of the place, involving shape, texture and color, which together determine an "environmental quality". With this, the terminology focuses on color as the essence of space.

as Casa Cruzeiro and the painter's studio, currently houses the Boesia Bar. The beige townhouse remains unused. In Source of the townhouses, a building that was once the House of Factories is now used by the Dynamico Course (PERIN, 2019).

Figure 1: Red House in 1913 and 2023: despite being a black and white photograph, it is noted that the contrast between the colors of the wall and the ornaments is not the same as today, in the same way that the shade of red used is more pigmented and dark than the preexisting color.



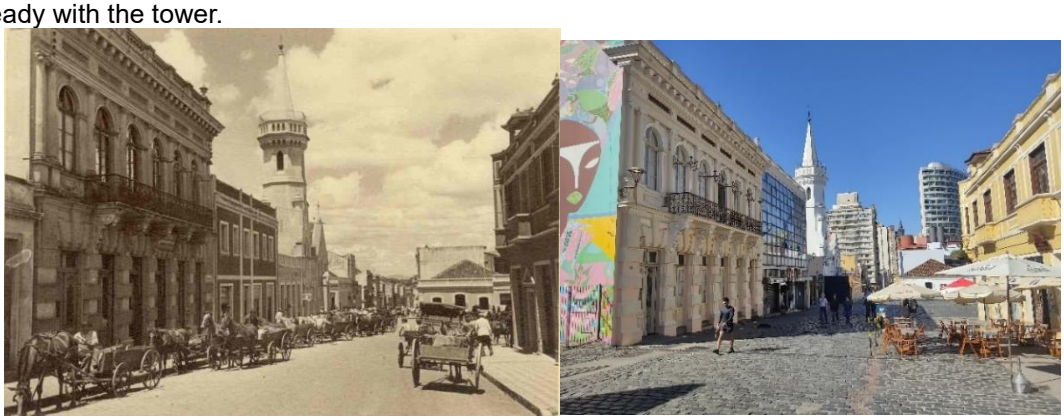
Source: Perin (2019); Author's collection (2023).

CASA HOFFMANN

The Hoffmann House, a two-story house built in 1892 by the German architect Neuman, is an architectural example with Germanic influence, reflected both in its structure and in the materials used (IPPUC, 1970). Originally, following the pattern of the time, it was intended for commerce on the ground floor and residence on the upper floor. For part of its history, it housed a fabric store and served as a home for a family of German immigrants.

In 2003, Casa Hoffmann underwent a significant transformation when it was inaugurated as the Center for Movement Studies. This change reflected a new proposal for the space, aiming to be a center for studies and experimentation of the movement, with a focus on valuing artistic expression and the cultural development of the region (HOFFMANN, 2023).

Figure 2: The settlers and their carts in the Largo in the 1950s; in the foreground the building on the left the Hoffmann House; on the right a part of the House of Rodolfo Strobel. In the background the Church of the Order already with the tower.



Source: Perin (2019), Author's collection (2023).

CASA STROBEL

Next to the "Red House", there is a building with an architectural style typical of Germanic houses, built in 1930 by Rodolfo Strobel, as indicated by the inscription "R. 1930 S." at its highest part. The Strobel family, of German immigrants, was responsible for the construction of the property (PERIN, 2019). In the 1980s, Largo da Ordem became a nightlife spot, highlighting the Bar do Alemão, which began in the warehouse of a store and expanded over time to become a reference in the region. The building previously housed a Casas Pernambucanas store, and currently, its ground floor is used for commercial purposes, including Largo's Bar and part of Bar do Alemão (PERIN, 2019).

FIGURE 3: Strobel House in 1930 when it had the Casas Pernambucanas on its ground floor; and nowadays using Largo´s Bar. It is noted that the cort used in the past presented a greater contrast between the wall and the ornaments.



SOURCE: Perin (2019); Author's collection (2023).

Largo da Ordem has not only witnessed the transformations of Curitiba over the centuries, but also reflects the city's identity, preserving memories and traditions through its buildings and commercial activities. The preservation of this heritage, both material and immaterial, is essential to keep the city's history and culture alive.

CHROMATIC INTERVENTIONS IN THE LANDSCAPE OF CURITIBA AND IN LARGO DA ORDEM

Regarding the chromatic changes in the landscape of Curitiba, in 1994 a Cooperation Agreement was signed between the Municipality of Curitiba and the Roberto Marinho Foundation, with the intervention of AkzoNobel. The same international company that carries out the Let's Colour around the World project arrives in Curitiba even before the project existed under this title, which only occurred in 2009, as seen earlier.

Taking this Term into consideration, Decree No. 246/1995 (CURITIBA, 1995) was sanctioned, which provides for the "Colors of the City" project, which covers part of XV de

Novembro Street and Barão do Rio Branco and Riachuelo Streets. It is a public-private partnership where the paints for the exterior painting were supplied to the owners free of charge by AkzoNobel. The interest of the project is in "recovering, revitalizing, preserving and valuing the heritage constituted by the historic buildings of the city center" (CURITIBA, 1995, p. 01).

After four years, the Cooperation Agreement was signed again and resulted in the project "Colors of the City – Phase II", following phase I, which would be an integral part of the Revitalization Project of the Barão/Riachuelo axis (CURITIBA, 1998). According to Decree No. 508/1998 (CURITIBA, 1998), technical criteria are established by the IPPUC, in addition to guidelines for the implementation of the project for the conservation, restoration and revitalization of the built heritage. The guidelines for chromatic interventions on the historic facades of the Center can be seen in FIGURE 4, where it is proposed how and with which colors the painting should occur.

FIGURE 4: Example of a color proposal made by IPPUC for historic properties located at Rua Barão do Rio Branco, 174, 158 and 146 in 1998.



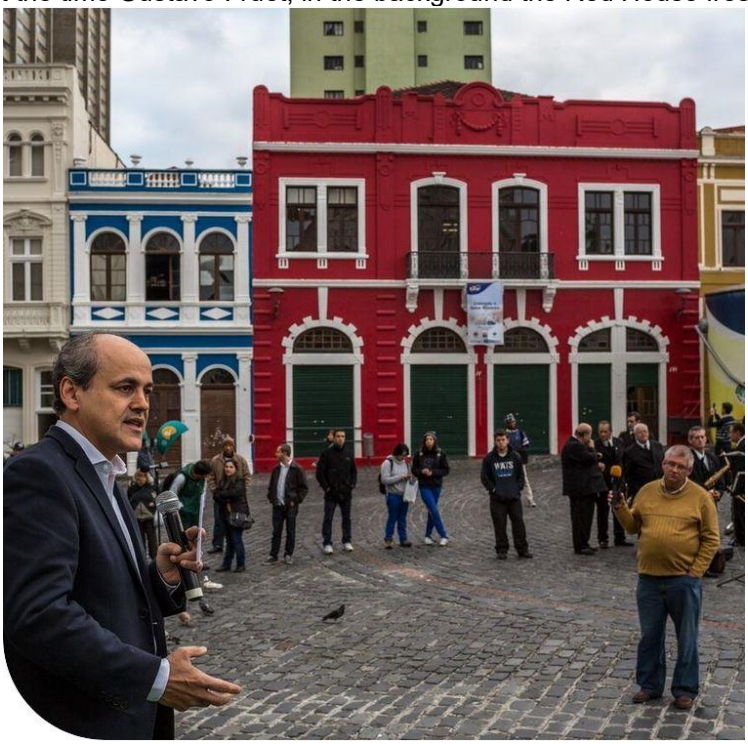
SOURCE: IPPUC (apud WEIGERT, 2020).

The chromatic revitalizations of historic facades continued in the following years. In 2005, actions were initiated within the scope of the "Tudo de Cor para Curitiba" project, once again in partnership with AkzoNobel, which resulted in interventions along Avenida Marechal Deodoro. This effort continued in 2010 with the intervention in 53 properties located on Riachuelo Street and, two years later, with the renovation of 14 buildings on São Francisco Street. In 2013, the partnership with Coral returned to the Historical Sector, starting a comprehensive revitalization process that began with the painting of the facades of the buildings (CURITIBA, 2013, 2014).

> More beautiful Historical Sector: The Historic Sector became more colorful, as a result of the project Tudo de Cor para Curitiba, which painted the facades of 32 buildings in the region, in partnership with the company Tintas Coral and the Business Network of the Historic Center (CURITIBA, 2016, p. 183).

According to AkzoNobel (2014) "the historic center of Curitiba was chosen to receive the 'Tudo de Cor para você' due to the buildings of great historical and cultural importance for the city", with this the program "promoted the renovation of the painting of 32 buildings in the historic center of the city, one of the most important areas of Curitiba". The celebration of the program in Largo da Ordem in FIGURE 5.

FIGURE 5: The celebration of the Tudo de Cor Program for Curitiba in 2014 in Largo da Ordem, in the foreground the mayor at the time Gustavo Fruet, in the background the Red House fresh in paint.



SOURCE: AkzoNobel (2014).

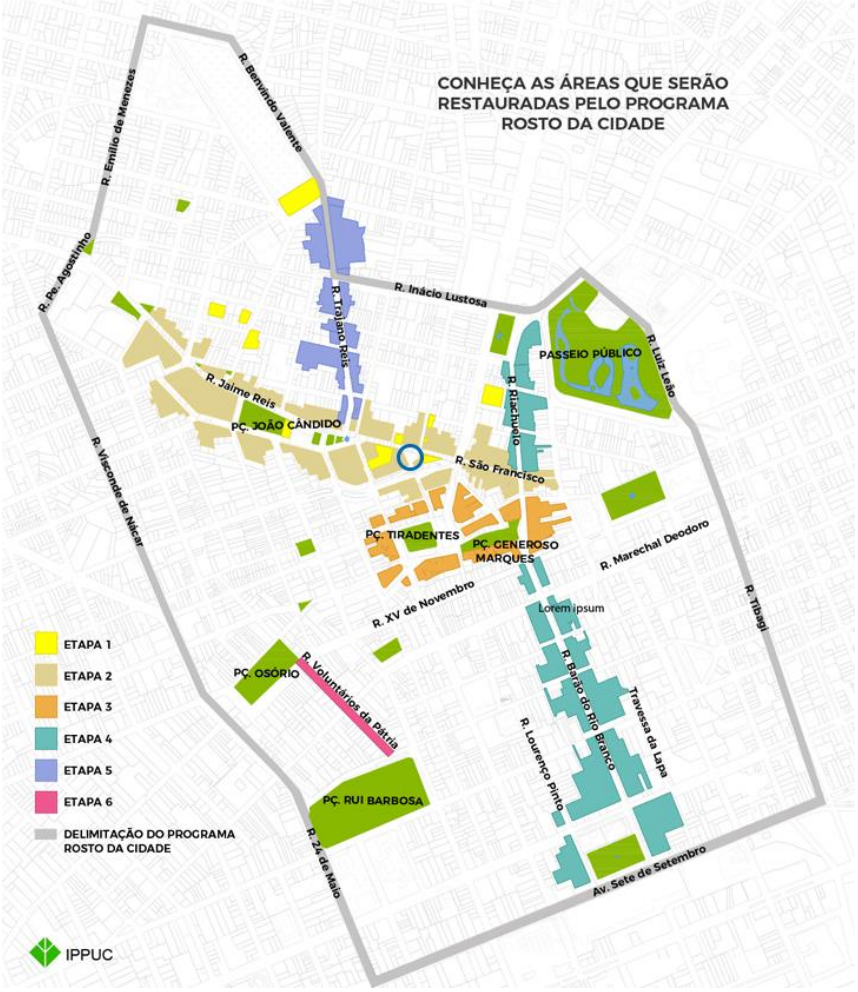
In 2018, the City of Curitiba launched a new project: "Face of the City", "a program to recover addresses and paths that are important for the collective memory of the population" (IPPUC, 2020, p. 28), with this quote it is noted the concern going beyond the visual aspects, encompassing the collective memory that is inscribed in the landscape. As exposed by the Curitiba City Hall (2018b), the project aimed to rescue the Center as a living, tourism and leisure area, being an investment aimed at generating jobs and income through tourism, in addition to the cultural preservation of the city.

In addition, according to the Law (CURITIBA, 2019b) that instituted the program, the objective was the "Recovery of the Landscape" by combating visual pollution, graffiti and

degradation of the city. Article 4 makes clear the responsibilities of the owners, who should "adopt and maintain the colors determined for the painting of the façade" (CURITIBA, 2019b). This model follows past initiatives of partnerships between the Curitiba City Hall and AkzoNobel, such as the "Colors of the City" project in 1995 for the painting of the Barão-Riachuelo Axis, and the "Tudo de Cor para você" project from 2010 to 2014, for the painting of Riachuelo Street, São Francisco Street and the Historic Sector (IPPUC, 2018).

The execution of the project was planned in six stages, mapped in FIGURE 6, where the cleaning of graffiti and the application of new paint with anti-graffiti resin were planned (CURITIBA, 2018a).

FIGURE 6: Polygon where the promotion of painting by the Face of the City Program was planned and the relative stages. The blue circle is the square that was scheduled to be the stage for the program in stage 2.



SOURCE: Annex to Decree No. 316/2019 (CURITIBA, 2019c), changes made by the author (2023).

The Face of the City begins with the painting of 14 municipal public properties, some of them, as seen in FIGURE 7, are located in Largo da Ordem or in its immediate surroundings, such as: the Romário Martins House; the Hoffmann House; the House of Memory; and the Curitiba Memorial.

FIGURE 7: Hoffman House setting for the first stage of the "Face of the City" project. In the background the tower of the Church of the Order, and the tables that occupy the sidewalk daily.



SOURCE: Curitiba (2018a).

In Stage 2, the interventions included Largo da Ordem (phase 1) and Rua São Franciso (phase 2), which are part of the Historic Sector of Curitiba, one of the building complexes with the greatest historical and cultural importance in the city (IPPUC, 2018). The cut that encompasses Stage 2 – phase 1, that is, the Largo and its surroundings, presents 66 properties that were part of the chromatic recovery proposed by the IPPUC. In FIGURE 8 it shows the surroundings of the square after the execution of the project.

Phase 2, involving São Francisco Street, involving 28 properties, aimed to value pedestrians and their landscape, the result of the proposal can be seen in FIGURE 9. The definition of colors was made by the IPPUC, in FIGURE 10 an example of how the registration of the properties related to this stage was made.

FIGURE 8: In the photograph, Dr. Claudino dos Santos Street, which gives access to Largo da Ordem itself, with the implementation of a 1.5-meter-wide concrete strip aiming at accessibility and painting of the facades.



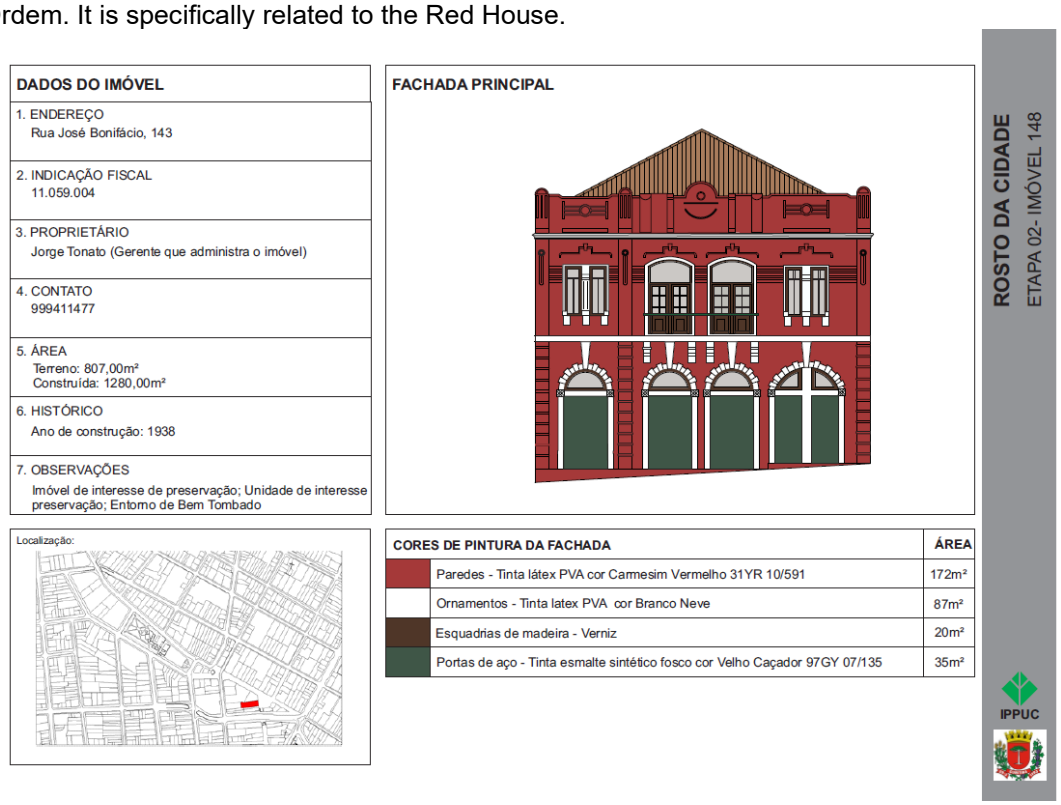
SOURCE: Mauro Magnabosco (IPPUC, 2020).

FIGURE 9: São Francisco Street revitalized with the implementation of an accessible lane and preservation of the historic floor; new public lighting system; and the painting of the facades according to the study elaborated.



SOURCE: Carla Choma Franki (IPPUC, 2020).

FIGURE 10: Example of a file with the color proposal made by the IPPUC for historic properties located in Largo da Ordem. It is specifically related to the Red House.



SOURCE: IPPUC (2018).

Stage 3 starts covering the Tiradentes and Generoso Marques Squares along with the surrounding region. 75 properties were mapped for this stage, which provides for the implementation of the accessible concrete lane, along with the preservation of the pavement and the existing petit pavé designs (IPPUC, 2020). The fourth stage comprises the 136 properties from the Barão-Riachuelo Axis to the Passeio Público (oldest municipal park, State Heritage since 1999), including the Cine Passeio, illustrated in FIGURE 42 that was also renovated (IPPUC, 2020).

Stage 5 involves Trajano Reis Street, where the painting of 71 architectural examples and the adaptation to the accessibility of the stretch was planned. The last stage comprises the Osório and Rui Barbosa Squares, and their connection through Rua Voluntários da Pátria. The interventions, as illustrated in FIGURE 43, aimed to provide qualified access to pedestrians, preservation of the historical drawings in pavement stone, improvement in lighting and painting of the Paraná Institute of Education (IPPUC, 2020).

As can be seen, the actions that take place all over the world, with a view to transforming the historical landscapes, are also present in Curitiba. For 24 years, a significant set of historic properties has been the scene of repeated chromatic changes, with clear concerns with the image of the city before tourists and possible investors.

FINAL CONSIDERATIONS

The connection between memory and color plays an essential role in the proposal to protect the chromatic memory of Largo da Ordem. The careful selection of colors for buildings, fundamental for the understanding and appreciation of architecture, demands deep historical knowledge (KÜHL, 2004). In architectural ensembles and historic centers, where the approach to surfaces must be historical and critical, there is an alternation between restorations and free interventions, highlighting the need for color planes that minimize changes in the consolidated image over time (Bonelli, 2004). In contexts such as Largo da Ordem, where the alternation between restorations and free interventions is a constant, the creation of a Color Plan proves to be essential to minimize drastic transformations and preserve the consolidated historical image of the space.

To face these challenges, it is proposed to prepare a Color Plan for Largo da Ordem. This proposal may include a Historical Survey that incorporates the technical knowledge of experts in architecture and history, investigating the original and traditional colors of the area. This investigation can be enriched through the research of historical photographs and the collection of older residents, in addition to the use of pictorial prospecting. This step is essential to ensure that the interventions respect the chromatic identity of the region and the cultural memory of its inhabitants.

The elaboration of the Color Plan must harmonize the contributions of the community with the historical guidelines, resulting in a palette that preserves the authenticity of Largo da Ordem. When submitted to the community and local authorities, the plan should stimulate dialogue and exchange of feedback, promoting an inclusive and participatory approach. In addition, urban restoration and revitalization practices must prioritize not only a "youthful" and pristine appearance, but also the value of the marks of time and local characteristics that make the urban environment authentic and meaningful to its inhabitants. Thus, an approach that favors the harmony between tradition and transformation is suggested, aiming at the preservation of historical heritage without erasing its history.

In conclusion, the development of contextualized chromatic planes, combined with the participation of the community in the decision-making processes, are essential steps for a more integrated preservation. The implementation of a well-founded color plan not only safeguards the chromatic memory of Largo da Ordem, but also strengthens the ties between the community and its heritage, contributing to the preservation of a unique cultural identity that enriches both the urban scenario and the collective imagination of the region.

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THE ROMAN EASTERN FRONTIER AND THE PERSIAN WARS IN LATE ANTIQUITY: CONFRONTATION AND COEXISTENCE IN GREEK AND SYRIAC ECCLESIASTICAL SOURCES (410-428 AD)

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ABSTRACT

The history of relations between the Eastern Roman and Sassanid Persian Empires were permeated by warlike conflicts, at different times, between the two powers during Late Antiquity. This theme has been worked on by historiography, especially with emphasis on the conflicting moments recorded by the Greek sources that have come down to us. Considering the context of the search for the affirmation of different Christian strands in the Mesopotamian region between the two empires, in the first half of the fifth century AD, the objective of this article is to demonstrate that, in addition to the conflictual episodes that resulted in warlike confrontations, there was a need, at times, for negotiations and coexistence between the rulers of both empires in the face of the pretensions of the Christian elites that emerged on both sides of the border in the search for for political-administrative autonomy. For this analysis, the "Ecclesiastical Histories" of Socrates of Constantinople and Theodoret of Cyrus, written in Greek, and the "Acts of the Persian Martyrs under King Yazdgird I" and the "Synodicon Orientale" (Records of the Nestorian Synods), written in the Syriac language, will be used.

Keywords: Late Antiquity. Eastern Roman Empire. Sassanid Persian Empire. Political-religious and administrative conflict. Nestorian Controversy.

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INTRODUCTION

THE PROBLEM

The warlike conflicts fought between the Eastern Roman Empire and the Persian Empire[2] in Late Antiquity were numerous and were related to political, religious and administrative interests along the extensive Mesopotamian frontier shared by both. Such confrontations seem to intensify with the emergence of the Sassanid Persian dynasty in the third century AD.[3], when the Roman emperor Gordian III (238-244) organized an expedition to face the first campaign of the Persian king Shapur I (240-270) against the Roman Empire (DODGEON; LIEU, 1994). A detailed overview of the recurrence and interests that permeated these confrontations, as well as the search for diplomatic solutions, is provided in the work *Rome and Persia in Late Antiquity: Neighbors and Rivals* (DIGNAS; WINTER, 2007), which provides an analysis of sources and contextual information up to the fall of the Sassanid dynasty on the occasion of the Arab conquests in the seventh century.

However, what can be perceived in the historiography of these conflicts is the emphasis given to conflicting periods to the detriment of the negotiations established with a view to accommodating interests. As Jan Willem Drijvers (2009) observes, such perceptions that emphasize belligerence are mainly due to the predominance of the use of Greco-Roman sources that bring a biased image of Persian-Sassanid society. In order to try to circumvent the problem, the objective of this article is to analyze the conflict that occurred between the two empires in the years 421 and 422, which was quickly resolved through diplomatic channels, which resulted in agreements between the Eastern Roman emperor Theodosius II and the Persian king Bahrām V. It is noteworthy that the context of this conflict was surrounded by the emergence of Nestorian [4]political-religious ideas which flourished precisely in the fluid region of the Mesopotamian border between the two empires. In the Eastern Roman Empire, the conflict arising from such ideas became known as *the Nestorian Controversy*.

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[2] The term "Persian Empire" can be used generically to designate the political union of different peoples (Medes, Persians, Parthians, Aryans, Bactrians, etc.), who belonged to the Indo-European linguistic trunk and recognized themselves as descendants of common ancestors from the steppes of Central Asia (Transcaucasia and Transoxiana). Around the end of the second millennium B.C., they began to settle and live with other peoples of the geographical region of the Iranian plateau (Assyrians, Chaldeans, Elamites, Babylonians, etc.). After conquering the region, they were ruled by different dynasties, which can also name the empires they ruled: the Achaemenid Empire (550-330 BC), the Parthian or Arsacid Empire (247 BC-224) and the Sassanid Empire (224-651) (LIVERANI, 2016, p. 737-758).

[3] All other dates listed refer to the period after Christ, unless otherwise indicated.

[4] The Nestorian ideas were related to the attempt to explain the relationship established between the divine and human natures in the incarnate Christ. One of the main defenders of the period was Bishop Nestorius of Constantinople, who ascended to the episcopal see of the capital of the Eastern Roman Empire in 428, on the recommendation of Emperor Theodosius II.

To understand to what extent the emergence of Nestorianism influenced the internal political-religious balance in both societies, based on the interaction between the Persian and Roman Christian elites of the Mesopotamian region, and how it conditioned the foreign policy between their rulers, especially during the war of 421-422, the present analysis will comprise the period from the first Synod of the Persian Church, occurred in 410, until the installation of Bishop Nestorius, in the episcopate of the capital of the Eastern Roman Empire, Constantinople, in 428. The organization of the Persian Christian clergy can be seen in the *Records of the Nestorian Synods* (*Synodicon orientale*), which took place in the years 410, 420 and 424. The information from these records will be supplemented with the narratives of the *Acts of the Persian Martyrs* under King Yazdgird I, in order to better understand the relations between the royal power and the Persian ecclesiastical hierarchy. In addition to these documents, the interaction of this hierarchy with the Christian communities in the Eastern Roman Empire will be verified through the *Ecclesiastical Histories* of Socrates of Constantinople and Theodoret of Cyrus, whose texts describe the exchanges of episcopal embassies sponsored by the sovereigns of both Empires. It is, therefore, documentation of ecclesiastical origin contemporary to the events investigated.

From these analyses, it can be seen that Christian groups located on both sides of the fluid border between the Persian and Eastern Roman Empires, although subject to different political powers, shared feelings of belonging and common interests that brought them together around the political-religious culture that would come to be labeled Nestorianism. The evidence also indicates that the association between these groups affected the balance of internal forces that supported the sovereigns of both Empires, requiring these rulers to develop strategies and take joint actions in view of the common problem. In the Eastern Roman Empire, this situation contributed to the emergence of the *Nestorian Controversy*, when Nestorius, one of the members of this supraterritorial community, was appointed bishop of Constantinople. In the Persian Empire there is the persecution waged by the sovereign against the Christian population described in *the Acts of the Persian Martyrs*. This context, which required negotiations between both rulers, conditioned the rapid resolution of the war of 421-422 between the two empires.

THE RHETORICAL BATTLE IN THE DOCUMENTS

Considering that the disputes between the Eastern Roman and Sassanid Persian Empires had political-religious and administrative components, the nature of the sources of Late Antiquity for access to these conflicts resulted in testimonies highly permeated by the partisan passions of those who produced, kept and transmitted them (CARRIÉ, 1999, p. 11-

25). Inserted in the disputes for affirmation between the different Christian strands that coexisted in the context, such documents can be considered propagandistic pieces, of refined rhetorical elaboration, which aimed to meet the interests of the factions that faced each other in the political-religious arena. Therefore, they are made up of discursive artifacts that must be questioned not only as vestiges of the past, but also through the subjectivity or intentionality of their production as surrounded by the reality of those who manufactured them. In this sense, the analysis of the content and the public for which these discursive constructions were intended allow us to speculate on the motives and objectives underlying them (FUNARI, 2003, p. 21-27).

In this perspective, the *Synodicon Orientale* or *Register of Nestorian Synods* is inserted , which consists of the gathering of the minutes related to the procedures and decrees established in the Synods of the Church that took place in the territory of the Persian Empire and, later, those held after the conquest of the region by the Arab peoples, in the middle of the[5] seventh century and are related to thirteen Synods that took place between the years 410 and 775. The translator into French, Jean-Baptiste Chabot (1902), organized the edition from copies of the manuscripts produced by the patriarchs of the episcopal see of Seleucia-Ctesiphon, at the end of the eighth century. The copy of the archetype is identified as MS K VI, 4 and is part of a set of forty-six Syriac manuscripts belonging to the collections of the Borgia Museum in the Vatican's Congregation for the Propaganda of the Faith. The rest of the material is identified as Syriac MS 332, belonging to the National Library of France (CHABOT, 1902, p. 1-16).

The three synodal acts that allow us to glimpse the conflict in question and its developments refer to the Synod of the year 410, presided over by the Catholicos[6] Ishāq (*Syn. orient*. I, p. 253-275); in the year 420, presided over by the catholicos Yahballāhā (*Syn. orient*. II, p. 276-284); both Synods that took place under the reign of Yazdgird I; and that of the year 424, presided over by the catholicos Dādīšō (Syn. orient. III, p. 285-298). Although Nestorius was not mentioned in the records of these first three Synods, as he would only assume a political-religious role after his appointment to the episcopate of Constantinople in 428, the editor of the collection suggested, in addition to the old title *Synodicon Orientale*, the alternative title of Records of the Nestorian Synods. Such a denomination does not seem at all inappropriate since, as mentioned earlier, the political-

[5] Dialect of the Aramaic language.
[6] *Catholicos* was the distinctive term claimed by the bishop of the See of the capital Seleucia-Ctesiphon, in the Persian Empire, and by the superior bishop of the ecclesiastical hierarchy in the kingdom of Armenia, who sought to establish primacy over all other metropolitan bishops of these regions (*Syn. orient*. I, p. 253; Moses of Korene, *Hist. arm.*, III, 49).

religious culture that would later be called Nestorianism had already flourished in the region at least since the final decades of the fourth century.

Analysis of these minutes provides relevant information about the relationships of the Christian clergy with the Sasanian rulers and the ruling elites, civilian, military, and religious belonging to the Zoroastrian clergy[7]. They also provide indications about the conflicts within the Persian Christian communities themselves. This helps to visualize the maneuvers through which Yazdgird I and Bahrām V sought to maintain the political-religious balance of all this diversity, in order to ensure the central role they played in Persian society. In view of the diversity of the actors, ecclesiastical, civil and military cited in the minutes, the prosopographic analysis is a valuable tool. The purpose of the prosopographic method is to collect biographical data of political and religious elites that transcend their individual lives from the perspective of analyzing groups of individuals based on their mutual contacts and common interests. (KOENRAAD; CARLIER; DUMOLYN, 2007, p. 41-43; PUECH, 2012, p. 155-168).

In this sense, data collected in the documentation itself provide general factors of interest groups and the motivations for their actions. In the case of the Persian elites, the data collected in the documents can be complemented from works such as *Studies in Sasanian Prosopography*, by Alireza Shapour Shahbazi (1998) and *Sources Sassanides et Prosopographie sur l'Antiquité Tardive*, by Rika Gyselen (2008). With regard to the Roman elites, based on the subsidies of the works A *Dictionary of Christian Biography and Literature to the End of the Sixth Century AD*, by Henry Wace and William C. Piercy (1999); *The Prosopography of the Later Roman Empire. Vol. II – A.D. 395-527*, edited by John R. Martindale (1980).

Samples of this information can indicate the intertwining of the Roman and Persian Christian elites in the Mesopotamian region, which indicate the need for agreements between the sovereigns of both empires in order to secure their territorial domains:

> ***Ishāq***. Catholicos of Seleucia-Ctesífon, capital of the Sassanid Empire, located in the Mesopotamian province of Bēth Arāmāyē. He was a native of the city of Kaskar in the province of Asūristān, also located in the eastern region of the Empire, between the Euphrates and Tigris rivers. He was related to a non-immediate predecessor, the Tomarsa catholicos. He was elected to the See of the capital after disputes with the Qayoma catholicos, who resigned after being persuaded by Mārūtā. After his election, he was arrested by the king after accusations made against him by his opponents in the ecclesiastical hierarchy. After being released, he presided over the Synod of 410, convened by Yazdgird I, together with Mārūtā. On that occasion, he tried and condemned his opponents, being supported by most of the bishops of the Mesopotamian provinces. He received letters of support from the Eastern Roman bishops Porphyry of Antioch, Acacius of Berea, Pachyda of Edessa, Eusebius of Tella, and Acacius of Amida (*Syn. orient*. I, p. 253-275; *Syn. orient*. II, p. 280-283; LABOURT, 1904, p. 89-92; ASMUSSEN, 2008, p. 932; BRUNNER, 2008, p. 757).

[7] Zoroastrianism was the dualistic religion, as well as Nestorian ideas, predominant in the Persian Empire.

Mārūtā. Bishop of Martyropolis, in the Roman province of Mesopotamia, in the Diocese of *Oriens*. He was sent by Theodosius II, on more than one occasion, in embassies to the Court of Yazdgird I, at the beginning of the fifth century. Together with the Catholicos Ishāq, he presided over the Synod of Seleucia-Ctesiphon, in 410, which established rules for the restructuring of the Persian ecclesiastical hierarchy. It is recorded that he would have cured Yazdgird I of a chronic headache and, for this reason, would have won great esteem from the Persian sovereign. In addition, the Zoroastrian magicians tried to involve him in embarrassing situations before the king, as they feared that he might persuade Yazdgird I to become a Christian (*Syn. orient*. I, p. 253-275; Socrates, *Hist. eccl*., VII, 8, 1-20; LABOURT, 1904, p. 88-94; WACE; PIERCY, 1999, p. 863; HERMAN, 2014, p. 72).

As in the Eastern Roman Empire, the Persian ecclesiastical hierarchy sought to establish its circumscriptions based on the political-administrative geography of the Persian Empire. Therefore, the understanding of this organization can be complemented by the work of the Armenian writer Moses of Korene, *History of Armenia*, which brings us relevant information about the geography and administration of the Sassanid Empire in the period.[8] The writer divides his work into three books, the closest date of which is the second half of the fifth century (TRAINA, 2007, p. 164; MAHÉ; MAHÉ, 1993, p. 11-15), and the third and last book comprises events ranging from the end of the Arsacid monarchy (428) to the death of the bishop (439), a period in which Armenia is absorbed by the Persian political-administrative structure (Moses of Korene, *Hist. arm*, III, 58-68).

With regard to the Eastern Roman Empire, the association between bishops and imperial officials who congregated in the factions led by Nestorius and his main opponent, Bishop Cyril of Alexandria, can be perceived. These associations conditioned the actions of the Eastern Roman Emperor Theodosius II to alternate support between the two factions in favor of the security of his position as ruler (FIGUEIREDO, 2018, p. 110-134). This strategy seems to be similar to that adopted by the Persian sovereigns. To also visualize this disposition in relation to the Sassanid elites, in addition to the information extracted from the minutes of the Synods mentioned above, one can also reaffirm this consortium between ecclesiastics and laity through the *Acts of the Persian Martyrs under King Yazdgird I*. These accounts have aroused the interest of historians in terms of the study of the formal recognition of the Persian Church and the structuring of its hierarchy.

They are also part of the recent debates about the alternation in the periods of support and persecution of the Christian population of the kingdom by the Persian sovereigns (BROCK, 1982; PAYNE, 2015). Since such analyses are restricted to understanding the correlations of internal political-religious forces in Sassanid society,

[8] According to Giusto Traina (2007, p. 164), there are no records that contemporary textual documents of Persian origin have reached us that give us knowledge of the administrative organization of the Sassanid Empire. In this matter, historiography makes extensive use of later narratives, preserved mainly in the Syriac language (e.g. The Chronicle of Arbela) and in the Arabic language (al-Tabari) (WIDENGREN, 2007). The work of Moses of Korene, being more contemporary, can give us a closer picture of the Persian administration.

without, however, extending the analyses to the external relationship with the Eastern Roman Empire, it is clear that historiography has encountered obstacles in understanding the reasons that led to the sudden change of position in the treatment given to Persian Christians by Yazdgird I and his son, Bahrām V, as well as the quick willingness of both sovereigns to end the war of 421–422. Thus, these documents must be inserted in a broader context that, in addition to contemplating the formation of factions among bishops and Persian royal officials, also makes it possible to offer an explanation for the alternation of support that has taken place, as will be shown later.

The *Acts of the Martyrs* is composed of five accounts by a Persian hagiographer named Abgar and narrates the martyrdom of Christian individuals from the provinces of Bēth Raziqāyē, Bēth Hadyab (Adiabene), Bēth Garmai and Hormizd-Ardašīr, during the rule of Yazdgird I. The text was translated into English and published in a bilingual edition, for the first time, by Geoffrey Herman, in 2016, from the manuscript MS BL Add 7200, from the XII/XIII century, kept in the British Library, London, and the manuscript MS Berlin Or. Oct. 1257, held at the Staatbibliothek, Berlin. Paul Devos (1965, p. 303-328) and Scott McDonough (2008b) agree that the texts are contemporaneous with each other and can be dated between the years 421 and 424. It is a rich material that can be put into dialogue in the minutes of the Synods, making it possible to identify political-religious actors with regard to their performance in the balance of forces based on the prosopographical method:

> ***Tātāq***. Originally from the province of Adiabene (Bēth Hadyab). He held the position of royal domestic (high ranking in the Court). He would have abandoned royal service without permission and went on to monastic life. He was instructed, but refused to abandon the Christian faith. For this reason, he was arrested and brought by the chief of the magicians before Yazdgird I, being interrogated and executed (*Acta mart*. II, p. 28-35; HERMAN, 2014, p. 79; DEVOS, 1965, p. 303).

The meanings that can be extracted from these documents, written and preserved in the Syriac language, can be complemented by the narratives of Theodoret of Cyrus (ca. 393-460) and Socrates of Constantinople (ca. 380-?), who wrote their *Ecclesiastical Histories* in the first half of the fifth century, in the Greek language. They are documents that dialogue with each other, as their authors sought to offer, in addition to relevant information on the political-religious issues of the Eastern Roman Empire, also their particular descriptions of those events related to the conflicts between the ecclesiastical hierarchy and the Persian sovereigns. At the same time, they give important indications regarding the foreign policy of cooperation established between the rulers of both Empires when commenting on the episcopal embassies. These documents indicate that Socrates and Theodoret did not share the same political-religious views, since, in the environment of

great diversity in which they were inserted, they produced personalized versions of events that best satisfied the interests of their groups. In this way, the discourses they produced on the conflicts in Persia reflect the political-religious tensions within the Eastern Roman Empire itself, tensions that would contribute to the emergence of the *Nestorian Controversy*. These are documents that should be analyzed as representations that are "crossed by disputes and struggles for the power to categorize and classify – for the power to represent and to be represented" (BLÁSQUEZ, 2000, p. 188).

This same provision should apply to the discourses inserted in the documents of Persian origin and written in the Syriac language, described above. Socrates was a native of Constantinople and evidence indicates that he lived approximately between 380 and 440. His writing context is related to the conflicts between the various factions that faced each other in the imperial capital (URBAINCZYK, 1997). Thus, it is speculated that he belonged to the Church of the Novatians, composed of individuals who accepted the prevailing orthodoxy, but differed regarding the norms that governed the ecclesiastical organization. Everything indicates that the imperial power tolerated these dissident groups in order to better maneuver the political-religious diversity in Roman society (FIGUEIREDO, 2018, p. 143).

Bishop Theodoret (ca. 393-460) was a native of Antioch, and in his youth became bishop of the city of Cyrus in the province of Osroene. Like Nestorius, and most of the bishops of the Diocese of *Oriens*[9], he was a follower of the ideas of bishops Theodore of Mopsuestia and Diodorus of Tarsus about the duality of the nature of the body of Christ, a discussion that, in the theological field, was central to the debates of the *Nestorian Controversy*. Both authors declare themselves to be continuators of the work *Ecclesiastical History*, by Eusebius of Caesarea (approx. 263-339) and, thus, produced a genre of historical narrative that mixes events related to the situation of the Church under the different emperors who succeeded Emperor Constantine (272-337) (MITCHELL, 2015, p. 33-36).

With regard to the notion of history, which gives us the dimension of the political-religious and administrative intertwining in the context, Socrates (*Hist. eccl.*, V, Preface) stated that political and military events are intertwined with events related to the Church. Theodoret (*Hist. eccl.*, Preface), in turn, believed that the natural order of the world is not

[9] At the beginning of the fifth century, the Eastern Roman Empire was divided into two large circumscriptions called Praetorian Prefectures (Illyricum and East). These, in turn, were composed of smaller regions called Dioceses, which housed the Provinces, whose capital cities were called metropolises. The Dioceses of *Oriens*, Egypt, Pontica, Asiana and Thrace belonged to the Praetorian Prefecture of the East. The Praetorian Prefecture of Illyricum was composed of the Dioceses of Dacia and Macedonia.

random and uncertain, but, on the contrary, fulfills a divine plan, despite the existence of poverty and injustice. These perceptions are relevant to the understanding of the writing of both authors.

Socrates' work is divided into seven books covering the period from 305 to 439. For the purpose of this article, chapter 8 "Propagation of Christianity among the Persians by Maruta, bishop of Mesopotamia" will be used; chapter 18 "The renewal of hostilities between Romans and Persians after the death of Yazdgird, king of the Persians"; chapter 20 "A second defeat of the Persians by the Romans" and chapter 21 "The kind treatment of the Persian captives by Bishop Acacius of Amida", all inserted in Book VII. Socrates wrote in Greek and his work has been preserved in that language by different medieval manuscripts. The bilingual Greek/French edition translated by Pierre Périchon and Pierre Maraval, published by *Les Éditions du Cerf*.

Bishop Theodoret of Cyrus also wrote his *Ecclesiastical History* in Greek, although he stated that Syriac was his first language (ROHRBACHER, 2002, p. 126). His account covers the period from 325 to 428 and was probably only published after the death of Emperor Theodosius II, in 450 (LEPPIN, 2003, p. 228-229). He produced his work in five books, with emphasis on chapter 39, inserted in Book V, entitled "Of the persecutions in Persia and those who were martyred". The text was translated from Greek into French by Jean Bouffartigue and printed in a bilingual edition also by *Les Éditions du Cerf*. Therefore, the concern here is to bring together contemporary documents, produced by both Persians and Romans, which allow us to broaden the reading of those events related to the interaction between the Christian communities of the Roman-Persian border region and the resolution of the conflicts arising from these contacts. We add, however, that the meaning that can be extracted from the reading of these discursive artifacts is also surrounded by the reality of the moment of the one who reads and interprets them, thus creating a new representation of that reality that one wants to portray (JENKINS, 2005, p. 49).

From the treatment of this documentation, it becomes possible to offer a reading of them that indicates the need for negotiations and coexistence between the Roman-Eastern and Persian-Sassanid sovereigns, to the detriment of the warlike confrontations already well worked out by historiography.

THE NEGOTIATIONS: THE SEARCH FOR COEXISTENCE AND THE MAINTENANCE OF POWER IN ECCLESIASTICAL SOURCES

The first indication in the sources that attracts attention was the summoning of Nestorius, a monk of Persian descent and superior of a monastery near Antioch, to occupy

the head of the episcopate of the imperial capital Constantinople, in 428 (Nestorius, *Liber*, 376-377; CHESNUT, 1978). On the trip that took him to the imperial capital, Nestorius was escorted by the *magister utriusque militiae per Orientem*[10] Flavius Dionysius, who was returning from Persia, on a mission delegated by Theodosius II, which aimed to renew the peace treaty that had put an end to the brief war conflict between the two empires, which took place in 421-422 (TRAINA, 2009, p. 1-6). In that same year of 428, Moses of Korene, an Armenian writer of the fifth century, still reported that part of the clergy of the kingdom of Armenia who opposed *the Sahak catholicos* , defender of Cyrilian ideas (CONSTAS, 2003, p. 104), allied themselves with the local aristocracies and, with the help of the king of Persia, Bahrām V, deposed the Armenian king, Artashes IV (Moses of Korene, *Historia Armeniorum*, III, 63).[11] From then on, Armenia became a province (satrapy) of the Persian Empire, which bordered the Eastern Roman Empire. On the other hand, the Persian king granted the Armenian elites more autonomy in the management of their interests and domains (THOMSON, 2008, p. 665; GARSOÏAN, 1998).

This precedent in Armenia seems to have weighed on Theodosius II's decision to summon Nestorius to occupy the episcopal see of the imperial capital, Constantinople. This imperial strategy seems to aim to bring together and give greater political weight to the segments that congregated around him, especially the elites of the Diocese of *Oriens,* a border region with the Persian Empire, as we indicated before. It should be noted that the dualistic theology defended by Nestorius was part of a political-religious culture that longed for greater political-administrative participation in a structure that centralized a large part of decisions in Constantinople.[12] The emergence of this ideology can be traced to the final decades of the fourth century, when the separation of the two portions of the Empire occurred. The most prominent representatives of this theology at that time were Bishops Diodorus of Tarsus (?-392) and Theodore of Mopsuestia (350-428), whose episcopal sees were also located in the Diocese of *Oriens.*

However, by anticipating a situation that could move towards a solution similar to that adopted by the Armenian elites, Theodosius II's decision to give greater political weight to this group of which Nestorius was a representative seems to have helped to precipitate the

[10] He is the main military official (general) in charge of the defense of the Praetorian Prefecture of the East.
[11] As Richard N. Frye (1983, p. 120) points out, a branch of the Arsacids (Parthians), to which Artashes IV was a part, moved to Armenia when the Sassanids seized power in Persia in the year 224. This branch founded a new dynasty that ruled the kingdom until 428.
[12] As an example to indicate this centralization, we cite the vast epistolary correspondence of Bishop Theodoret of Cyrus, an ally of Nestorius, which shows us the intense exchange of letters between this bishop and officials of the imperial court in order to request resources of all kinds for the population of the province of Euphrastense, where the city of Cyrus was located (ROHRBACHER, 2002, p. 127). Teodoreto's network of correspondents was mapped by Adam M. Schor (2011) and Vincent Puech (2011).

emergence of the *Nestorian Controversy*. In addition to the theological issues brought into its core, the conflict also included ancient disputes between Antioch and Alexandria for preeminence in the Eastern Roman ecclesiastical organization. Such disputes also took place over the search for political control of the See of Constantinople, since its bishop was one of the members of the imperial court and, therefore, acted as an advisor in imperial policies. Regarding this multiplicity of interests, Pierre Bourdieu (2007, p. 62-64) already indicated that the religious field is a place of competition and the ideologies produced in it, aiming at the establishment of the monopoly of the instruments of salvation, are propitious to be used in the struggles for prestige and power among its members. Given the appeal that issues related to salvation[13] acquired in that context, Cyril, Nestorius, and their allies took advantage of the theological dispute to extend their spheres of influence to broad contingents of Eastern Roman society, or even beyond it, as in the case of the emerging Persian ecclesiastical hierarchy.

As already stated, in addition to these findings, the issue needs to be further explored in order to contemplate the interference that part of the Christian elites of the Persian Empire exerted in the process by associating themselves with the group to which Nestorius would emerge as one of the leaders. This concern stems from the fact that there was no clear and fixed boundary between the Persian Empire and the Eastern Roman Empire. The marks changed during the various wars that took place between the two empires in Late Antiquity.[14] As a result, the population living in this vast region shared common cultural elements, the most noticeable evidence, according to the documentation consulted, was the persistence of the use of a lingua franca on both sides, Syriac, a dialect of Aramaic, and the belief in a dualistic Christian deity as imagined by Nestorian theology. In this sense, Norberto Guarinello (2010, p. 121) emphasizes that borders, whether political, economic, social or cultural, have multiple faces and densities and it is through them that

[13] The theological question related to the definition of the correct divinity had a practical character for individuals, as it was related to the salvation of humanity (soteriology). In the conception of Cyril of Alexandria, inspired by the theology of Bishop Athanasius (296-373), the union of the divine and human natures in Christ was necessary for the redemption of humanity to take place. The teaching and example of Christ alone would not be enough to change human behavior. (LYMAN, 1993). On the contrary, in Nestorius' conception, inspired by Diodorus of Tarsus and Theodore of Mopsuestia, salvation would be a human task of ascension towards a perfect era, which would be realized from the pedagogy of the examples of the man Jesus and would not necessarily require the union between the flesh and the divinity for this to occur (FAIRBAIRN, 2007, p. 392).

[14] At the beginning of the fifth century, the territorial boundary between the two empires was maintained as established in the peace agreement negotiated between Emperor Jovian (363–364) and King Šāpur II (309–379). This agreement returned to the Persian Empire a vast area conquered by Emperor Galerius (305-311). In this sense, in the middle of the fourth century, the Persians retook important localities that had long been under Roman rule, such as, for example, the city of Nisibe, now constituted as the capital of the Persian province of Bēt 'Arbāyē. Later, the philosophical schools of this city became important centers for the dissemination of Nestorian theology (DARYAEE, 2011, p. 183; GREATREX, 2014, p. 166). For a broad perception of these border displacements during Late Antiquity, see DODGEON; LIEU (1994) and GREATREX; LIEU (2002).

individuals or groups confront each other, integrate or confront each other. It seems, therefore, that the boundary line between the "Persian being" or the "Roman being", in that circumstance and place, was not sufficient to separate individuals who had a certain number of belongings to share (REBILLARD, 2014, p. 105), among them the strong ties of a political-religious culture that yearned for greater political-administrative autonomy.

The Christian communities existing in the Persian Empire in the first half of the fifth century were organized based on conflicts inherent to the very need to establish an ecclesiastical hierarchy, as well as by the disputes for space in Persian society, waged with other political-religious forces, such as those religions represented by the Zoroastrian, Jewish, Manichaean and other clergy. Some legends permeate the accounts about the arrival of Christians in the Persian Empire. One of them, attributed to the Jacobite clergy[15], claimed the foundation of the episcopal see of the Persian capital, the metropolis of Seleucia-Ctesiphon, to the apostle Thomas, in the second half of the first century (LABOURT, 1904, p. 11-21). As in the great episcopal sees of the Roman Empire, such links to characters or remarkable facts of the Christian past were part of the struggles for prestige and power that permeated the structuring of the ecclesiastical hierarchy. This would have occurred as a result of the evangelizing efforts of the Christian clergy of the neighboring Roman-Eastern cities of Edessa and Antioch (ASMUSSEN, 2008, p. 930).

At the beginning of the fourth century, it can be seen that disputes over jurisdictions and preeminences in the sense of establishing the hierarchy of the clergy were already present. However, the conflicts that occurred during the reign of Šāpur II (309-379), who seems to have inserted the Persian Christian communities into the political game of external conflicts with the Roman Empire, would have led to the dismantling of the incipient ecclesiastical organizations (DARYAEE; REZAKHANI, 2016, p. 1-8). The reorganization of the Persian Christian clergy would not be resumed until the beginning of the fifth century, during the reign of Yazdgird I. At this time, although the Persian Christians were already spread throughout the Iranian plateau, the largest contingent of them seems to be concentrated in the border region with the Eastern Roman Empire (*Syn. Orient*. I, II and III).

According to Jérôme Labourt (1904, p. 5-6), Christian doctrines achieved greater penetration in this region of Mesopotamia, between the valleys of the Euphrates and Tigris rivers, precisely because of a cultural issue, since it was there that most of the adherents of the ancient Semitic Assyrian and Chaldean cults were concentrated, who met in Persian territory. The provinces located in this Mesopotamian region were the most strategic, wealthy, and concentrated important cities of the Persian Empire. In view of this, they were

[15] A denomination related since late antiquity to the adherents of the Syrian Orthodox Church.

regions subject to the direct control of the king. In the other regions, as indicated by Ze'ev Rubin (2008, p. 651-654), the control exercised by the central government was not uniformly effective. The Sasanian sovereigns respected the territories secured by the great lords of the kingdom (which could come from the Sasanian dynasty itself or from the diversity of other peoples such as Parthians, Medes, Aryans, Bactrians, etc., which made up Persian society). The leaders of these lineages admitted only nominal allegiance to the central government and, in this way, enjoyed a certain autonomy in their hereditary territorial domains. It is in this sense that one can understand the nickname of "King of kings" that was attributed to the ruler (DIGNAS; WINTER, 2007, p. 234; *Syn. orient*. I, p. 254). In other words, on both sides of the border, the Christian population was subjected to a centralized regime in the figure of the sovereigns, a situation that seems to limit the political-administrative participation of the Christian elites of those regions.

The Acts of the Synods of Seleucia-Ctesiphon, in 410 (*Syn. orient*. I, pp. 254-275), and of Bēth Ardashīr, in 420 (*Syn. orient*. II, p. 276-284), convened under the patronage of King Yazdgird I, indicate that this sovereign would have largely favored that meeting by placing the administrative structure of the Empire to support the reorganization of the Persian ecclesiastical hierarchy. Both records praise Yazdgird I as a protector of Christians, and he is even compared to the Roman emperor Constantine (306-337) for similarly decreeing freedom of worship for Christians in the kingdom after the long period of conflict with royal power in the fourth century (McDONOUGH, 2008b). Socrates (*Hist. eccl*., VII, 8), for example, propagandized that Yazdgird I was very close to converting to Christianity, a fact that was not consummated due to the untimely death of that king.

Yazdgird I is also perceived to have been very close to the Eastern Roman Emperor Arcadius (395-408), since, at the request of this Roman ruler, the Persian sovereign would have sent the eunuch Antiochus to the Court of Constantinople in order to act as preceptor to the future emperor Theodosius II. because, it seems, at that time, succession disputes were already being outlined in the Court of Constantinople (GREATREX; BARDILL, 1996, p. 171-197; KELLY, 2013). This favorable disposition among the rulers persisted after Arcadius' death. The minutes of the Synods of 410 and 420 and the narratives elaborated by Socrates and Theodoret reveal to us the good relations through the constant exchange of embassies in the period.[16] At the Synod of 410, the Roman imperial power sent Bishop

[16] In the Persian Empire, during the fifth century, rulers seconded bishops to diplomatic missions, as was the case in the Eastern Roman Empire (CANEPA, 2009; McDONOUGH, 2008a). The delegation of bishops to this role seems to indicate a strategy of the rulers aimed at maneuvering with the episcopal segment in favor of the political-religious balance. The perspective of analysis adopted by Julio Cesar M. Oliveira (2015), with regard to the intermediaries of communications in late antiquity, may collaborate in this perception.

Mārūtā of Martyropolis, of the Roman province of Mesopotamia, to collaborate with the *Ishāq catholicos* in resolving conflicts in the ecclesiastical hierarchy (*Syn. orient*. I, p. 254). Mārūtā would even have fallen into Yazdgird I's favor for having performed a miracle and cured the king's chronic headache (Socrates, *Hist. eccl*. VII, 8).

At this same meeting, it was possible to verify the reading of letters of support and friendship sent to the Persian clergy by the Eastern Roman bishops Porphyry of Antioch (Roman province of Syria I), Acacius of Berea (province of Syria I), Pachyda of Edessa (province of Osroene), Eusebius of Tela (province of Osroene) and Acacius of Amida (province of Mesopotamia) (*Syn. orient*. I, p. 255-256). That is, all these bishops belonged to Roman provinces bordering Persia. This disposition, which denotes a closer relationship between them, is also perceived on the occasion of the next Synod, which took place in the year 420, a few months before the death of Yazdgird I. This second Synod was presided over by the *catholicos* Yahballāhā, assisted by Bishop Acacius of Amida. On the eve of this meeting, Yahballāhā had just returned from an embassy to the Court of Constantinople, sent by Yazdgird I (*Syn. orient*. II, p. 276).

In these two Synods, the debates were centered on endorsing the canons of the Council of Nicaea, which took place in the Roman Empire in the year 325, in those provisions referring to the organization of the hierarchical structure, such as, for example, the form of consecration and the number of bishops per locality *(Syn. orient*. I, 263-273). This emphasis given to the organizational issues of the hierarchy, to the detriment of theological issues, seems to us justified when one perceives in the reading of the minutes the formation of factions of bishops who diverged about those rules. Although Yazdgird I determined the presence of the largest possible number of bishops from all over Persia to meet in those Synods, what can be seen, through the attendance lists, is the overwhelming majority of bishops from the Persian provinces of the region bordering the Eastern Roman Empire, since it was the region that concentrated the majority of the Christian population. Thus, one can find bishops representing the cities of Nisib (province of Bēth 'Arbāyē), Arbela (province of Bēth Hadyab/Adiabene), Karkā of Bēth Selōk (province of Bēth Garmai), Perāt (province of Maišān), among others, led by the *Catholicos* of Seleucia-Ctesífon.[17] The complaint of this majority group in relation to the other peers of the distant provinces was that they were loosening the rules that dictated episcopal ordinations. Moreover, they did so under the benevolent gaze of powerful individuals of the nobility and

[17] Details of the political-administrative organization of the Persian Empire, which served as the basis for the organization of the ecclesiastical hierarchy, can be consulted in Rika Gyselen (1989), Christopher Brunner (2008), Jes P. Asmussen (2008), Ze'ev Rubin (2008), Touraj Daryaee (2011), Michael Maas (2000) and Oliver Nicholson (2018).

Zoroastrian magicians (*Syn. orient*. I, p. 258-261).[18] They demanded, therefore, obedience to the rigid rules emanating from the Council of Nicaea and the submission of ordinations to the sieve of *the catholicos* (*Syn. orient*. I, p. 254-255). It is clear that the consecration strategy adopted by the Christian minority groups distorted representativeness, in view of the greater concentration of Christians in the Mesopotamian provinces. However, it seems to us that this was a maneuver favorable to Yazdgird I, since it diluted the power of the *Catholicos* and his allies in that strategic border region.

Despite favoring the Christian clergy, seeking to insert and use this segment in the balance of the political forces that supported it, Yazdgird I is considered an enigma for a large part of historiography, since, at the end of his government, the king would have undertaken virulent persecution of Christians (HERMAN, 2014, p. 67; McDONOUGH, 2008b, p. 129).[19] The most common justification used for this turn would be the submission of the king to the pressures of the Zoroastrian clergy due to the increase in the conversion of noble families to Christianity. However, analyzing the events surrounding the succession from Yazdgird I to his son Bahrām V, it can be conjectured that, as with the succession from Arcadius to Theodosius II in the Eastern Roman Empire, the Sassanid royal line encountered opposition among the nobles. There are even reports that suspect that the death of Yazdgird I would have occurred at the behest of noble opponents (SHAHBAZI, 2003, p. 255-262). It seems, therefore, that the Christians led by *the Catholicos*, taking advantage of the moment of political succession crisis, which began even before the king's death, allied themselves with the forces that opposed Yazdgird I, which would have led to the cruel martyrdoms described in the *Acts of the Martyrs* (*Acta mart.* I-V, p. 2-61) and in the *Ecclesiastical History* of Theodoret of Cyrus (*Hist. eccl.*, V, 39, 1-6).

After the death of Yazdgird I in 420, segments of the Persian elites attempted to prevent the accession of his son Bahrām V, the rightful heir in the line of succession, by passing him over in favor of a prince of collateral lineage. To secure his rights and assume power, Bahrām V marched towards Seleucia-Ctesífon supported by the army of al-Mundhir, ruler of the Arab tribe of the Lachymids (FRYE, 1983, p. 144). The minutes of the Synod of 424, now under the leadership of *the catholicos* Dādīšō (*Syn. orient*. III, p. 285-298),

[18] The epithet "Magus" was used in Christian sources to refer to Zoroastrian priests (Acta mart. I, p. 24). In the other sources these priests are identified as "mobed" (BIDEZ; CUMONT, 2007, p. v-xi). Regarding this priestly segment, Richard Payne (2015, p. 23-58) seeks to deconstruct the myth of intolerance attributed to him in relation to other religious associations. There can even be alliances between the Zoroastrian and Christian clergy in the defense of common interests.

[19] There is a historiographical debate about the existence or not of the persecutions at the end of the government of Yazdgird I. Some historians, such as Sebastian Brock (1982), with whom we are inclined to agree, based on the accounts of Theodoret of Cyrus (*Hist. eccl.*, V, 39, 1-6) advocate the existence of those persecutions. Another strand, which includes Geofrey Herman (2014), following Socrates of Constantinople (Hist. eccl., VII, 18) argues that the persecutions only occurred under the government of Bahrām V.

reveals the poor condition with which this segment of Persian Christians came to be treated after the succession conflicts that brought Bahrām V to power. Soon after his investiture, Bahrām V would have resumed the persecutions in a more forceful way, including with the support of the Zoroastrian mobeds (*Acta mart*. I-V, p. 2-61). The narratives of these persecutions reveal that many of those martyred Christians came from noble lineages, who worked in the Sassanid administration, thus indicating to us the dimension of the problem beyond the religious question.

It is also noteworthy that one of the canons approved at the meeting, and which expressed a demand of the new ruler, decreed the independence of the Persian Church in relation to the ecclesiastical hierarchy of the Eastern Roman Empire (*Syn. orient*. III, p. 296). This measure seems to have aimed to interpose barriers to possible alliances between the Christian clergy on both sides of the border and, in this way, avoid mutual interference, benefiting both rulers. Another effect of the political struggles in Persian territory resulted in the flight of many Christians to the territory of the Eastern Roman Empire. Socrates (*Hist. eccl*., VII, 18) reported that the Romans' refusal to comply with the extradition request of the fugitives would have given rise to the war of 421-422. This conflict was quickly resolved through diplomatic channels, which resulted in agreements between Bahrām V and Theodosius II (ZOUBERI, 2017, p. 123; SCHRIER, 2005, p. 75-86), who determined that the *magister* Flavius Dionysius would renew in 428, when he escorted Nestorius to Constantinople to assume the episcopate of the imperial capital.

The questions about the emergence and resolution of this war conflict are still not clear to historiography. Given the emphasis of Bahrām V and Theodosius II on its completion and in accordance with the terms established for its termination (HOLUM, 2004, p. 171-171), the conflict does not seem to have been enough to aggravate the good relations between the two Empires in the period. This leads us to believe that, despite the long history of conflicts between the two Empires in Late Antiquity, the strengthening of Christians in the border region required the two rulers to establish relations of coexistence for the benefit of the mutual security of their imperial domains. The exchanges of episcopal embassies using, including bishops from this border region, signal the willingness of the Persian and Roman rulers to maneuver politically with these individuals. In the case of Theodosius II, appointing Nestorius as bishop of the imperial capital meant getting closer to the expressive group of which he was a part and, thus, giving him greater political-religious weight in the center of power. However, this measure caused internal political imbalances in view of the contrary reaction of Bishop Cyril of Alexandria and his allies, thus causing the emergence of the *Nestorian Controversy*. On the side of Bahrām V, the constant

interference of part of the Eastern Roman clergy in the ecclesiastical hierarchy of the Persian Church was avoided, thus preventing the strengthening of Christian political-religious forces that could jeopardize the balance that the Sassanid Persian sovereigns sought to maintain in the internal political-religious game, especially with regard to control over the extensive and rich Mesopotamian region.

Recent analyses still find it difficult to explain the seemingly contradictory actions of the Persian and Roman rulers. In view of the documentary evidence gathered here, it can be indicated that the Christian communities on both sides of the fluid border of the Mesopotamian region between the Eastern Roman and Persian Empires, in late antiquity, shared interests that contributed to the construction of a common political-religious culture. The objective that moved the elites of these communities, both on the Persian and Roman sides, was to have greater political-administrative participation in relation to the Persian and Eastern Roman Empires to which they were linked. The evidence also indicates that the association between these groups affected the balance of internal forces that supported the sovereigns of both Empires, requiring their rulers to elaborate strategies and take joint actions in view of the common problem, especially as verified in the resolution of the war conflict of the years 421-422.

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BETWEEN FAITH AND LEGALITY: A STUDY ON THE REGULARIZATION OF PUBLIC LANDS OCCUPIED BY RELIGIOUS AND WELFARE ENTITIES IN THE FEDERAL DISTRICT

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ABSTRACT

The article explores the relationship between Church and State in Brazilian Constitutions, focusing on secularism and the growing political power of evangelicals. The research investigates how this influence impacts the regularization of public land occupied by religious and social assistance entities, which are objects of study in the Third Sector. Using a methodology that combines legal-constitutional analysis and the complex approach of Edgar Morin, the study highlights the historical construction of religious influence in Brazil. In the Federal District, urban expansion and population pressure complicate land regularization. Between 1991 and 2008, many legislative efforts failed due to violations of the Constitution and the LODF. Complementary Law No. 806/2009 and Law No. 6,888/2021 are important to resolve these issues, proposing new parameters for collaboration between the State and non-profit entities. The article's hypothesis, confirmed by statistical data, suggests that the increase in the political power of evangelicals influences the regularization of public land in the Federal District, evidencing a correlation between the growth of the evangelical population and the formulation of specific legislation.

Keywords: Laicity. Religious influence. Land regularization. Legislative Chamber of the Federal District (CLDF). Evangelical churches.

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INTRODUCTION

The present study examines the intricate relationship between Church and State in Brazilian Constitutions, focusing on secularism and the growing political influence of evangelicals in recent decades. The research investigates how this influence impacts the regularization of public land occupied by religious and welfare entities in the Federal District, a central theme in the study of the Third Sector. The relevance of the research lies in the need to understand how power dynamics and religious influence are intertwined in the formulation of public policies, affecting the urban and social development of the region.

The investigation seeks to analyze the possible correlation between the increase in the evangelical population in the Federal District and the formulation of legislation that aims to regularize the occupation of public land by religious and welfare entities. The study questions how this growing evangelical political influence, aligned with the national trend, can shape the process of land regularization, impacting the management of urban space and the relations between different religious groups.

In this context, the research raises the hypothesis that the growth of the evangelical population in the Federal District influences the formulation of laws that seek to regularize land occupied, especially by religious and welfare entities. To test this hypothesis, the study proposes to: 1) General Objective: To analyze the influence of the growth of the evangelical population on the regularization of public land in the Federal District. 2) Specific Objectives: 2.1) To examine the historical evolution of the relationship between Church and State in Brazil, from the imperial period to the present day; 2.2) To identify and analyze the legislation regarding the regularization of land occupied by religious and welfare entities in the Federal District; 2.3) To evaluate the statistical correlation between the increase in the evangelical population and the formulation of specific laws for land regularization and 2.4) To investigate the impact of religious political influence, particularly of evangelicals, on public policies in the Federal District.

Based on a methodology that combines the legal-constitutional analysis and the complex approach of Edgar Morin, the study aims to deepen the understanding of the dynamics of power and religious influence in the public sphere, contributing to the debate on the secularity of the State and the relations between religion and politics in contemporary Brazil. It is expected that the results of the research will provide subsidies for the formulation of more effective and equitable public policies, considering the issue of occupation of public land by religious and welfare entities in the Federal District, promoting a fairer and more sustainable urban and social development.

BETWEEN SECULARISM AND RELIGIOUS INFLUENCE: THE TRAJECTORY OF THE RELATIONSHIP BETWEEN CHURCH AND STATE IN BRAZIL

The Constitution of 1891 reserved 14,400 km2 in the Central Plateau for the future capital, establishing the secular character of the State. Although Brazil is secular, it is not atheist. The presence of the church has been a unifying factor in democracies. Here, "church" encompasses several Christian denominations, all within the scope of the Third Sector (Mendes, 2011, p. 113; Bulos, 2014, pp. 504-577-579).

There is a belief that the active participation of religious entities in public life contributes to social cohesion and to the promotion of ethical and moral values that underpin the Democratic Rule of Law, "promoting the existence of an active civil society, which is fundamental for the consolidation of democracy" (PAES, 2012, p. 62).

As will be analyzed below, over the centuries, churches have been responsible for a wide range of assistance, educational and citizenship promotion activities, acting as essential partners of the State in the provision of services to the most vulnerable population. Whether through social assistance, education, health or culture programs, traditional religious entities contribute significantly to improving the living conditions of the communities in which they are inserted (SILVA, 2006, pp. 326-351; NEVES, 2008, p. 366).

THE INFLUENCE OF THE CATHOLIC CHURCH

John Gilissen (2003, p. 17) discusses the influence of the Catholic Church on universal law, noting that canon law, belonging to the community of believers, exerts considerable influence on secular law in Western Europe. He highlights this influence due to the Christian universalism prevalent in the Middle Ages, the exclusivity of canon law in writing in Western Europe between the ninth and thirteenth centuries, and the competence of ecclesiastical courts in matters such as marriage and divorce.

The influence of canon law declines from the sixteenth century onwards, as states become secularized, especially after the French Revolution, when religious influence on law decreases significantly, especially in France. However, canon law continues to be one of the historical foundations of Western law, despite the advances of rationalism and natural law in the seventeenth and eighteenth centuries (KOSELLECK, 2016, pp. 270 and 280). Subsequently, it is noted that secularism in Brazil is constitutionally established with the promulgation of the first republican Constitution of 1891.

In the contemporary context of Brazil, there is a complex intersection between religion and politics, revealing a flexible boundary between these social spheres. This relationship manifests itself in diverse interactions, shaped by historical, cultural, and

political nuances. Religious leaders influence political institutions, religious discourses and values permeate debates and electoral campaigns, and religious manifestations often take on political connotations. However, this dynamic is heterogeneous and constantly changing, reflecting the diversities and contradictions of contemporary Brazilian society (ORO, 2005, p. 2).

In the current Brazilian political scenario, the marked influence of evangelical churches, particularly Pentecostals, in the political sphere stands out, evidenced by the formation of the so-called "evangelical benches" in different governmental instances, from the municipal levels to the National Congress, including the state and district Legislative Assemblies.

This presence generates a mimetic effect on other religious groups, such as Afro-Brazilians and Catholics, who show a growing interest in their political representation. This phenomenon is especially relevant in the context of the Catholic Church, which maintains a long-standing relationship with the Brazilian State, alternating between periods of proximity and distance throughout history. In addition, the rise of far-right groups within these religious segments is observed, pointing to a certain corrosion of the systems that underlie the Democratic Rule of Law, with potential implications for the country's political and social stability (FERREIRA, 2020, pp. 46-69).

A superficial analysis is carried out about the intrinsic relationship between the main religious expressions in Brazil, aiming to identify patterns, trends and transformations over time, with a view to a more comprehensive and grounded understanding of this complex and multifaceted phenomenon.

During Brazil's Colonial and Imperial periods, Catholicism was the official religion, with the state exercising control over the Church through the Portuguese Royal Padroado. Under this regime, the executive branch had a constitutional duty to protect and supervise the church, including the appointment of bishops. This relationship reflected a mentality of the Ancien Régime, valuing a liturgical view of the world as essential for the conservation of society (OLIVEIRA, pp. 76-96; NEVES, 2003, p. 27).

Esquivel (2003, p. 4) argues that the institute of the Padroado had a negative impact on Brazilian Catholicism, leading to a reduction in ecclesiastical influence due to submission to political power. This resulted in a conflicting relationship between the Church and the State during the Imperial period, marked by two major conflicts: the "Feijó Schism" (1827-1838) and the "Religious Question" (1872-1875). These events contributed to the gradual separation of church and state, culminating in the transition to republican rule.

According to Gabriel Oliveira (2017, p. 78), in the years that marked the process of Independence and the granting of the first Brazilian Constitution in 1824, disputes arose for the control of ecclesiastical competences among the political agents of the State, involving different sectors of the clergy. Themes related to the intersection of politics and religion dominated the debates, demonstrating the State's effort to centralize Church affairs, while liberal discourse incorporated religious elements into its rhetoric, reflecting an adaptation between the new constitutional prerogatives and the old religious beliefs.

After Brazil's Independence in 1822, the ruling elites were composed mainly of farmers and merchants, linked to the agrarian economy and interested in maintaining traditional structures, including the slave system and large property. Influenced by Enlightenment ideals, these elites consolidated a conservative and anti-democratic ideology, resisting industrial development and maintaining Catholicism as the official religion, although they tolerated other religions in private cults. They established a centralized political system, subordinating the Church to the State and implementing indirect elections based on qualified voting, excluding a large part of the population from the electoral process. Life tenure in the Senate and in the Council of State perpetuated the political elites, forming an oligarchy that monopolized power and titles of nobility (COSTA, 1999, pp. 10-11).

In Brazil of that period, liberalism was imported and did not emerge from a bourgeois struggle against aristocratic privileges. The lack of an active bourgeoisie limited support for liberalism, which came mainly from the rural strata. The landlord elites resisted the abolition of latifundia and slavery, restricting the reach of liberalism. The issue of slavery was central in all revolutionary movements, with a predominance of opposition to the emancipation of slaves due to the fear of revolts (LIMA JÚNIOR, 1968).

Elitist, racist and slave-owning behavior was common among revolutionaries, as observed in the Inconfidência Mineira and the Bahian Conjuration. Even with the participation of blacks and mulattoes, leaders such as Cipriano Barata expressed disdain for them. This elitist mentality was also manifested in the revolutionary proclamations, which guaranteed the masters' right to property over slaves, evidencing the continuity of the interests of the elites during the liberal period (TAVARES, 1817; MOTA, 1972, p. 154).

A peculiarity of Brazilian liberalism was its conciliation with the Church and religion. The presence of priests in revolutionary movements, such as in the Revolution of 1817, led them to be accused of propagating ideas of Homeland and Freedom and collaborating with revolutionary groups. The Right of Patronage and the participation of sectors of the clergy in Freemasonry explain this adherence to revolutionary ideas, evidenced by the posters

during the Revolution of 1817 exalting both the Homeland and the Holy Catholic Religion (COSTA, 1999, p. 31 *apud* GRAHAM, 1956, p. 121; ARMITAGE, 1943, p. 25).[6]

On May 3, 1823, members of the Brazilian Parliament gathered to participate in the first Constituent Assembly of Brazil. During a semester of intense work, the Assembly held 148 sessions and deliberated on 38 bills, 157 nominations and 237 opinions. It was not surprising to find several Catholic priests among the participants in the Constituent Assembly, given the historical influence of the Church in the country, where it had a cultural monopoly and played a significant role in the administration (COSTA, 1999, p. 132).

In addition, the Constitution of 1824, in its article 5, granted Catholicism the *status* of official religion of the State, prohibiting the public worship of other religions and attributing to the Catholic Church the control of civil records of birth, marriage and death, as well as the management of cemeteries (NOGUEIRA, 2012, p. 65). Item IV of article 92 also provided that: "*They are excluded from voting in the Parish Assemblies. IV. Religious, and any, who live in cloistered Community*".

At dusk on November 15, 1889, Ruy Barbosa sat in front of a ream of foolscap paper, pen in hand, recording the events of the morning. Thus, before the dust of Deodoro's cavalcade dissipated, he began to sign the Organic Decree that established the Provisional Government of the newly proclaimed Republic (BALEEIRO, 2012, p. 13).

According to José Afonso da Silva (2001, p. 254), the Provisional Government issued Decree 119-A, of January 7, 1889, drafted by Ruy Barbosa, establishing religious freedom with the separation of Church and State.

In his analysis, Rodrigues (2013, p. 158) highlights two different approaches in relation to the regime of separation between State and religions. While Brazil adopts a flexible separation, recognizing the religious fact as part of the culture, France opts for a rigid separation, where the State seeks to abstract the religious differences of citizens in favor of an ideal of "universal citizen".

According to Neves (2014, pp. 120-121), the Church hierarchy was initially perplexed by the new situation. In March 1890, all the bishops issued a Pastoral Letter in defense of the union between Church and State, sending to the President of the Republic, Marshal Deodoro da Fonseca, a document entitled "Complaint", even though he declared himself a Catholic. On July 20 of that year, the Catholic Party was founded in Goiás, launching candidates for the September 15 elections. The defeat considered "shameful" was

[6] On the participation of priests in the Revolution of 1817, see Maria Graham, Journal of a voyage to Brazil and residence there during the years 1821-1823. London, 1924 (translation into Portuguese, São Paulo, 1956, p.121). John Armitage, The History of Brazil. London, 1836, 2v. (translation into Portuguese under the title História do Brasil, Rio de Janeiro, 1943, p.25).

attributed to electoral fraud. It can be seen that "secularism as a socio-historical process in development" (VALENTE, 2018, p. 111) is increasingly associated with the liberalism that historically founded it.

It was only in 1910 that Rui Barbosa, who had already become disillusioned with a work he had co-authored years earlier, finally raised the banner of revisionism openly, albeit timidly. He exposed in the platform of the Civilist Campaign of 1910 some points that, in his view, needed amendments. Of the eleven points that he considered untouchable, the defense of religious freedom with the separation of Church and State stood out (BALEEIRO, 2012, p. 38). This understanding was echoed in the Constitution of 1891, precisely in article 72, paragraph 7, which provided for the following:

> "Article 72. The Constitution guarantees to Brazilians and foreigners residing in the country the inviolability of the rights concerning liberty, individual security and property in the following terms:
> Paragraph 7 - No cult or church shall enjoy official subsidy, nor shall it have relations of dependence, or alliance with the government of the Union, or that of the States."

Years later, with the reform of the Federal Constitution published in the Diário do Congresso Nacional on September 4, 1926, this article was as follows:

> "Article 72 of the Constitution is replaced by the following:
> Art. The Constitution guarantees to Brazilians and foreigners residing in the country the inviolability of the rights concerning liberty, individual security and property, in the following terms:
> Paragraph 7 - No cult or church shall enjoy official subsidy, nor shall it have relations of dependence or alliance with the Government of the Union, or that of the States. The diplomatic representation of Brazil to the Holy See does not imply a violation of this principle."

Once again, the religious expressed discontent with the loss of Brazil's status as the official religion of Catholicism and the cessation of public subsidies. The primate archbishop of Brazil, D. Antônio de Macedo Costa, expressed concern, warning that the total separation of church and state would disturb the national conscience and have disastrous effects in the civil and political sphere. Despite objections, the 1891 Constitution established not only the separation of Church and State, but also recognized only civil marriage, removing the public validity of religious marriage (WESTIN, 2021).

According to Esquivel (2003, p. 9), during the 1930s, under the government of Getúlio Vargas (1930-1945), there was a phase of "reconciliation" between the Catholic Church and the State. This rapprochement was facilitated by the friendship between Getúlio Vargas and Dom Sebastião Leme da Silveira Cintra, who had been appointed coadjutor archbishop of Rio de Janeiro and the capital of the Republic on March 15, 1921 (IHGB, 2024).

The close relationship between these two important public figures solidified an alliance that brought the Church and the State closer again, albeit in a different way from the traumatic experience during the imperial period. In the same period, the Catholic Electoral League was also established, associated with Catholic Action, which, according to Gomez de Souza (2004, p. 84), "analyzed candidates for electoral offices, based on some principles or requirements that it considered indispensable for the interests of the Church (indissolubility of marriage, religious teaching in schools...) and recommended or vetoed these candidates."

In the Constitution of 1934 there is a strong clerical reaction against the secularism present in the Constitution of 1891, which resulted in the reintroduction of the reference to divinity in the preamble, which reads: "We, the representatives of the Brazilian people, putting our trust in God...". This divine invocation, as highlighted by Araújo Castro, was a response to the religious sentiments prevalent in Brazilian society at the time, meeting the expectations of the vast majority of the population (CASTRO, 1935, p. 56)

Briefly, the Constitution of 1934 established the separation between Church and State, prohibiting the intervention of the public power in religious affairs and guaranteeing religious freedom. Poletti (2012, pp. 34-35 and p. 84) highlights the main provisions regarding this relationship, including the prohibition of establishing, subsidizing or hindering the exercise of religious cults; the guarantee of the inviolability of freedom of conscience and belief; the maintenance of diplomatic representation to the Holy See; protection against deprivation of rights on grounds of philosophical, political or religious belief; the guarantee of freedom of worship and acquisition of legal personality by religious associations; the secular character of cemeteries; the protection of the family by the State; and the regulation of civil marriage with legal effects also for the religious.

The spirit of secularism of the 1937 Constitution is evident from its preamble, which stands out for not mentioning the name of God, a common practice in the other Brazilian Constitutions, except those of 1891 and 1934. This Constitution reiterates the principle of separation between Church and State, by eliminating the clause present in the 1934 Constitution that allowed reciprocal collaboration between both (SCAMPINI, 1974, pp. 163-164)

As Mariano (2002, p. 142) points out, the 1946 Constitution reiterated the principles of separation between State and Church, as well as collaboration between both in the promotion of the common good. However, this did not imply equal treatment by the State in relation to the various religious groups during the Republican period.

On the contrary, despite the legal provisions, other religions, such as evangelical and especially mediumistic (Afro-Brazilian and Spiritist), faced difficulties in being socially recognized, being often accused of disturbing public order, practicing healers, and illegally practicing medicine (BALEEIRO and SOBRINHO, 2021).

Father José Scampini (1974, pp. 369-430) points out that the 1967 Constitution reiterated the principle of separation between Church and State, in accordance with the provisions established in the Constitutions of 1891, 1934, 1937 and 1946. This reiteration included the prohibition of establishing, subsidizing or interfering in religious cults, as well as maintaining any type of relationship of dependence or alliance with them. Notably, this Constitution introduced a restrictive clause on 'reciprocal collaboration', present in the Constitutions of 1934 and 1946. Finally, the 1988 Constitution maintained the provisions in force in the other constitutions in relation to the separation of Church and State.

The period from the 1960s to the 1980s was marked by significant political and cultural changes on a global scale, especially in Latin America. These transformations had a profound impact on the Catholic Church, leading to the emergence of movements such as Liberation Theology, which exerted a significant influence on Latin American Catholic clergy. Due to its continental social dimension, this movement became, in the view of many academics, one of the most progressive in the world (LIBÂNIO, 1987, pp. 260-278; GILL, 1994, pp. 403-425).

The truth is that the Catholic Church has consistently maintained its political protagonism in relation to other religious denominations. Lacerda (2017, p. 18) summarizes well what was the true political status of the Catholic Church in the first half of the twentieth century:

> "It is necessary to recognize that, contrary to what a certain secularist militancy seems to believe, the presence of the Catholic Church in Brazilian politics has always been, since the proclamation of the Republic in 1889 until today, much more the rule than the exception. If, officially, the proclamation led to the separation of the Catholic Church and the State, a good part of the Brazilian political establishment accepted Catholicism as the de facto official religion during the first half of the twentieth century."

And the same author continues: "among those who opposed such a state of affairs were precisely the Protestants" (LACERDA *apud* DELLA CAVA, 1976).

However, in parallel with this dynamic, other religions, especially the evangelical, with its multiple denominations, gradually emerged, conquering a growing space in both the religious and political scenes. This advance of evangelical denominations was marked by the expansion of their representation in the spheres of power, such as the formation of "evangelical benches" in different political instances, from the City Councils to the National

Congress. This phenomenon deserves a more in-depth analysis to understand its implications in the interactions between religion and politics in contemporary Brazil.

THE GROWTH OF THE EVANGELICAL CHURCH

Despite having participated in national public life since the nineteenth century, evangelicals, including immigration and mission Protestantism, and later Pentecostalism from the twentieth century onwards, only emerged as a political phenomenon during the New Republic. During the First Republic (1889-1930), its presence in national politics was practically non-existent. It was in the Vargas Era (1930-1945) that Brazilian evangelical leaders made their first and most significant political pronouncement in reaction to the strengthening of relations between the Vargas government and the Catholic Church. This pronouncement, known as the "Memorial", launched in May 1932, was led mainly by Presbyterian leaders and included demands typical of the secular tradition, liberalism and a social democracy of the time, such as secret ballot, quick and free popular justice, complete secularity of the State and official education, absolute freedom of expression, compulsory popular education and the promotion of pacifism (ORO, 2005, p. 7).

For didactic, historiographical and mnemonic purposes, the table below is presented in order to facilitate the understanding and analysis of the different categories of historical Protestants and Pentecostals, contributing to a better understanding of the concept of "Protestant" and/or "evangelical".

Table 1

Historic Protestants	**Pentecostal Protestants**
Presbyterians	Assembly of God
Methodist	Christian Congregation of Brazil
Baptists	Foursquare Gospel
Lutherans	Brazil for Christ
Anglicans	God is Love
	New Life
	Universal of the Kingdom of God
	And many others

Source: Authors' Research.

The research reveals that both conservative sectors of the Catholic and Evangelical Churches participated in and strengthened the Brazilian Military Regime that lasted 21 years from 1964 to 1985 (TOLEDO, 1989). Analyzing the contributions of evangelicals over this period, the complexity of this group is perceived, which is not homogeneous as many imagine. Within the evangelical milieu, there is a diversity of thoughts and actions that is still present today (CNV, 2014).

The theological and pastoral scenarios of the Roman Catholic Church and the Evangelical Churches during the 1950s and 1960s played relevant roles in the events related to the establishment and consolidation of the Military Regime in Brazil. While Catholicism witnessed the emergence of initiatives in favor of human rights, with the foundation of the National Conference of Bishops of Brazil (CNBB), the expansion of social and educational programs, and the holding of the Second Vatican Council (1962-1965), evangelicals also took a leading role through both lay and clerical leaders and groups, working in both urban and rural areas. This engagement was in contrast to the conservative developmental model adopted by the State, which neglected public policies aimed at reducing socioeconomic and cultural disparities (PADILHA et al, 2022, pp. 18-19).

Roughly speaking, the leadership of the Presbyterians (including its offshoot, the Independent Presbyterian Church) and Baptists supported the military coup of 1964, with the exceptions of Methodists, Episcopalians, and Lutherans. "Opposition with resistance existed among Protestants, but not officially" (PADILHA et al, 2022, p. 38).

Regarding this support, Araújo (2010, p. 95) clarifies that "among the evangelical churches in Brazil, the Presbyterian Church was the most involved and the most committed to the 1964 Revolution because of the links of this Church with the middle class and because of the political prestige it enjoyed in political and military circles".

The little resistance that came from this denomination was from Jaime Nelson Wright (1927-1999), the son of American pastors, who graduated in theology and did graduate work at Princeton University in 1950 (MEDICCI et al., 2017, p. 221). His trajectory was marked by deep political and social engagement, especially in the defense of human rights, driven by the disappearance of his brother Paulo Stuart Wright, a sociologist and politician impeached in 1973 during the Military Dictatorship (VILELA, 2016, pp. 179-194).

Jaime documented torture and murders practiced by the State, participated in events in memory of the victims of the dictatorship, such as the cult in honor of Wladimir Herzog in 1975, and, from 1979, collaborated with the Archdiocese of São Paulo in the project "Brazil: Never Again". He also participated in the I National Congress for Amnesty, and his legacy is celebrated annually by the 2 de Julho Foundation in the Jaime Wright Award for Promoters of Peace and Human Rights (PADILHA et al., 2022, pp. 19-20).

The influence of evangelical churches, especially Pentecostal ones, in Brazilian politics is a significant and growing phenomenon, manifesting itself in the "evangelical benches" composed of parliamentarians who represent their interests in various governmental spheres. The lists of parliamentarians, produced by DIAP, may contain errors and outdated information, as they use the criterion of evangelical faith, including members

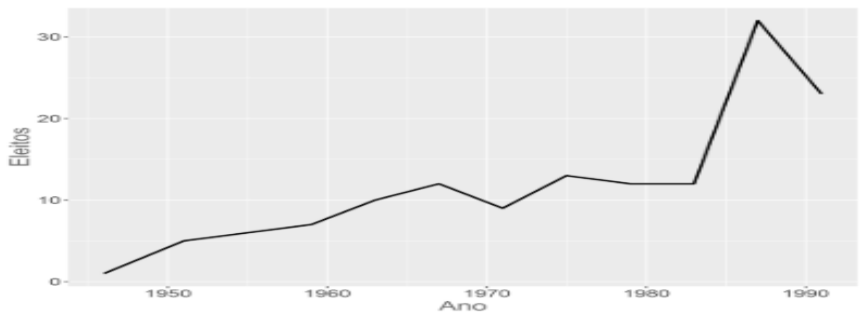
of historic and Pentecostal churches, and some not linked to any specific church (LACERDA, 2017, p. 63).

This influence manifests itself in a variety of ways. One of them is in the formulation and voting of bills that reflect the values and interests of evangelical churches, such as issues related to morality, family, education and health. In addition, evangelical churches have a considerable capacity to mobilize voters, which can be relevant in electoral periods (PIERUCCI, 1989, pp. 104-132).

This political extension of evangelical churches has generated debates and controversies, especially with regard to the secularity of the State and the guarantee of individual rights. Some critics argue that this influence may pose a threat to the separation of state and religion, while others argue that it is legitimate for religious groups to actively participate in the political process.

According to the data in Graph 1, regardless of opinions on the subject, it is undeniable that evangelical churches exert considerable influence in Brazilian politics and continue to play a significant role in the country's political scenario, with an exponential growth perceived during the last decades, as Freston (1993, p. 167) points out, when referring to the number of Federal Deputies and Evangelical Senators elected between 1946 and 1991:

Chart 1



Source - Freston (1993: 167)

In current times, significant transformations in the religious panorama can be observed from the perspective of Robbins (2008, p. 127), who in the last three decades (...) "they appear to be a period of especially rapid growth in Asia, Latin America, Africa and Oceania; recent estimates suggest that Pentecostal and Charismatic Christianity currently have about 523 million adherents, two-thirds of whom live outside the West, the place of origin of these religions."

In the same understanding, Ricardo Mariano (2008, pp. 68-95) states that Pentecostal churches register the highest rates of contemporary religious growth, attributed

in part to the lack of support by traditional social institutions. Faced with limitations in addressing individual issues and in the provision of essential services such as health, education, employment and housing, which substantially affect the well-being of vast segments of society, additional alternatives are sought.

For this reason, "the participation of civil society is increasingly requested as an alternative, in the Third Sector as a whole, as a materialization of the social state and understanding of the Democratic State of Law enshrined in contemporary constitutionalism" (PAES and MAZZA, 2015, p. 10).

Over the centuries, the construction of a just and democratic nation has been driven by the active participation of various sectors of society. In the midst of this context, Brasília emerges as a symbol of hope for Brazilians, reflecting the aspiration for a more inclusive and egalitarian country. While local leaders sought the autonomy of the Federal District through their political representation and the installation of the Legislative Chamber, the Catholic and Evangelical churches played an important role in promoting ethical and moral values that contributed to a more cohesive and participatory society.

POLITICAL AUTONOMY: THE FIRST CHALLENGES OF THE CLDF AS A LEGISLATIVE BRANCH

Chronologically, on April 21, 1960, Brasília is inaugurated and, months later, on October 3, a significant part of the political history of the people of Brasilia begins, who vote for the first time for President of the Republic. According to the headline of the Jornal de Brasília (1986, p. 3), of the 23,618 registered voters, 21,842 go to the polls to vote only for President of the Republic.

It is important to remember that before its political autonomy, the legislative body of the Federal District was the Federal Senate. The truth is that the House of Laws of the Federal District was not implemented, although it was provided for by Federal Law No. 3,751, on April 13, 1960, which tried unsuccessfully to establish the administrative organization of the Federal District, even predicting that the elections would be for mayor (PEREIRA, 2014, p. 8) with the installation of a legislative chamber composed of councilors. None of the initiatives is implemented because there are no elections, and the gap in the legislative residue remains for the entire duration of the 1967 Constitution (BRASIL, 1960).

In 1982, Brazil was the scene of the country's redemocratization process (KINZO, 2021, pp. 3-10). Several rallies for the "Diretas Já" are organized throughout the Federal District. Brasília, initially conceived as a federal appendage (ABRÚCIO, 1998, p. 17) without economic or political autonomy, follows a model similar to that of neutral municipalities of

the imperial period and the Federal District of Rio de Janeiro. Three decades pass before its citizens can exercise their right to choose their political representatives, with the end of the Military Regime and the approval of a constitutional amendment in 1985, which allows the election of congressmen (CLDF, 2024).

Full political autonomy is achieved with the election of the first congressmen, who strive to approve, as mentioned, an amendment guaranteeing the political autonomy of the Federal District. This victory culminated in the promulgation of the so-called Citizen Constitution, on October 5, 1988 (CHAIA & CHAIA, 2008, p. 176).

From then on, in 1990, the Federal District was able to elect its governor and the first 24 district deputies by direct vote. The installation of the Legislative Chamber on January 1, 1991 marks the beginning of a new era for Brasilia, ending decades of political and economic discussions about the administration of the special district. This historic milestone coincides with the struggle for the return of direct elections for the presidency of the Republic.

After three decades of anticipation, the 24 district deputies, elected by popular vote for the first time, took office, marking the end of a period of tutelage over Brasília and its departure from Brazil's political history.

Therefore, the installation of the CLDF represents the fulfillment of a century-old aspiration, dating from the dream of building Brasília, provided for in the Federal Constitution of 1891, to today's contemporary challenges.

INITIAL CHALLENGES OF PARLIAMENTARIANS AFTER THE INAUGURATION OF THE CLDF

When he took office for the 1st legislature, the district deputy was already faced with a great challenge related to the irregular public land that had persisted for years and that proliferated rapidly throughout the territory of the Federal District. In this context, the occupation of public lands by religious and social assistance entities was included.

There was an important variable to be considered: the CLDF was not yet institutionalized or professionalized (MELLO, 2015, pp. 20-37; VOLPE, 2006, pp. 7-43). Before dedicating itself to issues such as the regularization of religious land in public areas, the CLDF needed to carry out internal structural tasks, such as the creation of the Organic Law of the Federal District (LODF) and its Internal Regulations (RICL). In addition, in the external sphere, the implementation of the Master Plan for Territorial Planning of the Federal District (PDOT) and the Territorial and Urban Planning System of the Federal District (Sisplan) was pending, which would only materialize a year later, with the enactment

of Ordinary Law 353, of November 1992, replaced by Complementary Law No. 17 of January 28, 1997.

Without the consolidation of these fundamental legal instruments, the elected parliamentarian faced significant limitations in his ability to draft structuring legislation. The absence of the LODF and RICL, coupled with the lack of implementation of the PDOT, severely restricted the scope of action of the district parliament, making it difficult to achieve essential legislative initiatives to meet the demands of the population and address pressing issues such as land regularization.

Despite having qualified civil servants, the Legislative Chamber of the Federal District (CLDF) faced major structural challenges in the 1st legislature, such as lack of physical space and inadequate technological resources. These problems limited the ability to take advantage of the technical knowledge of the civil servants, justifying the delay in the discussion and approval of important legislation.

Still in the 1st Legislature, elected parliamentarians with religious agendas often adopted practices of the "old politics" in their parliamentary activities. Faced with the absence of legislation for fundamental issues, they resorted to improvised solutions, especially those deputies who were part of the support base of the governor of the CLDF. One of these practices was the appointment of their own regional administrators, who were given broad powers in a context of decentralized oversight of the GDF and centralized in the RAs.[7]

The regional administrators, appointed by parliamentary indication, granted precarious authorizations for the use of public properties, meeting the interests of the deputies who appointed them. Many religious leaders, some with limited legal knowledge, were induced to believe in the definitive resolution of the land issue. This misperception strengthened the relationship between parliamentarians and their electoral bases, consolidating support for future elections.

Throughout the various legislatures of the Legislative Chamber of the Federal District (CLDF), many deputies were elected with the support of their religious bases. Notably, parliamentarians associated with the Universal Church of the Kingdom of God received support almost exclusively from evangelical voters. Exceptions to this rule include Maurílio Silva and Rubens Brunelli, elected by the Casa da Blessing Church; Deputy Sandra Faraj, from the Christian Community Ministry of Faith; and Pastor Daniel de Castro of the Assembly of God of Taguatinga (ADET). On the Catholic side, Deputies Padre Jonas,

[7] Since 1989, during Roriz's term as "bionic governor", the Federal District has expanded its administrative territory with the creation of 18 new Administrative Regions, reaching a total of 35 today.

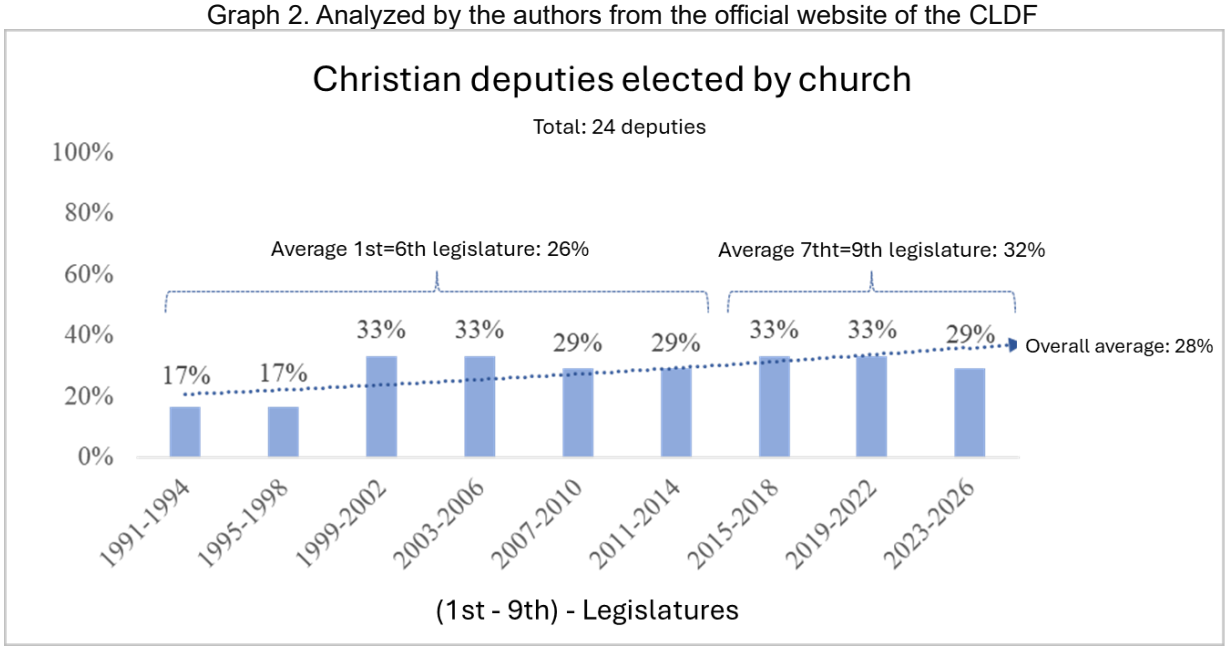
Washington Mesquita, Cláudio Abrantes and Pedro Paulo de Oliveira (Pepa) stand out. It is important to mention that these last two acted as the Christ of the Way of the Cross and as Coordinator of the event at Morro da Capelinha, in the city of Planaltina, DF, respectively.

In any case, the elected parliamentarians reflected the diversity of Brasilia's society, demonstrating its democratic and representative nature. However, the representation of specific interests of different social segments can interfere in political decisions, which are not always aligned with the broader public interest and generally do not coincide with their electoral bases (VOLPE, 2006, p.166; SAMUELS, 1997; AMORIM NETO and SANTOS, 2003; AMES, 2001).

The graphs below present revealing information about the profile of the district deputies. It is noted that approximately 28% of the 24 parliamentarians throughout all legislatures obtained explicit support from evangelical churches or implicit support from the Catholic Church for their elections as district deputies. This is because evangelical churches often cast pastors as political candidates, while the Catholic Church implicitly supports candidates based on their work in religious-related activities.

The data in **Graph 2** reveal a constant increase in the presence of the "Christian caucus", composed of evangelicals and Catholics, in the CLDF throughout the legislatures. For example, between the 1st and 6th legislatures, this representation averaged 26%, increasing to about 32% in subsequent legislatures.

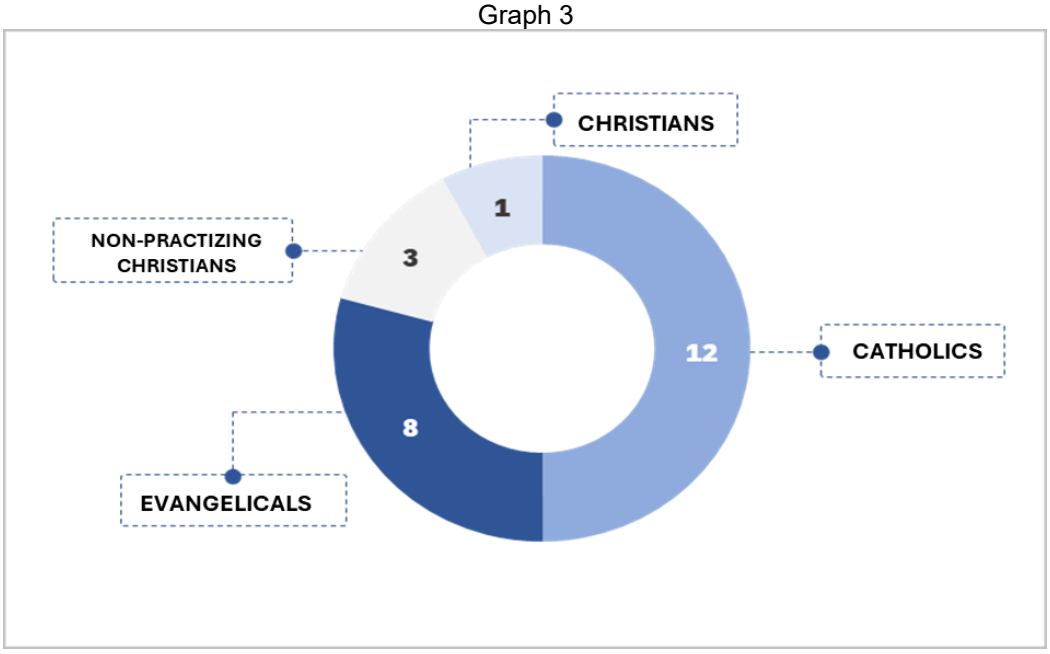
Graph 2. Analyzed by the authors from the official website of the CLDF



For a better understanding of the objectives of this study, it is essential to clarify which of the candidates in the legislatures analyzed would not be elected without the

political support of the Catholic and Evangelical churches. In this sense, it is not about the religion that the parliamentarian practices, but about the political commitment to his electoral base that elected him. The following graph shows the religion declared by the 24 deputies elected during the current legislature (2023-2026).

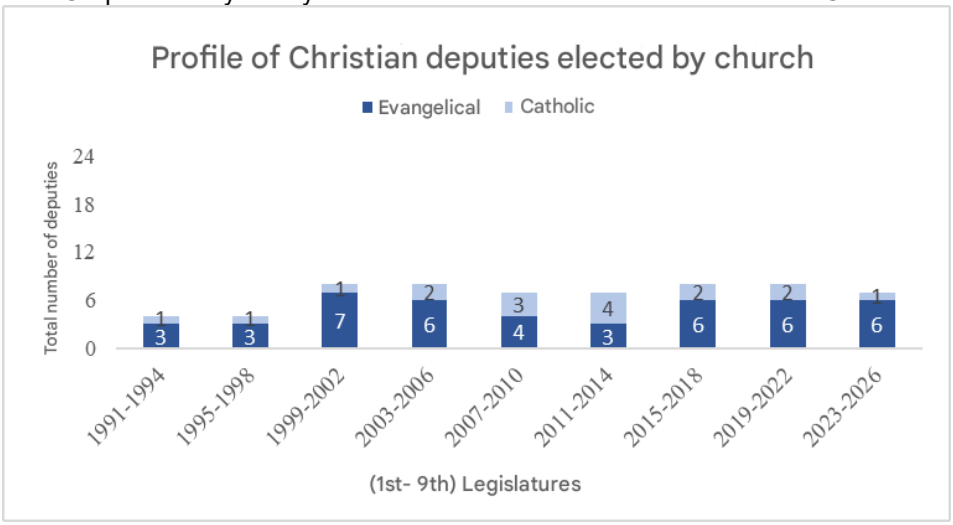
Graph 3



Source - Data extracted from Jornal Metrópole (16/10/2022)

The analysis of the data above reveals that half of the CLDF deputies declare themselves Catholic, but only one of them was elected with votes from this religion. This information is highlighted in **Graph 4**, which also reveals another relevant fact: of the 8 deputies who declare themselves evangelicals in the new legislature, 6 of them would not be elected without the votes coming from evangelicals.

Graph 4. Analyzed by the authors from the official website of the CLDF



With the exception of the 6th Legislature, it is notable that, in all legislatures, the evangelical presence has always surpassed that of Catholics. For example, in the 1st Legislature, evangelicals represented 12.5% (3 deputies: Maurílio Silva, Peniel Pacheco and Wasny de Roure) of the total number of parliamentarians, while in the 9th Legislature, this evangelical profile represents 25% (6 deputies: Iolando, Pr. Daniel Castro, Eduardo Pedrosa, Paula Belmonte, Martins Machado and Thiago Manzoni), doubling the number of parliamentarians over more than three decades. The observed growth shows a national phenomenon that denotes the growing political influence of evangelicals in various instances of power, including the Federal District, confirming the hypothesis initially proposed.

The conclusion of the above data shows that the increase in the representativeness of the Christian caucus to about 33% between the 6th and 7th legislatures, equivalent to eight parliamentarians out of a total of 24, stands out as an expressive phenomenon over the last three decades, exerting a direct impact on the socioeconomic and political context of the Federal District. The presence of this contingent in a legislative body with 24 members gives them a quorum of "simple majority" in the district legislative process, providing substantial influence both in the votes in the CLDF Plenary and in the definition of the political agenda of the GDF.

This scenario points to a relevant influence of religious dynamics on local politics, evidencing the political and social weight of this group. In addition, the success on specific issues, such as the regularization of public land occupied by philanthropic entities, reflects a shared interest by all Christian denominations in the search for solutions that meet their needs, highlighting their importance in the formulation of policies in the Federal District.

During the period from 1991 to 2008, the lack of a specific public policy for urban and land regularization of occupied real estate units presented a complex and prolonged dilemma. The regularization of these lands faced constant legal obstacles, related both to compliance with constitutional principles and to the practical application of the proposed measures. The material and formal unconstitutionality of the initiatives presented represented a significant challenge, requiring careful analysis and adjustments in the legislative proposals to move towards an effective solution to the issue of land regularization of "church land" in the Federal District, which would only be achieved almost two decades later, as will be shown below.

In the table below, some of these initiatives recorded by Orivaldo de Melo (2009) will be presented, in an exemplifying and summarized way:

Table 2

Law No. 1,019, of 1996: Authorizes the donation of lots to religious temples, Masonic temples and philanthropic, non-profit entities, located in a special area in the manner specified and provides other provisions. (Author of the project: Deputy Carlos Xavier) **Devices Questioned:** Full Text **Action/Plaintiff:** 2004 00 2 008420-0 ADI (PGJ) **Nature of Decision:** Final **DJU Publication:** 02.02.06 (File: 10.04.06)
Law No. 1,319, of 1996: Provides for the concession of use of public assets to entities mentioned. (Author of the bill: Deputies Luiz Estevão, Adão Xavier and Tadeu Filippelli) **Devices Questioned:** Full Text **Case/Plaintiff:** 2008 00 2 016888-0 ADI (PGJ) **Nature of Decision:** Final **DJU Publication:** 10/19/09
Law No. 2,688, of 2001: Provides for public interest collaboration between the Federal District and the entities that it specifies through donation with charge of the areas occupied by it for teaching, social assistance and health activities. (Author of the bill: Executive Branch) **Devices Questioned:** Full Text **Action/Plaintiff:** 2004 00 2 008193-1 ADI (PGJ)) **Nature of Decision:** Final **DJU Publication:** 14.09.04 (File: 22.12.04)
Law No. 2,926, of 2002: Authorizes the donation, with charges, of the areas occupied by entities that it specifies. (Author of the bill: Executive Branch) **Devices Questioned:** Full Text **Case/Plaintiff:** 2004 00 2 008193-1 ADI (PGJ) **Nature of Decision:** Final **DJU Publication:** 26.01.06.
Complementary Law No. 373, of 2001: Provides for the disallocation and allocation of an area for the implementation of a lot for a social assistance entity. (Author of the bill: Deputies Alírio Neto and Jorge Cauhy) **Devices Questioned:** Full Text **Case/Plaintiff:** 2005 00 2 000397-5 ADI (PGJ) **Nature of Decision:** Final **DJU Publication:** 17.01.06
Complementary Law No. 534, of 2002: Assigns the areas it specifies to religious entities, through donation with charges. (Author of the bill: Deputies José Edmar and Nijed Zakour). **Devices Questioned:** Full Text **Case/Plaintiff:** 2004 00 2 000165-5 ADI (GDF) **Nature of Decision:** Final **DJU Publication:** 13.11.06.

Source - Melo (CLDF).

Despite the principle of secularism explicitly enshrined in the Constitution of the Federative Republic of Brazil (CRFB), there is an occasional search for benefits by religious institutions with the State, evoking past privileges. Justice Marco Aurélio pointed out that the appropriate interpretation of this provision indicates the original constituent's option for state neutrality (ADPF 54, 2012, p. 2). The principle of secularism, reflected in the

Constitution, was also incorporated into the Organic Law of the Federal District (LODF), especially in items I to IV of article 18.

It is indisputable that the district deputies, without formalizing their intention, made efforts to reverse a jurisprudence that prohibited the donation of public land to philanthropic entities without financial compensation, both in the STF and in the TJDFT. This strategy involved the mass production of laws considered unconstitutional and illegal, overloading inspection bodies such as the Public Prosecutor's Office (MPDFT), the Court of Justice (TJDFT), the GDF Attorney's Office, the Federal District Court of Auditors, the Federal Supreme Court, the Federal District Inspection Agency (AGEFIS), and the Integrated Land Use Surveillance System (SIV-SOLO), among others.

Consequently, the increase in demand for technical work would require a sufficient number of public servants with the necessary qualifications to deal with the bureaucracy resulting from the irresponsibility and inefficiency of the legislative action of another Power. In the context of the Judicial System, there is a substantial increase in legal bureaucracy, negatively impacting the efficiency and effectiveness of these bodies, compromising their regular activities and affecting this system as a whole.

Many of these laws were judged years after they came into force, creating an expectation of legality in the legal environment during the period in which they are watched. According to the Court of Auditors of the Federal District, this scenario generated legal uncertainty for district public administrators, putting them at risk of practicing acts of management of the public good based on the hasty interpretation of district laws (TCDF, 1990, 1998, 2001, 2004, 2005).

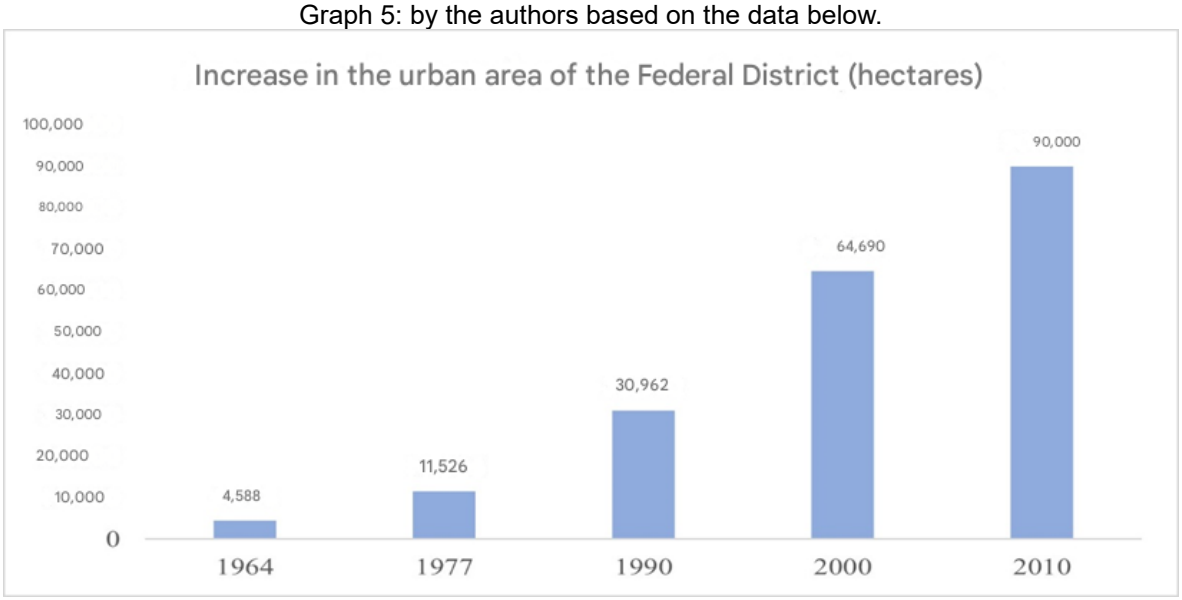
The introduction of new legal figures by the CLDF to regulate public administrative relations, such as the donation of public real estate with charges, has generated significant challenges. Terracap, for example, faces a Herculean task, comparable to the myth of Sisyphus, as it deals with a mission that is impossible to fulfill due to the scrutinizing inspection imposed by the new CLDF legislation on its real estate stock. This situation may violate the LODF, specifically Article 71, § 1, IV, by unduly attributing responsibilities to another power, posing an additional legal challenge to the implementation of these laws.

Regardless of the origin of the legislative proposals, whether from the local Executive or Legislative Branches, the crux of the matter is that religious and welfare entities do not have the necessary financial resources to acquire public land, especially in areas of high real estate value, such as those in the listed area of Brasília, where the cost per square meter is one of the highest in Brazil (IPHAN, 2016, pp. 1-18).

In addition to the financial challenge, additional obstacles have emerged that are difficult to resolve, including the scarcity and increased demand for land for religious and social welfare institutions, amid the growth of the urban area in the Federal District, coupled with political issues.

Rafael dos Anjos (2012, p. 13), a researcher at UnB, revealed that, between 1990 and 2010, Brasília underwent intense urban and social transformation. In 1990, the saturation of the Pilot Plan and satellite cities led to housing invasions and state actions, creating settlements without solving the housing problem. With 30,962 hectares, Brasília was already a young metropolis. By 2010, the urban area had expanded to 90,000 hectares, reflecting rapid territorial transformation and growing environmental problems. This expansion has led to the transition from rural to urban areas, intensifying urban challenges. Brasília began to incorporate extremes and contradictions, with uncontrolled growth increasing poverty, environmental degradation and socio-spatial segregation.

Graph 5: by the authors based on the data below.



The numbers show that the urban territory of the Federal District grew approximately 190.33% between 1990 and 2010. In addition, the population of the Federal District increased from 1,601,094 inhabitants in 1991 to 3,789,728 inhabitants in 2024, representing a significant growth of 136.71%, according to IBG data (2024).

This accelerated and uncontrolled growth has resulted in an increase in poverty and socioeconomic inequality, especially in peripheral areas of the Federal District. This situation refers to the famous question of Prof. Oscar Vilhena: "How does the deep and persistent socioeconomic inequality affect the integrity of the Rule of Law?" The answer suggests that the lack of minimum substantial guarantees provided for in the Constitution

aggravates social inequalities, creating obstacles to the full exercise of rights and to the participation of society in collective life. Consequently, this erodes the foundations of democracy and the rule of law (VIEIRA, 2008, pp. 191s and 212s).

These complex phenomena are directly related to the issue of the unconstitutionality of district laws, since, statistically, during this period, there was a higher incidence of laws judged unconstitutional, whose object was the donation of public land from Terracap and GDF to philanthropic entities.

As a result, new cities were created as Administrative Regions (RAs) in the Federal District, expanding the political power of the head of the Executive and the parliamentarians from the base of the GDF. The rise of religious leaders to the positions of district deputies led to the appointment of regional administrators who favored their political godfathers. This allowed religious and social assistance entities to establish themselves precariously on public land in the "urban voids" of the RAs, where there was no defined legal destination.

This contemporary vision finds a parallel in D'Epinay's work where local evangelical leaders are equated with "colonels", controlling "electoral flocks" that follow their political orientations. These leaders offer electoral support to politicians in exchange for benefits for their churches. In addition, the pastors themselves run for legislative positions with the support of their congregations and, once elected, promote policies in favor of their churches, to the detriment of the public interest (LACERDA, 2017 *apud* D'EPINAY, 1970, p. 19)

This situation resulted in a pent-up demand, as the GDF was unable to effectively meet the growing need for public land for these philanthropic entities. This occurred because the creation of new Administrative Regions was more a political act of the governor than the realization of a prior urban-legal planning. Therefore, there was no planning or study that would allow the rapid availability of public land for this purpose.

The bureaucracy and slowness associated with the legalization of land subdivision in the Federal District are so evident that, in many cases, public authorities choose to postpone land regularization to a later phase. This political decision avoids the requirements of environmental licensing and the investments in infrastructure necessary for the prior approval of land subdivision, as established by legislation (MARTINS, 2021, p. 2).

A Special Commission led by then-Deputy Brunelli highlighted the scarcity of land for all religious denominations, leading many Protestant churches to settle in residential areas. This resulted in disturbance of peace and, in some cases, criminal consequences. Itinerant public hearings were held in various Administrative Regions, generating opposition from

local communities, including evangelicals who lived in the vicinity of these "improvised churches" (CLDF, 2003 and 2004).

The concentration of traffic near places of worship generated congestion on residential roads, impacting the mobility of residents, especially in emergency situations. The absence of inspection, associated with political clientelism, stimulated the implementation of ineffective measures, aggravating urban problems. This dynamic, disseminated throughout the city, configured a systemic impact on the urban environment.

In 2009, Governor José Roberto Arruda, driven by previous proposals and the legislative agenda of evangelical deputies (ARAÚJO and SILVA, 2012), sent the Complementary Bill (PLC) 116/2009 to the CLDF. The PLC proposed the urban and land regularization of properties occupied by religious and social assistance entities, resulting in the enactment of Complementary Law No. 806/2009.

In the explanatory statement, the governor stressed that the initiative aimed to solve a chronic problem in the Federal District: the illegal occupation of public lands by entities, discussed for years in the Legislative Chamber of the Federal District. This situation, in part, was due to the high values of the properties, which made it difficult to acquire them by purchase or concession of real right of use, something essential for the Territorial Planning and Urban Development Policies of the Federal District (GDF, 2009).

The legislative process required the coordination of three fundamental "agenda holders" in this legislative context as rapporteurs, without whom the proposition would not have advanced. Evangelical Deputy Brunelli, who held the position of Vice-President of the Land Affairs Commission (CAF) and effective member of the Economy, Budget and Finance Commission (CEOF), and Catholic Deputy Rôney Nemer, in the Constitution and Justice Commission (CCJ), under the supervision of the Leader of the Arruda Government, Deputy Eurides Brito, were key elements in this process.

While Deputy Rôney Nemer took advantage of the centralized hierarchical structure of the Catholic Church, Deputy Brunelli faced additional challenges in articulating amendments due to the decentralized nature of power in evangelical churches. Acting as rapporteur in two Thematic Commissions (CAS and CEOF), Brunelli gained political prestige, especially among evangelicals, his most significant electoral base. During the period of amendments, Brunelli established strict requirements for pastors responsible for properties subject to regularization, in order to prevent possible fraud, given the urgency of the processing of PLC 116/2009, according to article 73 of the LODF.

The legislative process required legal skill to create a substitute for the original proposal, considering the different land particularities of each asset. 10 annexes were

added to the proposition to reflect this diversity. After the sanction of LC No. 806/2009, the challenge of the scarcity of financial resources of the entities arose, essential for effective regularization. Subsequently, Laws 4,968/2012 and 6,248/2018 were enacted to solve these problems, but proved ineffective over time.

In 2020, the GDF proposed solutions for the occupation of lots in the DF by sports clubs through Message No. 453/2020-GAG, resulting in Law No. 6,888, of July 7, 2021. The objective was to regularize properties occupied by associations and non-profit entities, including sports clubs, whose concession periods have expired, establishing counterparts due to the public nature of these properties. In addition, a structured collaboration between these entities and the State in the provision of social services was proposed, through "remuneration in social currency". The draft also addressed the difficulties faced by associations and entities in the maintenance of properties acquired in Terracap's public bids, proposing solutions to ensure compliance with the monthly installments of the deed of purchase and sale with fiduciary alienation.

The draft bill also establishes objective criteria for remuneration in social currency and proposes campaigns to renegotiate old debts related to properties occupied by associations or non-profit entities, as well as religious or social assistance entities. In accordance with District Decree No. 39,680/2019, the approval of the project resulted, as already mentioned, in the repeal of District Laws No. 4,968/2012 and 6,248/2018, establishing new parameters for the policy of regularization of occupations of the associations and entities in question (GDF, 2020).

In this regard, it is imperative to recognize the risks that arise when certain religious institutions exert significant political influence, particularly in the case of the Catholic Church and Evangelical denominations. Such dynamics can potentially undermine the principle of the secularity of the State, opening space for a religious polarization in the political sphere. This close connection between some churches and political power can result in public policies that exclusively favor the interests of these institutions, to the detriment of religious diversity and citizens' freedom of belief. On the other hand, religions of African origin continue to be marginalized by the State, evidencing the persistence of religious inequality.

Finally, while recognizing the positive role of churches in social cohesion and the promotion of ethical values, it is essential to ensure that the State maintains its religious neutrality to preserve democracy and the individual rights of citizens. Maintaining the religious neutrality of the State is essential to preserve democracy and the individual rights of citizens, in line with the best practices of state management in developed countries.

FINAL CONSIDERATIONS

This study analyzed the complex relationship between Church and State in Brazil, focusing on secularism and the growing political influence of evangelical churches in the regularization of public land occupied by religious and welfare entities in the Federal District. The research sought to understand how power dynamics and religious influence are intertwined in the formulation of public policies that impact land use and urban and social development in the region.

The study focused on the analysis of the correlation between the increase in the evangelical population and the legislative production aimed at the regularization of occupied lands, examining the hypothesis that the growth of this population directly impacts the formulation of laws that seek to regularize the land occupied by religious and welfare entities, especially in areas of high real estate value.

The investigation, using a methodology that combines legal-constitutional analysis and the complex approach of Edgar Morin, examined the historical trajectory of the relationship between Church and State in Brazil, from the imperial period to the present day, and the political influence of religions, especially evangelical, in the formulation of public policies in the Federal District. The research delved into the analysis of laws related to the regularization of land occupied by religious and welfare entities in the Federal District, identifying patterns, trends and transformations over time.

The main points addressed were: a) the research identified the existence of several laws that seek to regularize the donation of public land to religious and philanthropic institutions, despite questions about the constitutionality of these donations and their compatibility with the principle of secularity of the State. The large number of laws considered unconstitutional has overloaded the control bodies of the Federal District, generating legal uncertainty and compromising the efficient management of public assets; b) The accelerated urban growth of the Federal District boosted the demand for public land, including by religious entities. However, the scarcity of financial resources of these entities makes it difficult to acquire and maintain land, impacting the effectiveness of land regularization laws. The political influence of deputies and religious leaders also affects the management of urban space and relations between different religious groups. In this context, the research highlights the need for clear, equitable and transparent public policies that consider the financial difficulties of entities and promote the fair allocation of public land; c) Legislation and attempts at solution - The analysis of Complementary Law No. 806/2009 and Law No. 6,888/2021 demonstrated advances in the search for a constitutional and legal balance for the regularization of public properties occupied by non-

profit institutions. however, the effectiveness of these laws depends on factors such as the availability of resources, the effectiveness of enforcement, and political commitment to implementation; and *d) Relationship between churches and the state* - the study highlighted the complex relationship between churches and the Brazilian state, oscillating between cooperation and conflict throughout history. The research demonstrated the importance of guaranteeing the secularity of the state, respecting religious freedom and promoting equality between different religions.

This study sought to shed light on land policies in the Federal District, specifically in relation to the interaction between religious entities, political actors and the State. The research revealed the tension between the principle of the secularity of the State and the demands for public land by religious entities, evidencing the need for clearer and more equitable public policies in this area.

The analysis of laws and political practices demonstrated the influence of the "Christian caucus" in the formulation of public policies that primarily benefit the Catholic and Evangelical churches, neglecting the demands of other religious groups, such as religions of African origin. This inequality in the allocation of public resources and access to land reinforces the need for a broader debate on secularism and the guarantee of equal rights for all religions.

The difficulties encountered in the exercise of the investigation included obtaining precise data on the performance of the Christian caucus in the CLDF, the complexity of the legislation and the sensitivity of the issue. However, the results of the research contribute to the academic community by providing an in-depth analysis of the relationship between religion and politics in the context of land policies in the Federal District.

It is urgent that future research investigate the implications of Complementary Law No. 806/2009 and Law No. 6,888/2021, analyzing whether these legislations really promote equality and respect for religious diversity, considering, in particular, religions of African origin. The perpetuation of the exclusion of these religions from the process of formulation and implementation of public policies requires a critical and in-depth analysis, challenging future research to address how public policies and academic research itself can inadvertently contribute to the marginalization of specific religious groups, such as African-based religions. From this critical analysis, it is possible to identify mechanisms and practices that result in exclusion, seeking to overcome inequalities and promote social justice and the full exercise of religious freedom for all citizens.

The study reinforces the urgency of promoting public debate on the relationship between religion and politics in Brazil, with the aim of building a more just, egalitarian and

democratic society. By understanding the dynamics of power and influence, it is possible to formulate public policies that meet the interests of all citizens, regardless of their religious beliefs.

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THE USE OF DIGITAL RESOURCES TO ENHANCE LITERACY

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ABSTRACT

This article investigated the impact of new digital technologies on the literacy process of students with learning difficulties, with the central problem related to the insufficiency of implementation of these technologies and the inequality of access in schools. The overall objective was to analyze the transformative role of digital tools in the educational context, assessing both the challenges and the opportunities they bring. For this, a mixed method was used, involving bibliographic research and analysis of data collected in the field, with graphs that illustrate teachers' perceptions about the effectiveness of digital technologies in literacy. The most relevant results indicate that, although most teachers recognize the increase in student engagement and motivation with the use of technologies, obstacles remain related to the lack of infrastructure and adequate teacher training, although digital technologies offer significant potential to improve literacy and personalize teaching, their full impact will only be achieved with consistent investments and coordinated actions between schools, governments and society. The contribution of the research lies in the proposal of solutions for a more inclusive teaching, adapted to the individual needs of students, especially those who face greater barriers in the learning process.

Keywords: Literacy. Digital technologies. Learning disabilities. Digital inclusion. Education.

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INTRODUCTION

Literacy represents a crucial and fundamental stage in educational development, as it supports all other learning skills, expanding the capacity for exploration and integration into the world of knowledge. However, it is alarming that many children advance in their school path without a solid literacy foundation, which compromises both learning and personal and social development. Val (2006) defines literacy as the process by which the student appropriates the writing system, mastering the alphabetic and orthographic principles, essential for autonomous reading and writing. In other words, it is a domain of conventions and relations between the sound pattern of speech and written symbols, constituting a fundamental competence for full school and social development.

This issue transcends the educational aspect, emerging as a theme of social equality, since the acquisition of basic reading and writing skills is vital to provide equal opportunities. According to studies by Costa, Cassimiro and Silva (2021), the early development of literacy can vary enormously, depending on the family and social context; Children in more stimulating environments have significant advantages, while those in unfavorable contexts face obstacles that slow or limit their progress. These imbalances have long-term consequences, as children who do not master this elementary base not only face academic difficulties, but also suffer from low self-esteem and motivation, which weakens their confidence and enjoyment of learning.

Literacy, being one of the most important pillars of early childhood education, faces complex challenges that profoundly affect the school future of students. As Saviani and Galvão (2021) point out, among the main obstacles is the difficulty in adapting teaching methodologies to the particular pace of each student. Often, the educational system does not offer a sufficiently flexible environment to meet these specific needs, which causes serious gaps in the formation of written competence.

Other critical factors include the absence of adequate teaching materials, outdated and non-inclusive teaching methods, in addition to the lack of continuing education of educators, as discussed by Soares (2020) and Lima and Freitas (2020). The distance between pedagogical theory and its practice directly compromises the effectiveness of the teaching of reading and writing, evidencing the need for greater convergence between these aspects to ensure a solid and inclusive literacy process.

The lack of support and resources for students with specific learning difficulties is another relevant issue, as Santos and Ferreira (2020) emphasize. Literacy often does not consider the diversity of learning styles and the different needs of each student, resulting in the exclusion of many students who need additional support. Socioeconomic conditions

also intensify these challenges, as children in vulnerable situations often have limited access to reading materials and educational support, which further widens gaps in the development of reading and writing skills.

With the advancement of digital technologies, new possibilities arise to enrich the learning of students with difficulties, as evidenced in the research of Gökbulut and Güneyli (2019) and Azevedo and Amante (2021). Digital tools, such as educational games and simulators, offer interactive and personalized approaches that can be especially effective in developing cognitive and reading skills in students who face challenges in the traditional method. However, the lack of equal access to these resources can generate new educational disparities, creating additional obstacles for students from more vulnerable contexts, which points to the need for strategic and planned implementation.

The most severe consequence of these limitations is the continuous cycle of educational disadvantage. Students who do not develop basic reading and writing skills face persistent challenges in their academic and professional trajectories, limiting their potential for achievement and social participation, as highlighted by Ribeiro (2021) and Silva and Ribeiro (2019). Given this scenario, it is urgent to adopt comprehensive solutions that include adaptive teaching methodologies, continuous teacher training, and equitable access to technological resources. In this sense, this research aims to investigate effective digital technologies to support students with difficulties in the literacy process, with the aim of identifying tools that really promote the development of these essential skills.

Based on the results, it is expected that this investigation will contribute to a deeper understanding of Content Analysis in the qualitative approach in educational research, as well as support the training and development of new researchers. The intention is that these researchers can apply it, recognizing that, in qualitative analysis, the data are not always organized in a structured way, thus requiring a technique that ensures methodological clarity, credibility and scientific rigor.

THEORETICAL FRAMEWORK

Literacy in Brazil has a trajectory marked by deep social and economic inequalities, directly influencing access to basic education for a large part of the population. Since the colonial period, the responsibility for formal education was with the Jesuits, whose mission was indigenous catechesis and the training of local elites. However, this education excluded most of the population, particularly enslaved and indigenous people, who were kept on the margins of the educational process (Saviani, 2017; Soares, 2019).

After the expulsion of the Jesuits in 1759, the educational situation worsened, as control passed to the Portuguese Crown, which did not implement effective policies to expand access to education. With the arrival of the royal family in Brazil in 1808, some educational initiatives were introduced. Even so, they did not have the objective of teaching the masses to read and write, which contributed to the fact that the poorer classes continued to be excluded and illiteracy remained high (Santos; Freitas, 2020).

With independence in 1822, the demand for a literate population that could contribute to the construction of the nation-state arose. The Constitution of 1824 proposed the creation of schools of first letters, but the number of public institutions was insufficient and aimed at the urban elites. As a result, the popular strata continued to have high illiteracy rates, remaining excluded from the educational system (Souza, 2021).

In the First Republic (1889-1930), there were some reforms to expand access to literacy, but exclusion persisted. During the 1930s, the New School movement, led by educators such as Anísio Teixeira, advocated for accessible and democratic education. Despite this, the changes faced resistance from political and economic elites, limiting their impact (Saviani, 2017).

With the arrival of Getúlio Vargas's Estado Novo, there was an increase in the control and standardization of the school curriculum, but advances in literacy were still limited. The government prioritized industrialization and political control, and education remained a tool of social control, resulting in the maintenance of high illiteracy rates, especially in rural areas (Ferreira, 2019).

In the 1960s, Paulo Freire proposed an innovative methodology, centered on awareness and critical education. He argued that literacy should allow a critical understanding of reality. However, the military coup of 1964 interrupted this advance and adopted technicist programs, such as MOBRAL, which prioritized the training of labor, neglecting the critical aspect defended by Freire (Silva; Freitas, 2019).

With the redemocratization and the 1988 Constitution, education was recognized as a universal right. From this framework, programs such as PNAC and Literate Brazil emerged to ensure children's literacy in the early school years, focusing on eradicating illiteracy in Brazil (Souza; Freitas, 2021).

In addition, the 1996 Law of Guidelines and Bases of National Education (LDB) strengthened the right to quality basic education and guided Brazilian educational policies, establishing literacy goals with the National Common Curriculum Base (BNCC) in 2017. However, inadequate teacher training and limited infrastructure in schools make it difficult to implement these guidelines (Soares; Ferreira, 2019).

In recent decades, the introduction of digital technologies in literacy has opened up new perspectives. Tools such as apps and online platforms can assist in the development of reading and writing skills, especially for students with difficulties. However, the inequality of access to these technologies, especially in rural regions, limits their impact (Santos; Lima, 2021).

This context has driven digital inclusion policies to ensure that students from all social conditions have access to the necessary technologies. Silva and Ribeiro (2020) argue that such policies are essential for children in all regions to take advantage of these methodologies.

Even with advances, Brazil still faces high rates of functional illiteracy. Data from the IBGE show that 6.6% of the adult population is still illiterate, highlighting that, although absolute illiteracy has decreased, functional illiteracy remains a significant challenge (Souza; Freitas, 2021).

Thus, the trajectory of literacy in the country reflects structural inequalities and historical challenges. From the colonial period to the present day, access to education and literacy has been conditioned by political, social, and economic issues. However, recent educational reforms and the use of digital technologies indicate a path towards a more inclusive educational system (Silva; Freitas, 2019).

Digital technologies offer benefits to the literacy process, such as increased motivation and engagement. Multimodal tools, which combine visual, sound, and textual elements, provide an interactive and accessible approach to literacy, especially for students with learning difficulties (Santos; Lima, 2021).

In addition, the possibility of personalizing teaching is another benefit of technologies. With adaptive software, it is possible to adjust the content to the pace and needs of each student, which facilitates learning and meets individual differences (Soares, 2020).

For the impact of digital technologies on literacy to be positive, it is essential to ensure continuous teacher training and equal access in schools. Without these investments, digital tools will not reach their potential to promote inclusive and equitable literacy.

METHOD

For the preparation of this article, a rigorous methodology was adopted, initiated by an integrative literature review, which enabled a comprehensive and detailed approach to the use of digital technologies to support the literacy of students with learning difficulties.

The research included renowned academic databases, with the aim of compiling both qualitative and quantitative evidence on documented practices and outcomes in the educational field. The analysis was carried out with a mixed approach, incorporating the methods of Content Analysis, as proposed by Bardin (2017), which allowed a detailed exploration of pedagogical practices and evidence of results in the use of digital technologies for teaching and learning.

The choice of this integrative method aims not only to assess the effectiveness of technologies, but also to map the adaptability and accessibility of pedagogical practices in inclusive contexts, offering a solid basis for future analysis and an in-depth foundation for the development of more effective and inclusive educational methodologies.

To complement this integrative literature review, questionnaires were applied to educators who use digital technologies as a pedagogical methodology. These questionnaires allowed us to explore the experiences of teachers, addressing both the benefits and difficulties in using technologies to promote literacy and engage students with learning difficulties. This initial stage of the study aimed to consolidate a robust theoretical basis for the research, from which the objectives and hypotheses could be clearly outlined, ensuring the alignment between the theory and the data collection instruments.

The development of this study followed a well-defined methodological path, with stages inspired by Bardin's (2011) proposal, which includes pre-analysis, exploration of the material and treatment of the results. The first stage involved the submission of the project to Plataforma Brasil for approval by the Research Ethics Committee (CEP), in accordance with the guidelines of Resolution 466/12 of the National Health Council (CNS). This procedure ensured that the study was aligned with ethical principles and respect for participants. Formal consent was also obtained from the school institution and the Municipal Department of Education, along with the signing of the Informed Consent Form (ICF) by the participating teachers, in accordance with the guidelines of Deitos and Aragón (2021) on transparency and respect for the autonomy of those involved.

In the next stage, the exploration of the material was carried out through a systematic literature review, with the aim of identifying relevant studies on the use of digital technologies to support the literacy of students with difficulties. According to De Oliveira Cavalcante et al. (2021), digital technologies expand pedagogical opportunities and offer greater adaptability to the needs of students, promoting inclusive education. This review provided a solid theoretical basis and pointed out gaps in the literature, guiding the study in its objectives and hypothesis and outlining paths for a more specific contribution in the field of education.

The third stage of the study involved fieldwork for data collection, where quantitative questionnaires and qualitative semi-structured interviews were applied, in line with the mixed methodology of Bardin (2011). The sample consisted of 20 literacy teachers, selected based on criteria such as age group (25 to 50 years) and minimum experience of five years in the area. Technological tools, such as Google Forms, were used to apply the questionnaires, making the data collection process more efficient, safe, and agile, as highlighted by Mentone and Fortunato (2019) when dealing with the use of digital technologies in education.

In the analysis stage, both quantitative and qualitative data were organized and interpreted with the help of statistical techniques and Content Analysis, according to Bardin's (2011) principles. This analysis sought to identify recurring patterns and themes in the pedagogical practices of teachers in relation to the use of digital technologies, mapping challenges and opportunities that these tools offer in the educational context. The blended approach allowed for a broad and detailed understanding of the impact of digital technologies on literacy, generating insights into the experience of educators and the effectiveness of these resources in the school environment.

Finally, the treatment stage of the results involved the organization and discussion of the findings, allowing comparison with the existing literature. The results were presented in a systematic way, highlighting the theoretical and practical contributions of the research and proposing pedagogical interventions aimed at overcoming learning difficulties with the support of digital technologies. The study sought to propose strategies that improve the inclusion and educational development of students with literacy difficulties, in line with contemporary demands for digital and inclusive education.

This study, conducted in a careful and structured manner, aimed to provide a comprehensive understanding of the role of digital technologies in the literacy process. The research aims to bring significant contributions to the field of education, both in the theoretical and practical spheres, stimulating reflections and providing tools for teachers to effectively implement digital technologies in their pedagogical practices, especially in serving students with special educational needs.

RESULTS AND DISCUSSION

Data collected from participating teachers revealed that digital technologies play a transformative role in the literacy of students with learning disabilities. Ferreira and Souza (2019) point out that these tools increase engagement and allow for personalization of teaching, adjusting it to the needs of students. However, teachers indicated challenges,

such as inadequate infrastructure and lack of continuous training, which confirms the findings of Santos and Lima (2021) on the difficulties of adopting technologies in the Brazilian educational context.

By analyzing the quantitative and qualitative data, it was observed that the effectiveness of digital tools depends directly on teacher training and technological support in schools. Soares (2000) already warned that the success of literacy depends not only on access to tools, but also on the quality of pedagogical practices. Thus, the study demonstrated that reading apps and educational games are seen as effective, but require policies that ensure adequate training and infrastructure, as discussed by Azevedo and Amante (2021).

The final analysis reinforces that the use of digital technologies can make education more inclusive and personalized, meeting the specific needs of students with learning difficulties, as suggested by Val (2004). However, to achieve this transformation, a joint effort between governments, educational institutions, and society is needed to ensure equitable access to these tools, as highlighted by Ferreira and Souza (2020).

The data point to a significant impact of the use of digital technologies on literacy, especially in students with difficulties. According to Ferreira and Souza (2019), these tools, when well implemented, increase student engagement, making learning more interactive and personalized. In this research, it was found that the use of digital platforms and games facilitated the recognition of letters and phonemes, corroborating the ideas of Azevedo and Amante (2021) about the playful role of educational games.

However, technological limitations are a constant barrier. Silva and Freitas (2019) highlight that unequal access to the internet and the lack of equipment in Brazilian schools hinder the full use of these technologies. This scenario was confirmed by teachers, who report difficulties in applying interactive activities due to the absence of adequate technological resources, evidencing the need for public policies to universalize access.

In addition, the continuing education of teachers was considered essential for the effective use of digital technologies in literacy. Val (2004) emphasizes that teachers need to be prepared to integrate these tools into pedagogical practices. In the present survey, 25% of the participants indicated this need, reinforcing the importance of specific training to maximize the potential of technologies in the development of reading and writing skills.

Each graph analyzed highlighted valuable aspects about the use of digital technologies to support the literacy of students with difficulties. These data go beyond the reproduction of the results, suggesting that the increase in student engagement, promoted

by the use of technologies, transforms the dynamics of the classroom, confirming what Santos and Lima (2021) discuss about the impact of pedagogical innovation.

The increase in motivation is one of the highlights, with 50% of the participants recognizing this benefit. This data is in line with the research of Soares (2019), which highlights how digital technologies make learning more interactive and engaging. However, challenges related to infrastructure and teacher training remain, as evidenced by Silva and Freitas (2021).

On the other hand, the graphs also pointed out limitations in the use of technologies, such as the lack of adequate equipment and the difficulty of handling by students. This indicates that equitable access remains a major challenge.

Ferreira and Souza (2020) state that inequalities in access compromise the development of literacy skills, especially in low-income contexts, reinforcing the need for investments in infrastructure.

The literature highlights the use of educational games and interactive platforms as promising for literacy, a point confirmed by the data in the graphs. Teachers recognize the effectiveness of these resources, with 40% using educational games as support. This practice, in addition to facilitating learning, creates an environment adapted to the needs of students, as suggested by Val (2006) in his defense of the use of diversified approaches.

Another important aspect is the personalization of teaching provided by digital technologies, according to Ribeiro (2021). This practice, which allows students to advance at their own pace, was recognized by 15% of teachers as a benefit. This type of adaptation is essential for students with difficulties, since adaptive technologies adjust the content to individual needs.

Despite the advances observed, some limitations of the research should be considered, such as the analysis in only one school, which restricts the generalization of the results. Boccato (2006) warns about the importance of recognizing methodological limitations, suggesting that larger samples would bring a more comprehensive view of the impact of digital technologies on literacy.

It is crucial to reflect on the implications of these findings for the field of literacy and for future research. The results of this research expand knowledge by showing that, although digital technologies have great potential, there is still a long way to go in terms of access and training, as discussed by Santos and Freitas (2020).

In conclusion, the analysis of the graphs confirms the perceptions discussed in the literature and suggests new ways to improve pedagogical practice in the use of digital technologies. The advances and challenges identified indicate that the proper use of these

tools can promote an inclusive and personalized education, benefiting the literacy of students with difficulties. However, as several authors point out, the future of technologies in education depends on overcoming structural limitations and ensuring that all students can benefit from these innovations.

FINAL CONSIDERATIONS

The study highlights the transformative potential of digital technologies in the literacy process, especially for students with learning difficulties. Digital tools, by enabling a more interactive and personalized approach, have the power to increase engagement and facilitate the acquisition of reading and writing skills, fundamental aspects for the educational and social development of students. Research has shown that, when well implemented, digital technologies can act as effective pedagogical resources, promoting a more inclusive teaching experience adapted to the needs of each student. This result reinforces the importance of investing in the continued training of teachers and in school infrastructure, since equitable access and technical mastery of these tools are essential to maximize their impact on learning.

However, despite significant advances, the study also reveals the structural challenges that still limit the widespread adoption of technologies in the educational environment. The lack of adequate technological infrastructure and inequality of access continue to be barriers, especially in low-income contexts, where the lack of equipment and internet connection compromises the full use of these resources. The inadequate training of teachers for the use of these technologies also emerges as a limiting factor, which points to the urgent need for public policies and specific investments to overcome these obstacles.

The data collected and analyzed indicates that digital technologies not only offer new ways of learning but also promote educational personalization and inclusion. With the possibility of adapting the content to the pace and level of each student, these tools prove to be especially effective in serving students with learning difficulties. This aspect of personalization is a key differentiator, allowing students to advance at their own pace, which is essential for reducing learning gaps and promoting equity in education. However, for this potential to be fully explored, it is necessary that the application of technologies be accompanied by consistent pedagogical planning and institutional support.

The theoretical review and empirical data presented in this research emphasize the relevance of digital technologies as facilitators of inclusive literacy. However, for the use of these technologies to result in an effective pedagogical practice, it is necessary to ensure that all students and teachers have conditions of access and proper use of digital

resources. In this sense, collaboration between government, educational institutions, and society is essential to build a support network that enables the full use of these innovations.

In addition, the study indicates that the adoption of digital technologies in literacy needs to be aligned with innovative pedagogical practices and teacher training, so that they can incorporate these tools critically and consciously into their daily practices. Only with adequate preparation will educators be able to use digital technologies not only as auxiliary tools, but as central elements in the promotion of meaningful and transformative learning.

In summary, this research contributes to the understanding of the potentialities and challenges of digital technologies in supporting the literacy process, highlighting the importance of a strategic and well-planned implementation. By strengthening the theoretical basis and proposing practical solutions, the study offers directions for the improvement of educational policies and for the formation of a more inclusive education adapted to contemporary demands. The continuity of research in this field is essential so that new solutions can be identified and applied, promoting an educational environment that responds to the needs of all students and allows the full development of their skills and potential.

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GENERAL ASPECTS OF BOVINE WORMS AND THEIR OCCURRENCE IN THE STATE OF GOIÁS, BRAZIL

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ABSTRACT

Bovine worm is an infection of great importance for Brazilian and world livestock. The damage caused by parasitosis sometimes escapes reality and when it is noticed, it brings incalculable inconvenience. The control of parasites, whether gastrointestinal or pulmonary, must be part of a routine to be followed with great discretion and rigor by the rural property. Several studies demonstrate the economic impact and damage caused by worms. Financial figures are impressive about the size of the losses caused by parasites in cattle. In the state of Goiás, studies referring to *Hepatic Fasciola* are demonstrated in very significant data, as well as studies on Bovine Cysticercosis. Being careful and judicious in the use of anthelmintics is one of the main points to be observed in the established chemical management, in order to avoid resistance by parasites. It is important to know how to define the specific anthelmintic for the problem and target population. Biological management is used on a smaller scale in Brazil. To be successful in treatments, it is important to know the epidemiology and correctly apply the forms of control. There are several laboratory techniques available that can help in the correct diagnosis of parasitosis; Considering that most of them, because they are subclinical, are hardly perceived in everyday life in a visual way. Adequate sanitary management, adoption of efficient prophylactic measures with short-term results, bring numerous positive increases to the development of production animals. Establishing prophylactic calendars and instituting specific control programs for each situation or region converge to the consolidation of better gains at a lower cost.

Keywords: Endoparasites. Helminths. Parasitosis. Losses.

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INTRODUCTION

Cattle raising in Brazil represents one of the main sources of income for the farmer, cattle are known for their wide variety of products such as milk and meat, as well as numerous by-products, such as leather. Cattle ranching has been playing a role of great economic relevance within the national agribusiness. Brazil has the largest commercial herd in the world and the second largest effective herd in the world (LUNA et al., 2020; HEIDMANN et al., 2021).

The damage caused by worms is related to weight loss, decreased milk and/or meat production, predisposition to other diseases, low use of the food offered, among others. Animals of all age groups are generally infected, however, worms are more frequent in young animals (EMBRAPA, 2006a).

It is assumed that parasitism had its origin soon after the existence of life on earth. In the same sense, it is admitted that ectoparasites had their evolution prior to that of endoparasites. As well as the adaptability of gastrointestinal parasites, which used to be free-living and, over time, possibly ingested accidentally, resisted the new habitat and adapted to the internal environment (FORTES, 2004).

Bowman (2010) defines the parasite as a smaller living being that lives on or inside another larger organism (host), at the expense of the latter.

In Brazil, specifically in the Pantanal of Mato Grosso, Bianchin and Melo (1985) cite in their work that the authors Travassos and Muniz in 1927, had already described several species of helminths of both domestic and wild animals, already at the beginning of that twentieth century.

Lopes and Costa (2017), cite in their book that, according to Pinheiro et al., (1987), Paiva et al., (2001) and Rangel et al., (2005), it is believed that 100% of animals raised in the field harbor one or more species of helminths.

It is estimated that there are between 75,000 and 300,000 species of helminths. Nematodes and flatworms are the most important and the helminths of the phylum *Acanthocephala* are less important (TAYLOR et al., 2017).

There are several types of parasite classification, among which two stand out: regarding the time of permanence in the host (whether it is temporary, permanent or periodic) and regarding the type of this host (definitive, intermediate, paratenic/transport, reservoir or vector) (MONTEIRO, 2017).

The most widely used laboratory method for diagnosing helminths is counting eggs per gram of stool (OPG). It is a qualitative and quantitative method, since we are talking

about the elimination of eggs by females, of the main strongylids (LOPES and COSTA, 2017).

According to data released in 2014 by Sindan – National Union of the Animal Health Products Industry – in Brazil, it is estimated that the expenditure was approximately 220 million dollars per year with the use of anthelmintics. If resistance is present in a certain helminth population, these values may be higher (LOPES and COSTA, 2017).

In the United States, it is estimated that the damage caused by worms is around 330 million dollars/year. In Germany, 50 million marks/year, and in Italy it was close to 30 million lira/year (PEREIRA et al., 2005).

The objective of this study is to describe the general aspects of bovine worms in Brazil, with emphasis on the state of Goiás, from the etiology to control and prevention measures.

LITERATURE REVIEW

BRAZILIAN AND GOIÁS CATTLE FARMING IN STATISTICAL NUMBERS

Brazil has the second largest cattle herd in the world, with 244 million animals, behind only India, which has more than 300 million cattle. The perspective is that the world herd will pass the mark of 1 billion head in 2021 (FARMNEWS/USDA, 2020).

According to Abiec – Brazilian Association of Meat Exporting Industries – Brazil has consolidated itself as the largest exporter of beef.

Goiás closed the year 2018 with exports of more than 230 thousand tons of beef, a record amount in the last 20 years, accounting for business that reached US$ 1 billion in this segment (Agrodefesa/SED, 2018).

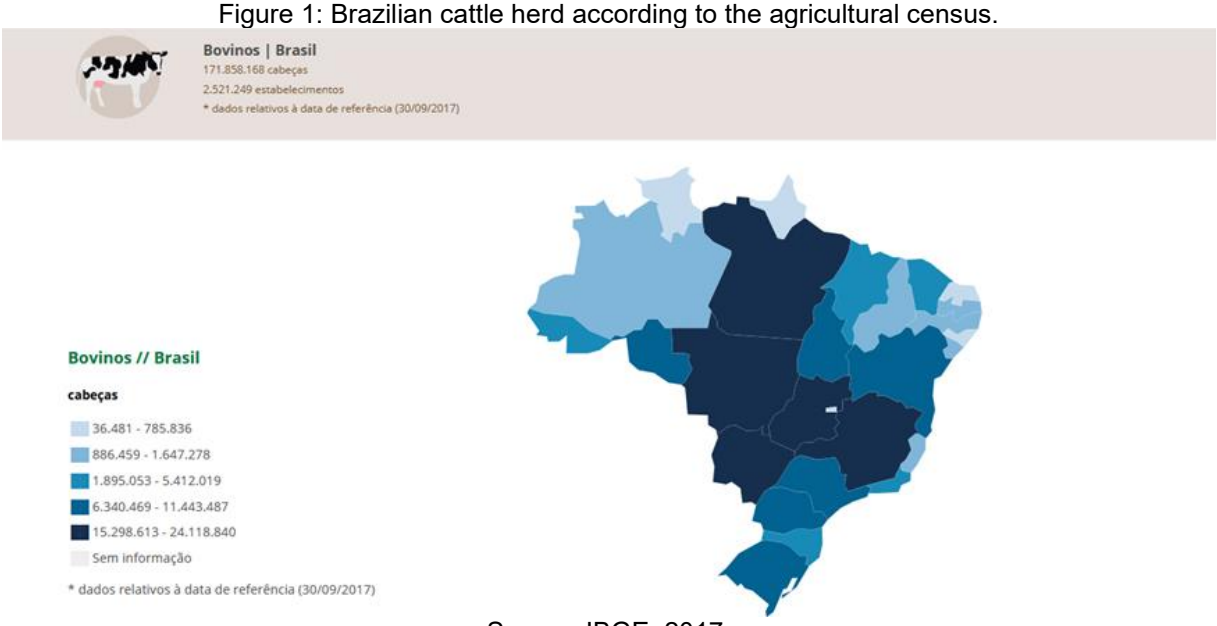
In the dairy farming segment, the state of Goiás stands out as the fourth largest milk producer in Brazil, representing 10.8% of the national production. In 2012, this sector moved around three billion reais (FAEG, 2019).

According to data released by Sindileite – Union of Dairy Industries in the State of Goiás, now in 2019, the state of Goiás produces nine million liters of milk per day, where small manufacturers are the majority (about 80%), but accounting for only 20% of total production. The state of Goiás exports 80% of its production; 64% of this amount is for the state of São Paulo alone.

According to MAPA – Ministry of Agriculture, Livestock and Supply – Brazil closed the year 2018 with a cattle population of 216,596,462 animals. Analyzing data from the IBGE – Brazilian Institute of Geography and Statistics – the institute accounts for a cattle herd of

171,858,168, according to the last agricultural census, represented in figure one (IBGE, 2017).

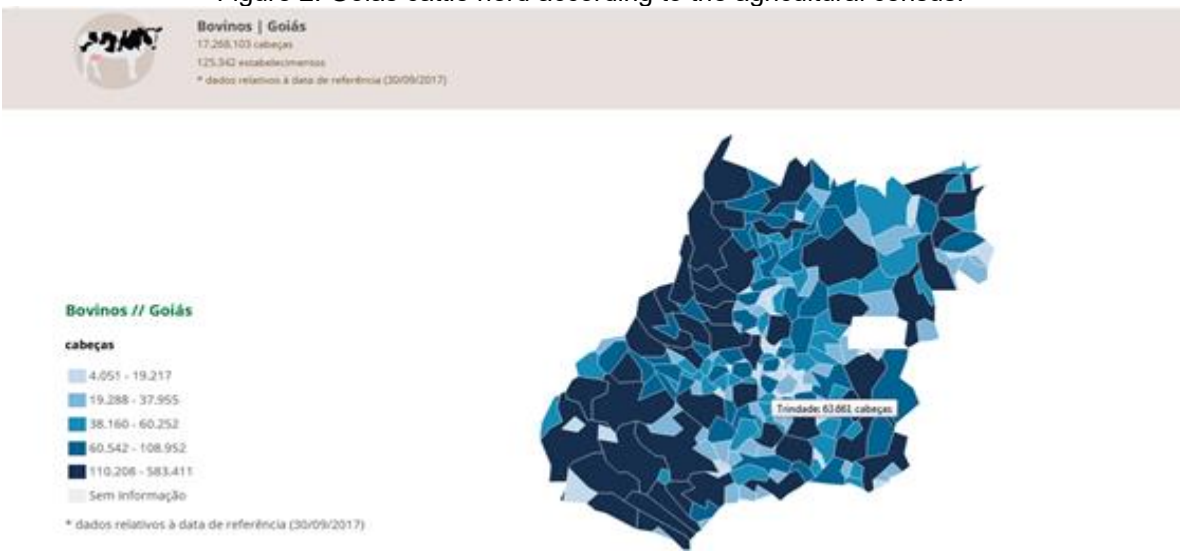
Figure 1: Brazilian cattle herd according to the agricultural census.



Source: IBGE, 2017.

For MAPA, there is a cattle herd of 22,412,687 head in the state of Goiás (MAPA, 2018). This number is practically identical to that released by the state health defense agency, Agrodefesa – Goiás Agency for Agricultural Defense – In the survey obtained by the IBGE, Goiás has a cattle herd of 17,268,103, distributed in just over 125 thousand breeding establishments, as shown in figure two (IBGE, 2017).

Figure 2: Goiás cattle herd according to the agricultural census.



Source: IBGE, 2017.

In Brazil, the GDP – Gross Domestic Product – of 2018, calculated by the Center for Advanced Studies in Applied Economics – Cepea of Esalq (Luiz de Queiroz College of Agriculture), a unit of USP (University of São Paulo), in partnership with the Confederation of Agriculture and Livestock of Brazil – CNA –, closed with a practically stable result compared to 2017 (CEPEA, 2018).

In the state of Goiás, the gross value of livestock production in Goiás in 2018 was 37.38%, with a highlight to the production of cattle, which was 17.72%; registering a positive change of 2.01% in relation to 2017. Beef exports alone accounted for 12.8% of the total (IFAG, 2018).

GENERAL ASPECTS OF WORMS IN CATTLE FARMING

Worms are a general name for parasitic diseases that affect animals. It is estimated that of 100% of the parasites, 95% are in the pasture and 5% in the gastrointestinal tract of the animals (BENAVIDES et al., 2020).

When the producer does not notice the parasite infections, the animals spend several months losing weight and delaying their development (20 to 30% drop in milk and meat production), low fertility, unnecessary expenses with dewormers due to the application at inappropriate times and the need to apply other medications to recover the animal. It is also worth noting the higher expenses with labor (EMBRAPA, 2006b).

Heckler (2015) cited in his work that the deleterious consequences of gastrointestinal worms in beef cattle, evaluated by Pinheiro et al. (2000), show that the weight gain of calves submitted to the treatment of gastrointestinal worms, compared to animals without treatment, can reach 50 kg/head. Borges et al. (2013), in Brazil and Miller et al. (1992), in the United States, also report that the use of antiparasitic drugs in beef cattle can result in an increase of 11.85 and 29.5 kg in weight gain, depending on the commercial formulation, product concentration and parasite load of the animals. Similar data were also observed by Bianchin et al. (2007) and Cleale et al. (2004), who observed an increase of 33 kg in body weight and 0.59 kg/day (23%) in weight gain, respectively, when treated correctly.

Rodrigues and Leite (2014) reported that when it comes to parasitic diseases, it is believed that there are no Brazilian commercial herds free of the problem; And these herds are responsible for the second largest meat production and the fifth largest milk production in the world.

Table one records numbers from a study carried out in 2013, on economic losses from parasitism in cattle, in only six main parasitosis. Untreated cattle (control) were

considered; not representing the real impact of worms in Brazil, but rather the possible losses to not be treated.

Table 1 – Economic losses caused by cattle parasites in Brazil.

Parasite	Millions of US$
- Nematodes gastrintestinal	7,107.97
Carrapato bovino: *Rhipicephalus (Boophilus) microplus*	3.236,35
Mosca-dos-chifres: *Haematobia irritans*	2.558,32
Berne: *Dermatobia hominis*	362,45
Worm fly: *Cochliomyia hominivorax*	336.62
- Mosca-dos-estábulos: *Stomoxys calcitrans*	335.46
Total	13,937.62

Source: GRISI *et al.,* (2013)

In Rio Grande do Sul, it is estimated that calves will be in the order of 10 to 30% due to worms. The most worrying thing is when thinking about subclinical worms, because, in addition to the losses, there is also the factor of difficult perception, to be judged and estimated (LOPES and COSTA, 2017).

MAIN HELMINTHS OF CATTLE IN BRAZIL

The phylum *Nemathelminthes* is composed of 6 classes, but only the nematode class has paraister significance for cattle. Nematodes are commonly known as "cylindrical worms". This class is subdivided into two subclasses: *the Secernentea* and the *Adenophorea* , the first, in turn, being subdivided into 16 superfamilies with the highest representations in veterinary medicine. In this phylum there are six orders of worms with greater importance in animal parasitology (RODRIGUES, 2016; TAYLOR et al., 2017; MONTEIRO, 2017 and URQUHART, 1996 et al., 1996).

Pneumogastroenteric nematodes are one of the main causes of decreased productivity in ruminant farming; whether it is large or small animals (LOPES and COSTA, 2017).

Other classes that can also internally parasitize cattle are Trematodes and Cestodes, belonging to the phylum *Platyhelminthes* (MONTEIRO, 2017).

Dentre os nematódeos pulmonares, tem-se: *Dictyocaulus viviparus* e *Dictyocaulus filaria*. No grupo dos nematódeos gastrintestinais, destacam-se: *Haemonchus, Cooperia, Trichostrongylus, Oesophagostomum, Bunostomum, Nematodirus* e *Ostertagia* (LOPES e COSTA, 2017).

Some species of nematodes have reduced pathogenic potential, while others can cause animal death even before the first clinical signs are observed. In general, the main species that parasitize cattle in Brazil, more prevalent and with the highest intensity of infection, belong to the genera *Haemonchus* and *Cooperia* (SANTOS et al., 2010).

Taylor et al., (2017), cite Acanthocephala as a phylum of minor importance in veterinary medicine, which has a close relationship with the phylum *Nematoda*.

The class *Cestoidea*, or simply *Cestoda*, is divided into two subclasses: the *Cestodaria*, which is composed of parasitic helminths of annelids and primitive fishes, the latter of which are of no importance to human medicine and even less to veterinary medicine; and another subclass, which is the *Eucestodo* (tapeworms). *Cyclophyllidea* and *Pseudophyllidea* correspond to the two orders with the greatest significance for human and veterinary medicine (SANTOS, 2017).

As principais espécies de cestódeos mais estudados são: *Taenia solium, T. saginata, T. multiceps, T. hidatigena, T. ovis, T. taeniformis, T. serialis, Davainea proglotin, Echinococcus granulosus, E. multilocularis, E. vogeli, E. oligarthrus, Hymenolepis nana, H. fraterna H. diminuta, Dipylidium caninum, Raillietina tetrágona, R. cisticillus, R. echinobothrida, Amoebotaenia sphenoides, Anoplocephala perfoliata, Paranoplocephala mamillana, Moniezia expansa, Thysanosoma actinioide, Diphyllobothrium latum e D. pacificum* (SANTOS, 2017).

The parasites belonging to the third class of greatest importance, within the phylum of Nematodes, are the Trematodes. In this class, the species belonging to the subclass *Digenea* are the ones that present the greatest morphological diversity among the flatworms. They are oviparous endoparasites found in all vertebrate groups and in all organ systems (ALEJOS, 2017).

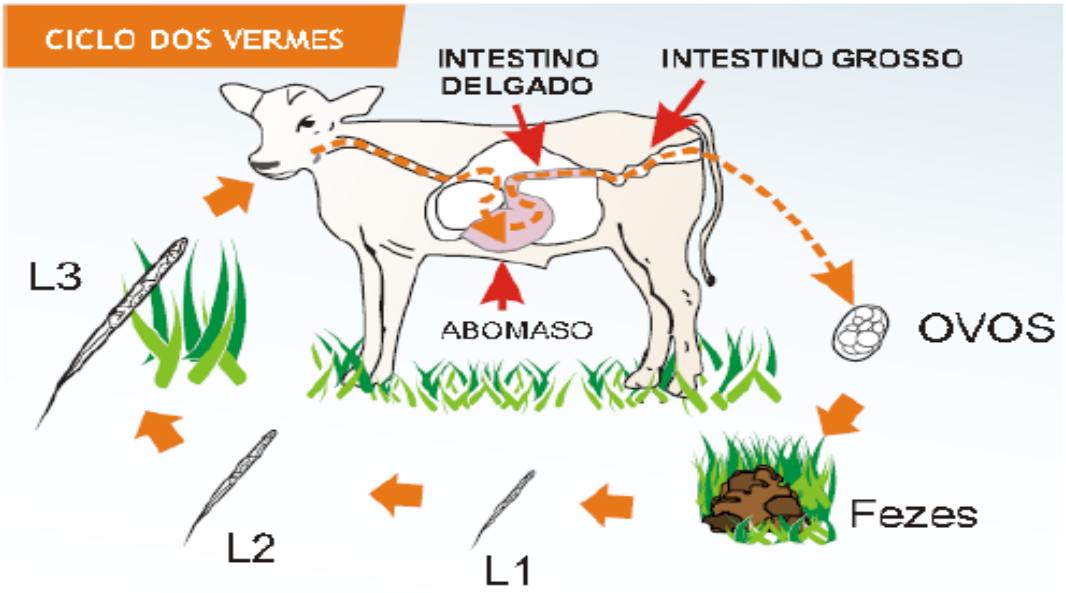
When it comes to public and animal health (with economic impact), the following species of Trematodes are the ones with the most prominence: *Fasciola hepatic*, *Echinostoma revolutum, Typhlocoelium cucumerinum, Brachylaemus mazzantii, Eurytrema coelomaticum, Platynosomum illiciens, Paramphistomum cervi, Schistosoma mansonie, Paratanaisia bragai* (ALEJOS, 2017).

EPIDEMIOLOGY OF WORMS IN CATTLE

Although the reasons for the occurrence of parasitic diseases are multiple and often interactive, the vast majority occur due to one of these four basic reasons: increase in the number of infective stages, change in host susceptibility, introduction of susceptible animals, or the introduction of infection (TAYLOR et al., 2017).

Worms can reach animals through different routes of infection. Most species are acquired orally, by ingesting larvae (L3), as shown in figure three, present in pastures, and some of them by ingesting larval eggs. The larvae of some species can also penetrate through the skin of animals or even pass from the cow to the calf through colostrum. In the vast majority of the Brazilian territory, the extensive production system is adopted, exposing the animals to continuous grazing, so that they remain constantly exposed to infection by parasites (PEREIRA et al., 2005).

Figure 3: Schematic representation of the generalized bovine worm cycle.



Source: Google Images, 2019.

In the evolutionary cycle, several environmental factors influence the pre-parasitic stages, among them: temperature, rainfall, evaporation, incidence of luminosity (sunlight), oxygen, humidity, soil and pasture type. In general, the development of free-living stages becomes faster with increasing temperature, on the other hand, survival time decreases. For optimal growth, the temperature range is 20 to 30ºC. Temperatures above 35 to 40ºC, as well as those below 8ºC, are not favorable to free-living and egg stages (LOPES and COSTA, 2017).

Among the endoparasites of cattle that do not use only the oral route to cause infection, *Strongyloides papillosus* and *Bunostomun sp* stand out. who also use the cutaneous route (PEREIRA et al., 2005).

In a study carried out in the municipality of Dracena-SP, where the degree of helminths in calves born to cows previously classified in different levels of parasite load were evaluated, it was found that: calves daughters of susceptible cows may be influenced

by their mothers in relation to parasite load and consequent reduction in their productive performance. However, male calves born to resistant cows, capable of adapting and susceptible, are not influenced by their mothers in the degree of worming and performance (YAMADA, 2016).

Evolutionary cycle of nematode larvae (L3) in ruminants

Ovipositions are made daily by adult females. If there are favorable conditions, such as temperature and humidity, a larva still inside the egg develops, called (L1). Then it begins to feed on bacteria present in the feces; then the first molt (L2) occurs, which continue to feed according to those of the first stage. A second molt originates the third stage (L3), which is the infective form. The latter does not feed (and can survive for months) due to the cuticle envelope of the (L2). The migration of (L3) occurs to the pastures and a smaller portion settles in the soil. This evolutionary cycle: L1 → L3, happens around 7 to 10 days. As soon as the larvae of the third stage are ingested, they evolve and through successive molts: L3 → L4 and L4 → L5, sexual maturity is reached and a new cycle is completed (LOPES and COSTA, 2017).

The larvae (L3) when ingested are preferentially lodged in the abomasum and intestines. Egg elimination usually begins between 18-30 days (pre-patent period) after ingestion of the infective form (PEREIRA et al., 2005).

Studies show that the longevity of the larvae (L3) of *Cooperia spp*., in pasture for example, was up to 15 weeks. On average, it is possible to find larvae of *Haemonchus spp*., *Trichostrongylus spp*. and *Oesophagostomum spp.* in fecal masses of cattle, goats and sheep, for up to 150, 100 and 70 days, respectively (LOPES and COSTA, 2017).

Clinical symptomatology in infected cattle

In general, worms can be gastrointestinal and pulmonary, the latter being more common in calves up to one year of age and more frequent in the colder months. The symptoms are generally associated with loss of appetite, weight loss, frizzy and dull hair, pale mucous membranes, more visible especially in the eyelids and vagina, bulging dewlap, arching of the spine, enlarged belly, coughing, accelerated breathing, mucopurulent nasal discharge, dehydration and death of the affected animals (EMBRAPA, 2006a).

Clinical manifestations due to the action of nematodes can be observed, such as: dyspepsia (↓HCL and ↑HCO^3: increasing the PH from 2.5 to ± 7.0), gastritis, and diarrhea (LOPES and COSTA, 2017).

Another very important effect in worms is the interference with protein metabolism, responsible for the formation and maintenance of muscle mass. This metabolism is impaired by decreased digestibility and nitrogen retention and also by the loss of endogenous proteins (mucosal lesions, exaggerated production of mucus and mucous cells, and large loss of epithelial cells). Worms can also compromise bone growth due to the loss of minerals, such as calcium, phosphorus and magnesium, in fecal matter and urine (PEREIRA et al., 2005).

Clinical manifestations and non-clinical or subclinical manifestations are basically the two types that are observed at the field level. The first corresponds to 5% of the diagnosed cases and the second, which, theoretically would be the most worrying, comprises 95% of the data obtained. Only those animals that are more susceptible manifest clinical symptoms. There are four types of actions/alterations caused by nematodes in animals: mechanical and traumatic action, alteration of metabolism, spoliative action and toxic action. In view of this, it is correct to state that the evolution of helminths caused by nematodes in ruminants is slow and chronic (LOPES and COSTA, 2017).

Predisposing factors to parasite infection

Due to the enormous ecosystem diversity and favorable climate for livestock production presented in Brazil, they favor the maintenance and multiplication of helminths in the free life phase, throughout the year (HECKLER, 2015).

Some factors or conditions predispose cattle to certain parasitic diseases. Age, for example, is one of the main ones; Young animals are more sensitive to worms than adult animals. Animals aged between weaning and 24 to 30 months are the most affected by the effects of worms. While adult animals (fattening oxen, cows and bulls) suffer less from the effects of worms due to the degree of protection acquired over the time of exposure to these parasites (PEREIRA et al., 2005).

Curiously, with the infection of cattle by *Babesia* and *Anaplasma*, an inverse age resistance is generally supposed, due to the fact that young animals are more resistant than adult animals, raised free of infection (URQUHART et al., 1996).

The racial factor is another important issue to be observed. There is increasing evidence that the susceptibility of many animal breeds to parasites varies and is genetically determined. When comparing the breeds of *cattle Bos indicus*, it is observed that they are more resistant to ticks and other hematophagous insects than the breeds of *Bos taurus*. Another example is the trypanotolerance observed in West African N'dama cattle (TAYLOR et al., 2017).

For a number of reasons, many parasites do not develop in hosts other than their natural hosts; as an example of this, this is what is seen in the species of *Eimeria sp*. In other cases, a limit is cited in the degree of development of the parasite, although usually without it causing a clinical symptomatology of the disease. An example of this is what happens with the larvae of *Ostertagia ostertagi*, common to cattle, when they occasionally parasitize sheep, but few of them reach the adult stage in this phase (URQUHART et al., 1996).

Gender can also be a predisposing factor; there is evidence that whole male animals are more susceptible than females to some helminth infections (TAYLOR et al., 2017).

Pereira et al., (2005) and Taylor et al., (2017), comment that other factors, such as: nutritional, immunological and physiological status, type of diet, stages of lactation and/or gestation and steroid therapy, can predispose cattle to parasitosis.

In the environmental aspect and as to the type of parasite in question, factors such as: the type of management adopted, intensity of parasite load, species of parasite involved, biotic potential, hypobiosis/diapause phase, micro-habitat and seasonal development, type of vegetation, climatic conditions and type of exploitation system; are cited in the literature (PEREIRA, 2005 and TAYLOR et al., 2017).

Pathogenesis and laboratory findings

Due to our climatic conditions, most cattle are parasitized throughout the year by gastrointestinal and/or pulmonary helminths. The eradication of these parasites is impossible, mainly due to their ability to multiply and adapt to the environment. They are undesirable and permanent "partners" of the producer and because they do not cause a large number of mortalities or acute diseases, they gradually undermine the cattle breeder's economy (LOLLATO, 2020).

Most helminth species are well adapted to their natural hosts and the occurrence of death as a consequence of parasitism is a rare phenomenon. Pathological alterations can be classified as: mechanical, traumatic, direct or indirect despoiling and toxic. The pathogenesis begins with the migration of L4 in the abomasal epithelium, causing mucosal hyperemia, progressing to a catarrhal inflammatory process with necrosis, erosion and even ulceration of the epithelium (FONSECA, 2006).

Nascimento et al., (2016), mentioned that in the blood count performed on a bovine infected by *Strongyloide papillosus,* anemia, leukocytosis, and hypoproteinemia were evidenced.

Intense parasitism produces a process of gastroenteropathy, thickening of the lamina, edema, and infiltration of inflammatory cells, increasing the permeability of the capillaries. The mucosa of the duodenum is swollen, sometimes slightly hemorrhagic and villous atrophy due to hypoalbuminemia (FONSECA, 2006).

The blood count has great diagnostic value, since severe anemias, leukocytosis, and eosinophilia can occur in worms (**MIYASAKA, 2018).**

Severe loss of blood and plasma proteins occurs in parasitism by *Haemonchus* and *Bunostomum* resulting in edema in the submandibular region. The intense parasitism by *Haemonchus* in calves promotes a decrease in the number of erythrocytes, considerably reducing the organic resistance of the animals. In the initial phase of infection by *Dictyocaulus*, atelectasis may occur; in the adult phase, these parasites may cause pulmonary emphysema (FONSECA, 2006).

LABORATORY DIAGNOSIS

The most used laboratory technique is parasitological analysis of feces. Feces must be collected and preserved correctly. After collection, if it is not possible to send the sample quickly to the laboratory, keep it in the refrigerator or on ice until the time of the exam, which must be carried out within 48 hours of obtaining the material. Never freeze the feces and if there is no possibility of refrigeration, the feces can be stored in 10% formaldehyde or MIF (merthiolate/mercurochrome, iodine and formaldehyde solution) (MONTEIRO, 2017).

While the OPG test is used to count nematode eggs, stool culture is the technique that makes it possible to identify, after seven days of incubation, which genera of nematodes are present (EMBRAPA, 2008).

Each bovine fecal sample must have at least 4g that during the collection procedure, can be stored in an isothermal box with ice. After collection, these samples, which cannot go directly to the laboratory, can be kept in the refrigerator at 8ºC. In the case of stool culture, fecal samples can remain at room temperature (MINHO et al., 2015).

The direct test, which is done by homogenizing a small amount of fecal sample in a drop of 0.9% physiological saline solution, is a very quick and simple method. It is performed by placing this sample, immediately after this mixture, on a microscopic coverslip (BOWMAN, 2010).

Fecal samples from large animals should preferably be collected from the rectum and examined while still fresh. If there is difficulty in collecting samples from the rectum, then fresh feces can be collected from the field or the ground, ideally the collection should be carried out only if the time when the animal defecated was observed. Individual samples

are required and, for ruminants, a minimum of 10 samples per herd should be collected (TAYLOR et al., 2017).

Minho et al., (2015), describe that a sample of 10% of the animals divided by categories and age groups within the property is recommended. For herds with quantities of less than 100 head, also divided into categories/ages, they recommend a minimum collection of 10 animals from that herd.

Numerous other techniques are cited in the literature as aids in parasitological diagnosis. Bowman (2010) lists some techniques such as: detection of parasite antigens in feces, concentration by flotation of eggs and cysts, culture of nematode larvae, fecal sedimentation technique, micrometry, culture for oocyst sporulation, egg count by dilution/concentration and also diagnosis by histopathology in heminths.

Taylor et al., (2017), cite the FLOTAC system as a diagnostic method, treating it as a simpler method for performing flotation in a centrifuge; This technique allows the quantification, in up to 1g of feces, of nematode and trematode eggs, as well as protozoan cysts and oocysts.

The Willis-Mollay technique, Faust *et al*. technique, modified Sheather technique, double centrifugation technique, modified McMaster technique, modified Baermann-Moraes method, among others; are cited by Monteiro (2017).

In view of the impossibility of calculating the population of worms existing in the host, based on the count of eggs in the feces, there is a parameter for the correct interpretation of the results. In the case of ruminants, for mixed parasite infections, egg counts above 1000 OPG, in general, are considered indicative of intense infection and those above 500 are considered moderate infections and up to 100 are mild. However, a low OPG is not necessarily indicative of very low or even non-existent infections (TAYLOR et al., 2017).

Helminths of the genus *Cooperia*, where the heavy infection is above 3000 OPG, and the parasites of the genus *Bunostomom,* which, from 100 onwards, is already considered intense (FONSECA, 2021).

Other diagnostic tests can also be used, but with numerous limitations, such as the EMZYME-Linked Immunosorbent Assay (ELISA) and PCR (TAYLOR et al., 2017).

Necropsy can also be a very important tool in the diagnosis of parasitosis in domestic animals; such as hookworm and strongylosis in small ruminants (BOWMAN, 2010).

PREVALENCE STUDIES IN SOME REGIONS OF BRAZIL AND IN THE STATE OF GOIÁS

Several studies on the prevalence of bovine worms in numerous areas of the national territory are available for consultation in the literature.

In a study carried out in the municipality of Realeza-PR, fecal samples were collected from 417 lactating cows and 169 calves, from 51 farms, analyzed by the methods of Willis and Gordon and Whitlock. Eggs of helminths of the superfamily *Strongyloidea* (94.1%), oocysts of *Eimeria* sp. (71.5%), eggs of *Eurytrema coelomaticum*, eggs of *Strongyloides papillosus*, eggs of *Toxocara vitulorum*, eggs of *Moniezia* sp. and eggs of *Trichuris bovis*. The frequency of eimeriosis and parasites of the superfamily *Strongyloidea* was higher in calves when compared to lactating cows. The parasites *E. coelomaticum*, *S. papillosus*, *T. vitulorum*, *Moniezia* sp. and *T. bovis* showed low prevalence and individual frequency, but were found in 24.5% of the farms and represented 2.7% and 5.0% of the infections found in cows and calves, respectively (PETRY et al., 2017).

In the study on the prevalence of *Fasciola hepatica* (bovine fasciolosis) that was published in 2018, referring to data on slaughters carried out between the years 2007 and 2014, the risk areas were evaluated, as well as the losses resulting from this parasitosis. Of the 23,255,979 cattle slaughtered, the average prevalence of *F. hepaticum* during the evaluated period was 0.0026% with a confidence index of 95%. In the State of Goiás, in approximately 10 years (since this parasite was first found by other researchers in 2007), *F. liverwort* has been diagnosed in 168 new municipalities. The estimated loss in this 10-year period, due to the condemnation of livers with *Fascíola* in cattle in the State of Goiás, was R$ 15,072.75 (AQUINO et al., 2018).

Regarding the prevalence and distribution of bovine cysticercosis (*Cysticercus bovis*), in the survey presented by Aquino (2017), it revealed a prevalence of 0.53%, with 42.31% of cysticerci being viable and 57.69% non-viable. The central mesoregion of Goiás had higher chances of finding cattle with cysticercosis (4.44%), when compared to the north (1.00%) and northeast (1.02%) regions. The economic losses estimated by the condemnation of carcasses, referring to slaughters in the period from 2007 to 2014, were R$ 64,809,817.50.

In Rio Grande do Sul, in the study carried out with 300 Angus cattle divided into two large lots: 114 steers between 12 and 15 months of age (super precocious confined group) and 186 steers aged between 36 and 40 months, under the pasture finishing regime, slaughtered in slaughterhouses in the southern region of the state; the general prevalence of animals with abomasum parasitized by *Haemonchus* SPP. was 14.04% in the super early

and 4.84% in the traditional category. In addition, it was observed that the finishing system significantly influenced the prevalence of *Haemonchus* spp. and the count of helminth eggs per gram of feces in the super precocious group was significantly higher when compared to that of cattle in the traditional group. Highlighting the importance of detecting parasitism by inspection at slaughter and laboratory examination of feces, for subsequent evaluations of sanitary programs. In addition to detecting possible failures or management risks, which cause economic losses (MARMITT et al., 2020).

Also for *Fasciola hepatic*, Araújo et al. (2007) found a prevalence ranging from 0.95 to 20%, referring to the slaughter of cattle, under federal inspection, coming from six municipalities in the state of Goiás. Based on epidemiological investigations, the authors identified that the animals positive for parasitosis were born and raised on their properties of origin, demonstrating the autochthonous character of the cases of bovine fasciolosis.

ANTHELMINTIC TREATMENTS AND THERAPIES AVAILABLE

The use of anthelmintic compounds to combat the most diverse worms in ruminants began with the discovery of the vermicidal activity of copper sulfate, in 1881, in sheep. Then came carbon tetrachloride (*Haemonchus contortus* in sheep). In 1939, the efficacy of phenothiazine was described with *Haemonchus contortus* and *Oesophagostomum radiatum*, also in sheep. After the 60s, with the discovery of thiabendazole, new concepts for anthelmintic drugs were obtained. In the 80s, the group of macrocyclic lactones (avermectins and milbectins) was discovered; causing a great repercussion because they can be used in various species and because they have great safety. In 2010, the mone-pantel was launched; derquantel in 2011: aminoacetonitrile and spiroindole derivatives, respectively. Other drugs not yet available are being studied, such as aurixazole (based on levamisole disofenate), for oral use for sheep and cattle (LOPES AND COSTA, 2017).

Evaluating the weight gain of 137 cattle aged close to 20 months, divided into five lots, one of which was the control/control, the other four lots received ivermectin dosages in the following concentrations: 4%, 3.15%, 3.5% + 1.25g abamectin and 3.5% of ivermectin associated with a vitamin compound ADE. No statistically significant differences were observed between the control group and all the other treatments, demonstrating that the different formulations did not interfere with the mean weight from 20 to 25 months. This result may have been explained by the residual effect of deworming, carried out 150 days before the beginning of the experiment. Animals in the control group of the experiment, despite suffering from parasitosis during the dry season, in the subsequent rainy season start to have a compensatory weight gain even when not dewormed during the rearing

phase. Thus, the author suggested the use of the most economical formulation in this age group in order to reduce the high production costs on beef cattle farms (HERDY et al., 2020).

It is important to emphasize that the rotation of drugs consciously used for anthelmintic treatment in cattle farming can delay the resistance of parasites to these more commonly used drugs (GASBARRE et al., 2009).

In order to synthesize and facilitate understanding, it can be said that antiparasitics are grouped into: anthelmintics, antiprotozoa and ectoparasiticides. Table one contains the main groups of anthelmintics currently used in the treatment of infections caused by nematodes, trematodes and cestodes (TAYLOR et al., 2017).

Table 1 – Groups of anthelmintics.

Chemical group	Cód. group	Nematodeans	Trematodeans	Cestodeans	Ectoparasites
Wide spectrum					
Benzimidazóis and pró-benzimidazóis	1-BZ	+	±	±	-
Imidazotiazóis/ Tetraidropirimidinas	2-LV	+ +	- -	- -	- -
Avermectinas/Milbectinas	3-ML	+	-	-	+
Derivatives of aminoacetil	4-AD	+	-	-	-
Espiroindóis	5-SI	+	-	-	-
Curto spectrum					
Salicilanilidas and Phenols substit.		±	+	±	±
Pepirazinas		±	-	-	-
Organofosforados		+	-	-	+
Arsenicais		+	-	-	-
Others		+	-	+	-

Source: TAYLOR et al., (2017)

As seen in chart one, this "other drugs" line are, for example: phenothiazine, epsiprantel, praziquantel, nitroscanate, emodepside, and chlorsulon (TAYLOR et al., 2017).

In a recent study published by SBTE – *Brazilian Society of Embryo Technology*) in 2020, treatment with levamisole phosphate at the beginning of the FTAI – Fixed Time Artificial Insemination protocol, improved the reproductive and productive performance of Nellore females. The use of a dose of the dewormer on the day of progesterone

implantation improved the cumulative pregnancy rate (FTAI + bull) as well as the body weight of Nellore females: cows and heifers (LOLLATO, 2020).

Rodrigues et al., (2020), analyzing the efficacy of two veterinary drugs from the avermectin group, tested 81 Nellore cattle in three groups, one of which was the control group; in the others, 3.5% ivermectin and 1% abamectin were applied. The collection was carried out directly in the rectal ampoule of the cattle, packed in thermal boxes and sent to the laboratory. A considerable reduction in the parasite load was observed on each day of post-treatment collection, however, the efficiency of the active ingredients was classified as inefficient, with a rate of 70.27% and 73.80% for ivermectin and abamectin, respectively. It was concluded that the drugs tested were not efficient in controlling the parasite load, and there was a need for immediate change of the active ingredients.

On the other hand, in the experiment using 40 Angus calves, 45 to 100 days old and with an average weight of 112.9 ± 19 kg, divided into two groups: control (20) and treatment with 1% (20) dual oil doramectin (20); where 2 weighings were carried out to evaluate the average daily gain and four feces were collected for a cropoparasitological examination. The OPG result did not show a statistical difference between the groups, however, the mean weight gain of the treatment group was higher than that of the control group: 884g and 446g, respectively (BARBOSA et al., 2021).

According to the different formulations on the market, the main routes of administration of anthelmintics can be defined. Among the main and most common are the oral, parenteral, transcutaneous (pour-on or spot-on) and intraruminal routes (LOPES and COSTA, 2017).

MAIN TYPES OF CONTROL AND PROPHYLAXIS USED IN BRAZIL

To be successful in parasite control programs, one must have knowledge of the epidemiology of the organisms present and the forms of control, both for the free and parasitic life phases. The goal is to keep all animals in full welfare conditions. Sanitary control methods cannot depend only on control with chemical products; in addition to providing a better health condition, they have to improve the benefit-cost ratio for the owner and make them reduce their expenses with the excessive administration of these products (MOLENTO, 2017).

For the most part, the most used method for controlling parasitic infections in production animals is the chemical method; due to its high efficacy, easy administration and good safety margin. On the other hand, its indiscriminate use has brought numerous

problems of resistance. The first reports of the appearance of resistance date back to the 1960s (MOLENTO, 2017).

Studies have shown minimal reversion to susceptibility in highly selected homozygous isolates, after discontinuation of the use of the selected drug and, consequently, once present in livestock farms, resistant worms can be considered permanent (TAYLOR et al., 2017).

By means of the technique of Global Genomic DNA Methylation – Deoxyribonucleic Acid –, in a work carried out in a herd of 72 half-blood Angus/Nellore heifers, with the objective of identifying resistant, resilient and susceptible animals to endo and ectoparasites; it was observed that 36.11% of animals were resistant, 52.78% resilient and 11.11% susceptible to infection by gastrointestinal helminths, with counts of 86, 392 and 1087 OPG, and 0.238, 0.225 and 0.197 of methylated DNA, respectively (GONÇALVES, 2020).

Some management strategies can be used to avoid parasite resistance, namely: treating the herd at intervals longer than the pre-patent period of the parasites; alternating different chemical compounds at intervals of more than three years (cattle); using both short- and long-acting products (according to demand/need); performing partial/selective treatments, allowing the survival of parasites in *refugee* (egg-larvae-adults: the larger the refugee population, the greater the possibility of dilution of the genes that encode resistant organisms) and treat newly acquired and/or introduced animals (MOLENTO, 2017).

There are non-chemical methods, which can be used for the treatment and control of worms. Mating between resistant animals, aiming at the procreation of animals genetically more tolerant to worms; periodic grazing on pastures with anthelmintic properties; administration of copper oxide metal particles, among others (TAYLOR et al., 2017).

Biological control is a natural phenomenon, based on the interactions that occur between living beings, especially those of a disharmonious nature (predation, parasitism and competition), which are of fundamental importance in the balance of ecosystems. Basically, this control is instituted in two ways: natural biological control and applied or artificial biological control. Entomopathogenic fungi such as *Metarhizium anisopliae* can be used to control the tick *Rhipicephalus (Boophilus) microplus;* as well as the distribution of nematofogo fungi in pastures, such as the genera *Arthrobotrys* and *Dactyella.* Bacteria of the genus *Bacillus* can also be used as biological control (GARCIA, 2008; GIROTTO et al.; 2008; BITTENCOURT and ARAÚJO, 2017).

Another method of biological control that is already widespread and known to many is the coprophagous beetle *Digitonthofagus gazella*. This arthropod has demonstrated its

efficiency and functionality in reducing the incidence of horn fly larvae: *Haematobia irritans* (MOLENTO, 2017).

Molento (2017) mentioned that several plants have demonstrated their antiparasitic effect, proving the phytotherapeutic potential of their extracts or oils.

In a study carried out by EMBRAPA Beef Cattle in Campo Grande-MS, Catto et al., (2014) tested the Asian plant: *Aza-dirachta indica*, more commonly known as "neem" or "nest". This plant, whether as the ground dried leaf, seed oil or the cake resulting from its pressing, is marketed for use in the control of worms, horn flies and also ticks.

The rotation of pastures or the temporary fencing of pastures, provides the death of numerous larvae during the period in which the areas are free of animals, making them less contaminated. In this process, the death of the larvae occurs due to the exhaustion of their energy reserves and the effects of desiccation, and 80% of them can die in about 30 to 45 days. It is worth mentioning that, during the period of occupation of the paddocks, the stocking rate is much higher than that of continuous occupation; it can provide greater contamination by eggs eliminated in animal feces. These, in turn, can result in infective larvae in just five to seven days (PEREIRA et al., 2005).

The fact of not directly incorporating newly acquired animals into the existing herd on the property, allowing them to comply with a quarantine period (being properly dewormed at purchase), contributes greatly to the reduction of environmental contamination, of infectious larvae in the pastures. The reduction in the number of head per hectare is also a factor in the increase in this drop. Another good alternative for this purpose is to alternate the grazing of young sheep with that of adult cattle and vice versa. Adult cattle are not infected with the same species of parasites that infect young sheep. In addition, cattle reduce environmental contamination of infective larvae in the field through grazing, favoring the cleaning of pastures (BENAVIDES et al., 2020).

The use of the agriculture-livestock system and/or ICLFS – Crop-Livestock-Forest Integration – is cited as an effective way, even temporarily, to reduce the number of infective larvae in the pasture (MOLENTO, 2017).

According to EMBRAPA (2006a), basically as a form of control and prevention, some care and criteria must be carefully observed. Important points should be considered in a bovine worm control program, as an example of these criteria to be followed, some main ones are: prevent the accumulation of larvae in the pastures, as the initial amount of contamination determines the severity of the infection. Animals must be exposed to a degree of contamination sufficient to produce resistance without negative interference with their productivity.

EMBRAPA (2006a) also mentions that the dewormer, when applied without the aid of complementary control measures, provides temporary relief. However, if the herd remains on contaminated pasture, it will be reinfested, as adult worms develop within 21 to 28 days after ingestion of larvae. The fertilization of beef grass production fields with cattle manure should be considered a risk factor for the appearance of infestations; Reducing the amount of worms in the animal reduces the number of eggs available for pasture contamination.

The use of vaccines could, without a doubt, be one of the main tools for the control of worms in ruminants, however, there is still no commercial presentation available. Studies already advanced with the use of molecular biology have managed to discover several antigens. Obstacles such as the preparation of stable recombinants, appropriate adjuvants, associated with a reasonable cost, prolonged and efficient action, make the launch of an immunizer for this purpose remote (BASSETO et al., 2014).

Much has been written about the prevention and control of bovine worms, each scheme has its pros and cons. Parasitism should be considered as an annual battle between the herd, the helminths and the breeder. The final criterion for the success of any prophylaxis effort is the overall benefit obtained, not the number of parasites that are destroyed (BOWMAN, 2010).

The development of eggs and larvae and the survival, persistence and migration of larvae in the pasture are limited by the dry season with a lot of sunshine and heat and often even by the excessive amount of rainfall. The most favorable combination for the development of worms is the one characterized by the presence of rainfall interspersed with periods of sunshine, which keeps the heat and humidity in the correct measure for its dissemination. With such knowledge, and especially knowledge about the transmission of larvae, it is possible to establish a preventive strategic control scheme in which climatic and management conditions must also be considered (EMBRAPA, 2006a).

PROPOSED ANTIPARASITIC TREATMENT REGIMENS

It is not new that there is concern with the correct use and application of antiparasitics in cattle. In a study carried out more than 30 years ago, the authors already warned about this issue, when in that year, HONER and BIANCHIN (1987) were already concerned with the revolution in the development of antiparasitic drugs. The authors mentioned the awareness of the importance given to gastrointestinal helminths, but with discouraging results obtained by the incorrect use of the products. That same year, it was already cited as having a "revolution/expansion", of the previous 20 years, when a greater quantity of anthelmintics began to be available on the market.

According to Honer and Bianchin (1987), the theory on the use of these anthelmintics, which had been developed specifically in Australia, identified eight different types of treatment possibilities, but four of them would be the most important: extensive preventive treatment, curative treatment, tactical treatment and strategic treatment.

Pereira et al., (2005) cited as a way of better understanding, four types of control used as tools for the implementation of parasitological control programs, namely: curative, suppressive, tactical and strategic.

More recently, Lopes and Costa (2017) describe that we must be very careful about the grace period of formulations available on the market, an aspect that is much forgotten by users. In addition to being a public health issue, it can cause damage to the environment (ecological imbalance) and trade embargoes on beef exports. The author mentions four types of treatment schemes:

The first is curative treatment, as it treats only animals that have clinical symptoms of worms. The second (tactical) treatment is the one that is used only in specific or even critical periods, such as: when acquiring new animals, climatic variations (↑outbreaks of worms), pre-calving period. Selective treatment, on the other hand, is when more specific techniques are used, such as OPG, for example; thus selecting those animals that really have worms. Although it is still a very little used treatment.

Finally, the strategic treatment is described. This treatment is basically based on the epidemiology of the nematodes and the climatic seasonality or rainfall index of the region. In general, the recommendation is that applications be carried out in periods when the parasite load is higher in the host, than in the environment (pasture); that is, in the driest periods of the year, respecting an interval between 60 and 90 days, according to the recommendations of each product (LOPES and COSTA, 2017).

According to Pereira et al., (2005), about 80% of the doses of anthelmintics used in Brazil are given erroneously and, therefore, without economic return. The erroneous use of anthelmintics and the non-adoption of other measures to control worms, make them one of the factors responsible for the low enjoyment of the national cattle herd. The same authors mention that, according to BIANCHIN (2000), the dosage of these animals has been done in the wrong way: both by wrong deworming at different times of the year and also by the lack of criteria in the inappropriate animal categories.

In studies carried out in 2016, it was shown that the treatment in the months of May-August-November provided a better benefit-cost ratio than those used in the months of May-July-September (LOPES and COSTA, 2017).

According to Molacco (2020), for dairy calves, worm control can be started from 2 to 3 months of age and treatments every 90 days should be repeated until they reach 12 months of age; when concentrated products are used that provide high efficacy and a longer control period. For heifers from 12 months of age, strategic control of worms is employed, with a treatment carried out at the beginning of winter (May/June), another near the end of winter (August/September) and another just after the beginning of spring (October/November). Treatment in mid-summer (February/March) is also recommended, as these animals are in broad body development and suffer a high negative impact from the main worms. For dairy cows, the author recommends that it be done when "at the entrance of the milking line" and in the dry period.

Identifying and separating ruminants from sources of infection is a strategy to be adopted in outbreaks of worms; It is recommended not to exercise animals affected by strongylosis. The use of anthelmintics should be based on knowledge of the biology of the parasites, as well as the climate of the region. When the contamination in the pastures is very intense, it is suggested to use strategic treatments: before calving and when returning to pasture, in mid-summer and autumn; sometimes complementing with tactical treatments (BOWMAN, 2010).

According to Lopes and Costa (2017), beef cattle can be divided into four categories, according to susceptibility to worms and the need for treatments: before weaning, from weaning to 24 months of age, adult males and adult females.

FINAL CONSIDERATIONS

In view of the above, it is verified the importance of controlling worms in cattle; regardless of the type of livestock exploitation that is being practiced. In the most diverse studies carried out, the increase in weight gain, milk production and fertility index, and even in the drop in mortality, among other positive benefits observed, has been proven.

Based on the studies of this literature review, we also observed that there are no evaluations of the economic impact of bovine parasitosis carried out in Brazil. There are several studies that consider economic and financial aspects, but not specifically economic impact itself.

It is estimated that the financial losses in Brazil were more than 15 billion dollars in one year, due to the action of the main endo and ecto parasites, due to the absence of adequate parasite control measures. Representing approximately more than 10% of the GDP of all livestock activity.

In view of the numbers and data exposed, a negative performance of livestock, especially in the case of cattle farming, can have disastrous consequences for the financial markets.

In order to optimize the results, which are, for the most part, the most expected and desired part of the cattle breeder, it is necessary to use sanitary tools available in the agricultural segment. Among these tools, health is undoubtedly one of the great pillars of cattle farming; whether it is beef or dairy.

The fight against worms, as recommended in a complete cycle production system, must be carried out from those younger to the oldest animals; making use of the numerous information available and its efficiencies being duly proven.

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EPIDEMIOLOGICAL SURVEILLANCE AND ACTIONS OF THE OFFICIAL VETERINARY SERVICE FOR THE PREVENTION AND CONTROL OF EQUINE INFECTIOUS ANEMIA IN THE STATE OF GOIÁS, BRAZIL

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ABSTRACT

Equine Infectious Anemia (EIA) is one of the main diseases that affect equids. Its prevention, control or even eradication are among the main objectives established by the National Equine Health Program (PNSE). The state of Goiás is an important national reference in equine breeding. Equids in general generate financial foreign exchange for Brazil, in the order of billions of reais annually and an estimated generation of jobs, indirectly, above two million employed people. Goiás has an equine population of over 380 thousand animals. Equine farming has direct interference in the most diverse Brazilian communities, whether at work, sport, leisure or health. Numerous centers for training, breeding and concentration of equids are present throughout the country. Infection occurs by transmission of blood from infected to uninfected horses. The diagnosis of EIA is made by the AGID test. It is estimated that only 10% of the equine population has been tested and that the prevalence in Brazil and South America ranges from 2-3%. In 2018, Goiás had 17 anemia outbreaks completed and another 33 remain pending. EIA is a disease that has no treatment or vaccine with wide efficacy. In order for blood serum to be collected, the professional in charge must be accredited by the SVO (Official Veterinary Service). Acquiring animals with negative tests for EIA, using disposable needles, isolation of positive animals and the sacrifice or sanitary slaughter of HIV-positive people, are among the main prophylaxis measures to be taken. Considering the importance and relevance of this disease, the objective of this work is to review the literature of the most diverse concepts in animal epidemiology and health defense, focused on the side of disseminating and contributing to the execution of the actions proposed by the PNSE, both by the SVO, and by the owners, breeders and professionals who work in equine farming, putting into practice what is determined by the current legislation. Animal health surveillance is one of the most demanding points for the control or even the eradication of diseases in production animals.

Keywords: Anemia Infectious Equine. Sanitary Defense. Vigilance. Epidemiology. Equines. Prevention.

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INTRODUCTION

In 2006, the first study that sought to measure the economic and social importance of the horse was published in Brazil. This study allowed us to see several important aspects of equine farming. Over the years, the data were partially updated and even so, this 2006 work continued to be almost the only economic reference for several technical, scientific and journalistic articles. In the economic aspect, the main changes occurred. At the time, based on 2005 values, it was found that the financial transaction totaled R$ 7,501,791,653.88 (MAPA, 2016).

Considering equine breeding, Equine Infectious Anemia (EIA) is a disease of significant importance and economic impact. It is an infectious disease of mandatory notification; For transit and participation in events, it is necessary to submit the animals to laboratory examination. It affects both horses, mules (donkeys and mules), and donkeys (donkeys), regardless of sex or age. However, the clinical course of EIA virus infection has been widely studied only in horses. The same occurred in serological surveys, in which the investigation of the occurrence of EIA has usually been estimated in populations of majority horses. Donkeys do not show clinical signs similar to those of horses/ponies infected by pathogenic strains of the IEA (OLIVEIRA, 2016).

According to MAIDANA (2011) and ALMEIDA, et al. (2006), cited by OLIVEIRA (2016), EIA is currently the major obstacle to the advancement of equideoculture, as it is an incurable and easily transmissible disease, causing losses to breeders who need the commercialization of these animals and harming the improvement of breeds, in addition to preventing access to the international market.

CURVELO (2014) mentions that, according to Ribeiral (2006), animals in the field that are not submitted to diagnosis represent a risk for the maintenance and dissemination of the disease on the properties, thus justifying the need for serological surveys that evidence and trace an epidemiological profile of the EIA, as well as the real prevalence rate of the disease in the different Brazilian biomes and states, because these indexes, together with the survey of risk factors associated with the disease, are of great importance as a subsidy for strategic decision-making for the control of the disease.

Assuming the existence of two distinct systems: one of care and the other of surveillance, the use of the expression "animal health care and surveillance systems" was common in South American veterinary services. This terminology is present mainly in technical and normative documents produced until the end of the 90s, in the case of Brazil, with emphasis on the classification system of the federation units, such as the classification according to the levels of three risks for foot-and-mouth disease. In short, these two

systems are complementary to each other, and are often confused, and the existence of a good sanitary or epidemiological surveillance system is only conceived from the existence of a structured veterinary care system (MAPA, 2007).

It can be said that, in an instructive and synthesized way, the veterinary care system represented the necessary structure for the practice of epidemiological surveillance. The term "attention" thus encompassed information regarding physical resources (consumables, laboratory, offices, vehicles, means of communication, etc.), human resources (and distribution of personnel, quantity and quality) and those associated with the political and legal fields (line of command, political will and legal instruments), while the term "health surveillance" involved information related to operations such as, for example, number of visits to rural properties, number of animals inspected, results of serum-epidemiological studies, among others (MAPA, 2007).

The veterinary surveillance structure involves, in each instance of the agricultural health care system at the federal and state levels, the coordination of animal health information, laboratories, standardization of procedures, human, material and financial resources. In the present study, the nomenclature "veterinary surveillance" will be used to mean epidemiological surveillance activities in the field of animal health, including structural or care aspects (MAPA, 2007).

Equideoculture plays an important role in state and national agricultural activity. Based on this, we will explain from now on, about one of the main diseases of Equids, guided and governed by the PNSE – National Equine Health Program – which MAPA – Ministry of Agriculture, Livestock and Supply – brings to breeders and professionals of equestrian agribusiness: Equine infectious anemia, also known by the acronym "AIE".

The objective of this work is to detail the main animal health defense actions, with a view to applying sanitary measures for the prevention, control or eradication of equine infectious anemia in the state of Goiás, created and developed by the national health defense agency (MAPA) and executed by the animal health defense agencies in the states of the federation that, in the case of Goiás, it is the Goiás Agency for Agricultural Defense – Agrodefesa.

LITERATURE REVIEW

EQUINE BREEDING IN BRAZIL AND THE HORSE AGRIBUSINESS COMPLEX

In Brazil, CEPEA (Center for Advanced Studies in Applied Economics), in partnership with CNA (Confederation of Agriculture and Livestock of Brazil), has been measuring the GDP (Gross Domestic Product) of agribusiness, including dividing it into agricultural and

livestock. It is observed that the participation of agribusiness in the total income generated in the country has remained between 20% and 25%. The production chain can be understood as a cut within the broader agro-industrial complex. Thus, inserted in agribusiness, there are the chains of soybeans, oranges, milk and various agricultural products. Unlike many agricultural activities, horse agribusiness does not fit into a standard structure, with a linear production chain. In reality, there is a series of intertwined chains, forming what is called an agricultural complex (MAPA, 2016).

As for the international trade in live horses, the problems with statistical data are not limited to the number of animals that make up the national herd. Other relevant information also presents divergences according to the source and operational limitations, as is the case of imported and exported animals. There are at least three important sources for this data: the FAO (Food and Agriculture Organization of the United Nations), the MDIC (Ministry of Development, Industry and Foreign Trade) and VIGIAGRO (International Agricultural Surveillance System), linked to the Secretariat of Agricultural Defense of the Ministry of Agriculture (MAPA, 2016).

The horse agribusiness complex directly employs 607,329 people. Considering the fact that each direct occupation provides four other indirect occupations, it is estimated that 2,429,316 indirect jobs are generated. Thus, the complex is responsible, directly and indirectly, for 3 million employed people (MAPA, 2016).

According to the 2017 agricultural census, carried out by the IBGE – Brazilian Institute of Geography and Statistics -, the population of equids (donkeys, horses and mules) in Brazil is in the order of 5,207,652 animals, clustered and distributed in 1,684,714 breeding establishments.

Comparing the IBGE data, in the 2017 agricultural census, which points to the state of Goiás with an equine herd of 344,715 animals, we observe a significant increase in this volume, when comparing with the data published by SEGPLAN - State Secretariat for Management and Planning - in 2017, with reference to the base year of 2016. This number pointed out by the IMB – Mauro Borges Institute – was 356,611 horses accounted for in the state of Goiás. As we can see in table 1 below (IMB/SEGPLAN, 2018).

Table 1 - Equine herd herd in the State of Goiás, in head, in the years 2014 to 2016.

Year	Equines
2014	385.525
2015	380.405
2016	365.611

Data Source Provider: Instituto Mauro Borges/SEGPLAN-GO (2018)

Some important factors for this discrepancy in the numbers obtained by the institutes; Among them the methodology used, failure to compile data, inefficiency of the personnel responsible for the interviews, lack of follow-up by the team, among others. Or even think of a real increase in this number of horses in Goiás, on the part of the study carried out by IMB/SEGPLAN, considering that it is an institute that belongs to our state and, theoretically, would have better and more precise conditions to do a more thorough and judicious work, than that provided by the IBGE in 2017.

SANITARY SURVEILLANCE, EPIDEMIOLOGY, ANIMAL HEALTH EPIDEMIOLOGICAL REPORTS AND ANIMAL HEALTH DEFENSE

> Some authors classify surveillance actions as primary, secondary, and tertiary, while others classify first, second, and third barriers. Another widely used classification is the definition of actions performed as passive or active measures. The term passive surveillance has generally been used to characterize routine activities involving the care of suspected disease occurrence or the description of the animal population of a region (BRASIL, 2007).

A clear example of this type of surveillance is seroepidemiological monitoring and surveys. According to the manual of veterinary surveillance of vesicular diseases (2007), regardless of the denomination used, epidemiological surveillance applied to animal health, or veterinary surveillance, consists of the following activities: obtaining and recording relevant epidemiological information; consolidation and analysis of the data collected; decision and establishment of preventive procedures; execution of emergency operations and notification and dissemination of communications with information about the disease and the results of the measures applied in all available means to reach a large part of those involved by the surveillance system (feedback).

A good surveillance system must have some characteristics, among them: sensitivity, specificity and timeliness (BRASIL, 2007).

> The veterinary surveillance system is also responsible for establishing the appropriate legal and administrative framework, applying all necessary resources to improve the efficiency performance of controls, including personnel, equipment, vehicles, and financial resources. It is also responsible for training personnel and developing mechanisms to involve the services of other government and private sectors and producers in the veterinary surveillance system (BRASIL, 2007).

The first record of the use of the expression "epidemiology" was in 1802 in Spain, with the historical meaning of epidemics. The physician, scientist and sanitarian John Snow (1813-1858) is considered by many to be the father of epidemiology, due to his famous studies on the cholera epidemic in London; the oldest and most illustrative example of the importance of mapping at the local scale is Dr. John Snow's map of cholera deaths in the Soho district of London in 1848 (ACOSTA, 2012).

According to MADUREIRA (2015) cited by ACOSTA (2012), the dictionary of epidemiology of Last (1995) defines epidemiology as the study of the distribution and determinants of health-related phenomena or states in specific populations, and the application of the results to control health problems.

Another definition of Epidemiology is the science that studies the health-disease process in society, analyzing the population distribution and the determinant factors of diseases, damage to health, and events associated with public health, proposing specific measures for the prevention, control, or eradication of diseases, and providing indicators that support the planning, administration, and evaluation of health actions (ALMEIDA FILHO and ROUQUAYROL, 1992, apud ACOSTA, 2012).

The OIE is an intergovernmental organization, based in Paris, France, responsible for regulating animal health worldwide; they have annual meetings every May, with the international committee. Within health defense, it is the most important body in the establishment of measures for the prevention, control and eradication of diseases in the world. The OIE began in 1920, due to the occurrence of rinderpest in Belgium as a result of the importation of zebu originating in India destined for Brazil. In 1924, 28 countries signed an agreement creating the *Office International des Epizooties (International Organization of Epizootics).* In 2003 it was renamed the World Organization for Animal Health (OIE). Currently, the OIE has the participation of 178 member countries, including Brazil (CHARRO, 2008).

One of the OIE's missions is to ensure the transparency of animal health in the world and to improve the knowledge we have about it. Among the formal obligations of the member countries of the institution, the sending, in a faster (timely) and transparent manner, of information on the pertinent animal disease, including the zoonoses present in

their territory, stands out. For this purpose, a list of diseases of terrestrial and aquatic animals was established that must be reported to the OIE (OIE, 2018).

Among the functions of the OIE, we can mention: collecting, analyzing and disseminating veterinary scientific information; offer experts and promote international solidarity for the control of animal diseases. Provide technical support to member countries in need of assistance for disease control and eradication operations, including zoonoses; support poor countries in helping to control diseases that cause large losses in livestock, as they represent a public health risk and concern member countries. To ensure the safety of world trade, developing sanitary rules for the international trade of animals or products of animal origin (CHARRO, 2008).

The National Animal Health Information System (SIZ) is managed by the Coordination of Information and Epidemiology (CIEP) of the Department of Animal Health, which manages data and information on the occurrence of diseases, as well as other information of interest to animal health. The CIEP is responsible for the immediate notifications of diseases and for the semiannual and annual reports that are sent by Brazil to the OIE, maintaining communication about the occurrence of diseases in the country. The main objectives of the SIZ are: to collect, consolidate, analyze and disseminate animal health information to support the preparation, implementation, evaluation and decision-making on strategies and actions for surveillance, prevention, control and eradication of animal diseases of relevance to livestock and public health; as well as subsidizing national animal health certification with international organizations and countries or economic blocs with which Brazil maintains trade relations (MAPA, 2018).

The SIZ database is based on a list of diseases that must be notified to the official veterinary service. The notification of diseases on the list established by IN – Normative Instruction – No. 50 of MAPA of September 23, 2013, is mandatory for all those who are aware of suspected or confirmed cases, according to the criteria and flows established in the standard. Notification must be made to the official veterinary services of the states – EVS – at the Local Veterinary Units – UVL's – or community service offices, at the headquarters of the EVS's or at the Federal Superintendencies of Agriculture – SFA's – for definition and necessary measures for the control and eradication of diseases (MAPA, 2018).

Until 2013, the OIE list included 141 diseases (FAEMG, 2013). The list is periodically reassessed and in case of modifications adopted by the World Assembly of Delegates (WAD) at its annual meeting, the new list will come into force from the first day of January of

the following year. For the year 2017, the list included 116 notifiable animal diseases, infections and infestations (VETSMART, 2017).

In Brazil, the first list of animal diseases was published by the regulation of the animal health defense service, instituted by decree 24.548, of July 3, 1934, and has since been expanded. This decree was the same one that approved and regulated the animal health defense service in Brazil. It was signed by the then president of the federative republic of Brazil, Getúlio Vargas (MAPA, 2018).

Animal health data collected by the official veterinary service since 1971 are available for consultation. In the period from 1971 to 1998, the data can be consulted in the animal health defense bulletins, and from 1999 onwards, the data can be consulted and extracted using an interactive tool for accessing and importing the data. Every six months, Brazil sends animal health reports on the occurrence of diseases in the country to the World Organization for Animal Health (MAPA, 2018).

Agricultural defense begins with the control of the entry of animals, vegetables and their derived products into Brazil. Luiz Pacífico Rangel described in 2017 the complex routine of agricultural defense in the largest port in Latin America: Port of Santos-SP. A movement of 90,000 containers per month, the need for cargo inspection at import, to prevent the entry of pests and diseases, and the certification for export to more than 150 countries of our agricultural products (MAPA, 2018).

The bibliography on communication in agricultural defense is quite limited, which makes it difficult to deal with the topic without referring to agribusiness in general. According to data from the year 2010 of Abag - Brazilian Agribusiness Association -, agricultural defense guarantees quality and safe supply, contributes to avoid the insertion of pests and diseases in the country and also provides good business opportunities. It is estimated that Brazil does not have access to markets of 20 billion dollars per year in exports, due to diseases that affect our agriculture and that could be eradicated or controlled efficiently (NOGUEIRA, 2013).

EPIDEMIOLOGICAL SURVEILLANCE AND MANDATORY NOTIFICATION: GENERAL CONCEPTS

According to the OIE (World Organization for Animal Health), the definition of epidemiological surveillance is the continuous investigation of a population to detect the occurrence of the disease/infection for prevention and control purposes, and involves the examination (clinical or laboratory) of part of this population (MAPA, 2007).

Notifiable diseases are the diseases on the OIE list, in addition to others that may compromise the national equine herd, the economy, public health or the environment. Any member of the community must immediately report any suspicion or occurrence of notifiable diseases to the unit closest to the agency that executes animal health defense activities. Efforts to prevent the introduction of new diseases in Brazil focus on controlling imports of live animals, animal multiplication material, and products with the potential to transmit etiological agents (MAPA, 2019).

The definition of notification, according to the epidemiological surveillance guide, is the communication of the occurrence of a certain disease or health problem, made to the health authority by health professionals or any citizen, for the purpose of adopting pertinent intervention measures. Historically, compulsory notification has been the main source of epidemiological surveillance, from which, in most cases, the information-decision-action process is triggered (MAPA, 2009).

Among the functions of epidemiological surveillance, we can mention: data collection, processing of collected data, analysis and interpretation of processed data, recommendation of appropriate prevention and control measures, promotion of indicated prevention and control actions, evaluation of the efficacy and effectiveness of the measures adopted, and dissemination of pertinent information (MAPA, 2009).

EQUINE INFECCOUS ANEMIA (AIE)

Equine infectious anemia is a viral, cosmopolitan, multisystemic disease caused by an RNA-virus (BUSATO et al., 2015).

It is an incurable disease with great prevalence in the Brazilian Pantanal, affecting about 50% of service animals (SILVA et al., 2004, apud MARQUES et al., 2012). The virus is classified and known as Equine AIDS (MARQUES et al., 2012). It is also known as swamp fever (SILVA, et al., 2013).

CORREIA (2016) mentions that, according to Aiello et al. (2001), the terms "equine malaria", napping disease or napping are also synonymous for the EIA. Equine infectious anemia was first described in 1843 in France, was recorded in the American continent, in Canada in 1881, in Venezuela in 1960 and in Argentina in 1964 (MONTELARO et al., 1993, apud SILVA, et al., 2013).

In Brazil, in 1954, Bernardino Manente presented clinical and anatomopathological descriptions of EIA during the II Pan-American Congress of Veterinary Medicine, in an experimental case. But scholars of the subject consider that the first properly documented observation is authored by Prof. Octavio Dupont, in 1966, when the author began to

observe the disease among the animals installed in the Brazilian Jockey Club of Rio de Janeiro (MAPA, 1988).

At the time, this diagnosis was established based on findings attributed to the destruction of red blood cells by viral action: presence of sideroleucocytes, deviations in total protein values and fractions in relation to albumin/serum globulin, obtained in the electrophoretic profile, dosage of total serum proteins and seroprotein fractions, as well as the presence of iron deposits in organs of the reticulum endothelial system (MARTINS, 2004 apud, SILVA, et al., 2013).

EIA prevention actions are characterized by being carried out temporarily or permanently, depending on the epidemiological context, through actions, activities, and strategies of health education, environmental management, and animal vaccination, when applicable (BRASIL, 2016).

Once the real situation of risk of anemia transmission (imminent risk) or the introduction of the disease is verified, the epidemiological surveillance area must begin the stage of development and execution of disease control, through appropriate and feasible measures to be applied directly and indirectly to the target animal population, in order to interrupt the disease transmission cycle. Disease control actions, activities, and strategies are subdivided into three types: control of imminent risk of transmission, control of incident disease, and control of prevalent disease (BRASIL, 2016).

After and during the application of the control measures of the target disease, their effectiveness should be monitored and evaluated. Depending on the result of the evaluation, it is necessary to continue with the control measures, until the objective is achieved (reduce or eliminate, when possible, the disease or the imminent risk). Surveillance measures are permanent. It should observe and pay attention to the guidelines recommended in the specific program for the disease, for the appropriate defense, surveillance and control actions, of MAPA (BRASIL, 2016).

MAPA, through the pertinent and current legislation, recommends the sacrifice of seropositive animals to control the disease in most Brazilian regions. In endemic areas such as the Pantanal, the isolation of seropositive animals is allowed, as their sacrifice would cause great damage to extensive livestock in the region, or even make it unfeasible (MARQUES et al., 2012).

No treatment is effective in eliminating the EIA virus, and there is no vaccine. Every Coggins test positive horse should be euthanized, even if it is an unapparent carrier, because of the potential to infect other horses. In Brazil, EIA is a notifiable and mandatory sacrifice disease. It is recommended to perform the Coggins test at least once or twice a

year. Every horse participating in auctions, tests and exhibitions, as well as every horse transported, must present negativity in the Coggins test as a certificate (BUSATO et al., 2015).

Acquire animals with negative tests for EIA, within the expiration date; clean the stalls, to avoid insects; vaccinate or medicate animals only with disposable needles; disinfect equipment before use; participating in events with equine agglomeration where the animals are proven negative for EIA, through laboratory tests, are important prophylaxis measures to be taken by equine owners (MAPA, 2010).

In iatrogenic transmission, humans play an important role in the epidemiology of the disease due to the use of contaminated needles, surgical instruments and utensils, such as bridles and spurs, and can spread the disease within the same herd or even to other properties due to inadequate hygiene and management practices (MORAES et al., 2017).

Another important measure for the prevention of EIA is the isolation of positive animals and the sacrifice or sanitary slaughter of HIV-positive animals (GOIÁS, 2019).

According to current legislation, the results of positive animal tests for equine infectious anemia must be immediately forwarded to the SVO (GOIÁS, 2019).

Normative Instruction No. 45 of June 15, 2004, approves the rules for the control and prevention of equine infectious anemia; among them, it is established, in its first article, the sanitary slaughter of positive animals: article 17, paragraph IV and article 19, sole paragraph. In the case of animal sacrifice on the property, this service must be accompanied by the animal health defense service.

SPECIFIC ACTIONS OF THE OFFICIAL SERVICE IN THE FOCUS OF THE DISEASE

According to article 17 of IN 45 of 2004, the following animal health defense actions must be carried out by the SVO:

> I - Interdiction of the property after identification of the carrier equid, drawing up a term of interdiction, notifying the owner of the prohibition of the transit of equids from the property and the movement of objects that may transmit the EIA virus;
> II - Epidemiological investigation must be carried out on all animals that reacted to the EIA diagnostic test, including transit history;
> III - Permanent marking of the equids carrying the EIA, by means of the application of a burning iron on the left side shoulder with an "A", contained in a circle of 8 (eight) centimeters in diameter, followed by the acronym of the UF, according to the model;
> IV - Sacrifice or isolation of carrier equines;

V - Carrying out a laboratory examination, for the diagnosis of EIA, of all horses existing on the property; Note: identification must be made in a proper and individualized form. The animals will be reviewed, the papers will be filled out and signed by a veterinarian registered by the official veterinary service;

VI - Disinterdiction of the focus property after carrying out 2 (two) tests with consecutive negative results for EIA, with an interval of 30 (thirty) to 60 (sixty) days, in existing equines;

VII – Guidance to the owners of properties that are in the perifocal area, by the official veterinary service, to submit their animals to laboratory tests for the diagnosis of EIA.

Sole Paragraph. The marking of equidae is the responsibility of the official veterinary service and will not be mandatory if the animals are immediately euthanized or sent for sanitary slaughter. If the transport to the slaughter establishment cannot be carried out without a stop for rest or feeding, the animals must be marked and the resting place previously approved by the animal health service of the respective UF.

AGRODEFESA, through IN No. 006 of June 2018, established guidelines for the qualification and registration of veterinarians from the private sector with the official service, for the collection of samples for laboratory diagnosis of EIA and Glanders. With the objective of standardizing the actions carried out by autonomous professionals, as well as greater control of the inspection of documents issued and generated by these professionals, within the scope of animal health defense.

The Agency also has available for consultation, on its website, a manual/booklet for the review of equids, which will be submitted to laboratory tests. It deals specifically with the various types of equine coats. It is a very interesting material, well illustrated and that satisfactorily meets the needs of both field professionals (self-employed from the private sector), breeders and owners, as well as the State Agricultural Inspectors - FEA - for the exercise of their inspection activities.

It is worth mentioning that the qualification of veterinarians to collect and send samples for laboratory tests of Glanders will be granted by the Ministry of Agriculture, Livestock and Supply. The veterinarian qualified by MAPA to request, collect and send samples for glanders laboratory tests will be automatically registered to request, collect and send samples for EIA laboratory tests. For this registration with the Agency, the professional must be mandatorily qualified by MAPA (GOIÁS, 2018).

The culling or isolation of equine animals carrying EIA should be determined in accordance with the standards established by the SVO. When the indicated measure is the

sacrifice of the carrier animal, this will be carried out by the official veterinary service, within a maximum period of 30 (thirty) days, from the result of the diagnostic exam, preferably on the property where the animal is. If it is not possible for the sacrifice of the carrier animal to be carried out on the property, the sanitary slaughter may take place in a slaughterhouse with an inspection service and the transport must be an appropriate vehicle, with a numbered seal applied at the origin. The sacrifice of the carrier animal must be quick and painless, under the responsibility of the SVO; On the occasion, a term of sanitary sacrifice will be drawn up, signed by the official veterinarian, by the owner of the animal or his legal representative and, at least, by a witness. The owner of the sacrificed animal will not be entitled to compensation (BRASIL, 2004).

In its article 25 to IN 45 of 2004, it provides information that the equine, with permanent marking of EIA bearer, that is found on another property or in transit will be summarily sacrificed in the presence of 2 (two) witnesses, except when proven to be destined for slaughter. The property where this animal is found will be considered a focus (BRASIL, 2004).

In chapter 7 of this IN, specifically articles 26 to 28, it is dealt with with the properties controlled by the IEA. The property will be considered controlled for EIA when it does not present a positive reactive animal in 2 (two) consecutive diagnostic tests for anemia, carried out with an interval of 30 (thirty) to 60 (sixty) days. In order to maintain the situation of controlled property for the disease, all its equine herd must be tested at least once every 6 (six) months and present a negative result. For the property declared controlled for anemia by the SVO of the respective state, a certificate will be conferred, at the request of the interested party, renewed every 12 (twelve) months (BRASIL, 2004).

PRECAUTIONS TO BE OBSERVED WHEN SENDING SAMPLES TO THE LABORATORY

In order for the laboratory to receive the blood serum for the examination of equine infectious anemia, in addition to the review form, if it is not the veterinarian responsible for delivering the sample(s), a form of "Appointment of Carrier and Statement of Counter-Proof for EIA" must be completed and sent by the person responsible for delivery. This form, in addition to identifying and designating the person who is being assigned the responsibility of delivering the sample to the laboratory, is also made necessary to use it, when it is necessary to take a counter-test of the test. In this form, the declarant assumes, in addition to all responsibility for sending and delivering the sample(s) to the laboratory, also the responsibility for having accompanied the centrifugation and/or fractionation of the sample(s) (Agrodefesa, 2019).

Another important form for the laboratory to receive blood serum, for the purpose of diagnosing the EIA virus, is the veterinarian's term of commitment. Without this document completed and signed by the professional responsible for collecting the material, the laboratory does not receive the sample(s). In summary, in this document, the professional registered by the SVO, assumes to comply with what is determined by the current legislation (whether for the IEA or glanders), undertakes to make good identifications of the equids (reviews), to provide clarifications, is responsible for divergences, etc. (Agrodefesa, 2019).

In the case of a serological survey for property control, the requisition and result form for the EIA test may be used for serological survey purposes, which is not valid for transit (BRASIL, 2004).

According to LABVET - Veterinary Analysis and Diagnosis Laboratory - of Agrodefesa, in the review forms, all fields must be properly filled in. The address of the owner and the veterinarian must be complete (street, n.º, neighborhood, city and telephone with area code). If the owner resides on the farm, put the name of the farm, highway and km where the property is located or its state registration. Lack of information, incomplete/incorrect information, erasures, documentation, stamp and signatures, will result in the retention of samples in the screening sector until the pending documentation is resolved. Specifically for the equine infectious anemia form, it must be in 3 copies, with the review of the first copy with a blue pen, the original signature and the stamp must be stamped in all copies (Agrodefesa, 2019).

Among the recommendations passed on by LABVET, with regard to the quality of the sample itself, we can mention the main points of note: At least 2 mL of serum (refrigerated or frozen) are required for each test, with 1 mL intended for the test and 1 mL sealed as a counter-test. The tubes must be properly identified and packed in an isothermal box containing disposable ice or in a plastic bag. Samples should arrive at the laboratory at a maximum of 8 °C. Whenever the technician of the sample screening sector deems it necessary, due to the conditions in which the sample arrived at the laboratory, the temperature will be measured and in those situations in which a temperature above the recommended temperature is verified, the sample will be discarded. Hemolyzed samples, with evidence of contamination or without identification will be discarded (Agrodefesa, 2019).

LABVET warns: "Samples sent in syringes, gloves, vaccine tubes and the like will not be accepted; When sending blood to the laboratory, be aware that it may hemolyze during transport, which will lead to its disposal!" (Agrodefesa, 2019).

With regard to the deadline for delivery of results and the validity of the tests, LABVET says that the deadline for delivery of the EIA result is up to 3 working days after inoculation, and samples delivered to the screening sector until 15:00h, if there are no pending issues, will be processed and inoculated on the same day and those delivered after this time will be processed only on the following day. The samples delivered after 15:00 on Thursday, together with the samples delivered on Friday, the result will be made available on Monday. EIA tests with negative results will be valid for 60 days after sample collection. Positive results will be forwarded first to the coordination of PESE as well as MAPA and, later, to the requesting veterinarian (Agrodefesa, 2019).

REGULATION OF ACTIONS AND GUIDELINES RELATED TO SANITARY DEFENSE AND EPIDEMIOLOGICAL SURVEILLANCE (LEGAL FRAMEWORKS)

First, it is worth mentioning that, in one of MAPA's publications, in 2010, by the SFA – Federal Superintendence of Agriculture -, the material released at the time (folder), dealt specifically with the IEA and glanders. They reported on equine influenza, but it is evident that the emphasis was much more significant on those first two diseases than on the last one (MAPA, 2010).

It is important to highlight the importance of making a brief chronological analysis of MAPA's normative acts, with a view to regulating the actions and guidelines to be taken regarding health defense and epidemiological surveillance activities, both for the IEA and for glanders. In this sense, we can list the following "legal frameworks":

- Decree No. 24,548, of July 3, 1934: Approves the regulation of the animal health defense service;
- Ordinance No. 200, of August 18, 1981: Includes equine infectious anemia in the list of diseases subject to the application of animal health defense measures;
- Ordinance No. 84, of October 19, 1992: Approves the standards for the accreditation and monitoring of EIA laboratories;
- Service Instruction No. 17, of November 16, 2001: Determines the adoption of sanitary measures due to the occurrence of equine influenza;
- Normative Instruction No. 24, of April 5, 2004: Approves the norms for the control and eradication of glanders;
- Normative Instruction No. 45, of June 15, 2004: Approves the norms for the prevention and control of the EIA;

- Decree No. 5,741, of March 30, 2006: Regulates articles 27-A, 28-A and 29-A of Law No. 8,171, of January 17, 1991, and organizes the Unified System of Agricultural Health Care (SUASA);
- Normative Instruction No. 17, of May 8, 2008: Establishes the National Equine Health Program within the scope of the Ministry of Agriculture, Livestock and Supply;
- Normative Instruction Mapa No. 06, of January 17, 2018: Approves the guidelines for the control, eradication and prevention of glanders in the national territory;
- SDA Ordinance No. 35/18, of April 17, 2018: Defines laboratory tests for the diagnosis of glanders in Brazil;
- Normative Instruction No. 006/2018, of Agrodefense, of June 18, 2018: Provides for the procedures for the qualification and registration of veterinarians from the private sector with the Goiás Agency for Agricultural Defense for the collection and submission of samples for laboratory diagnosis of equine infectious anemia and glanders, in the state of Goiás.

FINAL CONSIDERATIONS

Having knowledge of the epidemiology, pathogenesis, clinical signs, treatment and prevention of the most diverse diseases that affect farm animals are fundamental pillars for the correct application of animal health defense and epidemiological surveillance tools.

As we have seen, in 2018, the state of Goiás had 17 EIA outbreaks completed and another 33 that still remain pending. In many cases, it is the deficiency in communication between health defense agencies and the private sector or even the lack of human, structural and technological resources, which contribute to the appearance of data that are at the same time inconsistent, flawed and dangerous for animal epidemiological surveillance. Situations of this type put at risk the animal health defense system of any state, whether in Brazil or abroad.

In the state of Goiás, we have a single study from 1978, which is still what we have as official data on the prevalence of EIA, not leaving us reassured, of the current epidemiological situation that we are facing the disease.

Practical measures can be taken by the SVO, in situations of animals proven positive for the IEA. In this list of actions, we can mention the interdiction of property or breeding for the transit of equines; the marking of positive animals with the letter "A"; isolation of positive

animals; epidemiological investigation on the affected property and slaughter or sacrifice of seropositive animals.

This is undoubtedly one of the major obstacles that the animal health defense service faces. Many owners are resistant to putting their animals to diagnostic tests, when on many occasions, animals that may be seropositive there are a constant risk to other existing equine populations. Not to mention those situations where the animal is confirmed positive for EIA and the owner does not comply with what is provided for in the Legislation, committing numerous infractions, frauds and many others, in an attempt to "circumvent" the inspection and performance of the SVO.

The effective actions and actions of animal defense agencies, such as: OIE, MAPA and Agrodefense, for example, are fundamental for the application, maintenance and improvement of sanitary control measures, in order to combat, prevent or even eradicate anemia

In view of the exposures to the IEA and the agricultural defense service, we can make an analogy and observe that epidemiological surveillance is fundamental for the maintenance of the state or country free, controlled or even eradicated from diseases. When there is interaction and consonance between the governmental spheres: be it municipal, state or federal, we can notice that the so-called "gear" of the animal health defense system works in its fullness and harmony.

In addition to seeking cooperation and partnership from the most diverse bodies, entities and institutions in the agricultural sector, we must promote health education actions, so that information about the EIA, its agent, means of contamination, symptoms, care and prevention can be taken, not only by the SVO; but mainly by owners, breeders and professionals from the private sector.

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GAMIFICATION IN MEDICAL EDUCATION IN RADIOLOGY THROUGH DIAGRADQUIZ FOR TEACHING PATHOLOGICAL PATTERNS OF THE LUNG PARENCHYMA

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ABSTRACT

The present research reports the process of development and validation of a digital quiz-type game, composed of radiological images of lung diseases, questions and answers, educational videocast, which allows the user to learn in a playful way the diagnosis including Covid-19, helping the continuing education of physicians at a critical moment for public health in Brazil in the face of the Covid-19 pandemic, With an increase in the number of cases and deaths, with low availability of serological tests, knowledge of tomographic patterns was imperative for diagnosis. The use of serious games is a strategy to offer digital, integrated and motivating learning, with flexibility of time and space for the construction of knowledge. Through the development of a tool that supports the use of active methodologies in medical education, with the creation of gamified mobile digital technology with immersive learning (Game Based Learning), the following research problem is presented: What is the process to create and validate a quiz-type digital serious game for learning pulmonary tomographic patterns and diagnostic imaging in the context of COVID-19? DiagRadQuiz is a game created in a master's research in Health Sciences Teaching, developed from 2019 to 2021. The game was created from a multidisciplinary team composed of a doctor specializing in radiology and diagnostic imaging, a pedagogue in the area of health technologies and an architect working in programming. It is a serious game for Android smartphones, which aims to assess previous knowledge and teach pathological patterns of the lung parenchyma defined in chest computed tomography. The DiagRadQuiz was validated by information technology specialists (games) and doctors specializing in radiology. All evaluators stated that they would indicate DiagRadQuiz as a pedagogical tool for teaching pathological patterns in tomography prevalent in Emergency Care services, including Covid-19.

Keywords: Gamification. Serious Game. DiagRadQuiz. Medical Education. Radiology.

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INTRODUCTION

In 2020, there was little availability of RT-PCR serological tests and the low sensitivity of rapid tests led the Ministry of Health to review the diagnostic criteria for COVID-19. According to the clinical-epidemiological criterion, confirmation would be based on the analysis of the patient's history, taking into account whether he had symptoms characteristic of COVID-19 and whether he had contact with infected people. On the other hand, the clinical-imaging criterion analyzes tomographic alterations of patients who have had contact with infected people. The final decision on the diagnosis is up to the doctor. In view of the pandemic situation that entered 2021, with an increase in the number of cases and deaths from COVID-19, the low availability of serological tests (which took up to a week to be ready when in high demand), knowledge of tomographic patterns related to COVID-19 was imperative for the diagnosis and management of patients in an assertive manner. The use of new methods or didactic strategies for teaching and learning in the Health Sciences is essential for the treatment of patients with diseases of the lung parenchyma.

The use of *serious games* is a strategy, linked to digital technologies and mobile devices, to offer new teaching-learning possibilities, with flexibility of time and space for the construction of knowledge, which is fundamental in times of social distancing. The present research reports the process of development and validation of a digital quiz-type game, composed of radiological images of lung diseases, questions and answers, educational videocast, which allows the user to learn in a playful way the diagnosis of Covid-19, helping the continuing education of physicians at such a critical time for public health in Brazil.

Through the development of a tool that supports the use of active methodologies in medical education, with the creation of gamified mobile digital technology that provides meaningful and immersive learning (Game Based Learning), the following research problem is presented: What is the process to create and validate a serious digital quiz-type game for learning pulmonary tomographic patterns and diagnostic imaging in the context of COVID-19?

DiagRadQuiz is a game created in a master's research in Health Sciences Teaching, developed from 2019 to 2021. It is a serious game for smartphones with Android and iOS operating systems and aims to assess prior knowledge and teach the main pathological patterns of the lung parenchyma defined in high-resolution chest computed tomography.

PROJECT OF THE DiagRadQuiz

Game created from the joint effort of a multidisciplinary team consisting of a physician specialized in Radiology and Diagnostic Imaging, a pedagogue researcher in the area of health technologies and an architect working in programming. For the creation of the game, the five basic principles for creating adapted digital games from Awan (et.al., 2019) were followed, they are:

- **Interactivity with informative feedback**: engagement in the game is directly related to interaction and real-time feedback on your hits and misses, and it is necessary to provide means for the player to overcome these mistakes, since it refers to an educational game. The lack of specific knowledge about a certain standard can be overcome by accessing the explanatory videos.
- **Specific objective**: the player must be aware of the objective of the game. In DiagRadQuiz he is informed, right at the beginning, that it is a game to assess and learn specific patterns of diseases of the lung parenchyma, including Covid-19.
- **Feeling of improvement**: the number of correct answers should increase with the number of times the player accesses the game and this perception is of fundamental importance for student engagement.
- **Sense of security**: DiagRadQuiz is a safe environment in which the player can be mistaken about the pathological patterns of the lung parenchyma that cause harm to the diagnosis and management of patients, meeting the principles of simulation that are important in medical education (safe learning environment in which error is a didactic strategy).
- **Engagement of the senses (vision):** for a non-RDDI audience, the observation of specific nuances related to pathological patterns requires the activation of specific areas of vision and memory.

MULTI-PROFESSIONAL CREATIVE TEAM

Specialist in Radiology and Diagnostic Imaging

Responsible for researching and defining the main lung diseases that lead the patient to seek emergency services. Since the objective of the game was to teach the pathological patterns observed in the lung parenchyma, including those observed in SARS-Cov 2 infection, priority was given to diseases that determine changes in the lung parenchyma observed in specific "windows" (interval corresponding to variations between

black and white for images and level corresponding to variations in gray). Diseases that determine alterations that can be observed only in mediastinal "windows" were excluded.

To choose the diseases to be included in the game, references from the MSD Manual were used. The changes were divided into five groups:

- infectious processes: community-acquired pneumonias, atypical infections, pulmonary tuberculosis, fungal infections, and viral infections, including COVID-19, are addressed;
- dissemination of neoplastic diseases: lung metastases and carcinomatous lymphangitis;
- inflammatory processes: hypersensitivity pneumonitis, respiratory bronchiolitis related to smoking, and cryptogenic pneumonitis in organization;
- exacerbation of chronic processes: pulmonary emphysema and interstitial lung diseases.
- Pulmonary parenchymal alterations related to extrapulmonary pathologies: acute pulmonary edema and pulmonary congestion.

From the determination of the diseases to be addressed, the researcher specialized in RDDI selected images corresponding to the diseases to be addressed in the game, with relevant clinical data and with the diagnostic hypotheses to be included in the differential diagnosis for the game.

For the use of the images from the personal archive, the researchers obtained, according to the guidance of the Research Ethics Committee, an authorization for their use. The specialist in Diagnostic Imaging was also responsible for recording short explanatory videos to describe the changes observed in the exams. For the recording of these videos, we used as a reference the glossary of terms for lung imaging published by the Fleischner Society in 2008 (HANSELL *et al*, 2008). For descriptions related to Sars-Cov2 infection, the reference was the consensus published in March 2020 by the RSNA (North American Society of Radiology) that reports pathological patterns of COVID-19 (SIMPSON *et al*., 2020).

Education professional specialized in information technology

It brought to the project the theoretical framework regarding the pedagogical bases for the development of a Serious Game. For the development of the game, we started from the pedagogical paradigm of learning by experience (learning by active exploration and self-direction to the detriment of learning secondary to direct instruction), a paradigm that is dominant in the design of serious games. This paradigm derives directly from

constructivism, formulated by Jean Piaget (PIAGET, 1976) in the 1920s, where the student becomes the protagonist in his learning ("playing" is the student's personal decision and will occur at the moment defined by the student himself, bringing autonomy to him), where the level of maturity of each student is respected (the passage of phases and the number of correct answers in quiz-type games reflect the degree of knowledge of the student). student and are determined solely and exclusively by the student), the learning process is dynamic, with broad interaction and participation of the student (allowing for greater engagement), learning is built gradually (again the passage of phases represents the gradual construction of knowledge, as well as higher scores in quiz-type games). In addition, the process of creating the game includes the concept that learning must be somehow related to the real world so that the student can correlate theoretical concepts with real events (DEWEY, 1916).

Amador Programmer

Being an architect and urban planner by training and having developed a series of works in computer graphics, the amateur programmer with experience in Python and C languages, searched the web, software available in the C language in a free version (free of cost). The software chosen was Unity, from the developer Unity Technologies, for its ease of creating and developing 2D games. In addition, the programmer chose Keynote, developed by Apple, associated with the video recorder included in the basic Ios software package for the realization of the explanatory videos. For eventual video edits, the programmer used the Windows video editor software, included in the Windows 10 basic package. To reduce hisses, and therefore improve the quality of the videocast audios, the Audacity equalizer was used, for audio editing, available in a free version on the internet.

For the animations used in the manual in the final version of DiagRadQuiz, Adobe Photoshop, developed by Adobe, was used. In the process of creating the game, we tried to use exclusively free software. However, after the analysis of the validators, it was noted inconsistency and difficulty in understanding the manual (to be explained in the section on validation) and it was decided to make an animation. To carry it out, it was decided to use Adobe Photoshop, in a version paid monthly by the programmer.

DEVELOPMENT OF THE SERIOUS GAME

The DiagRadQuiz development process followed the steps proposed by Olsewski and Wolbrink based on an integrative review published in 2017 (OLSZEWSKI; WOLBRINK, 2017) in which they defined the theoretical-practical assumptions necessary

for the development of a Serious Game for the medical area. Considering the recommendations, the following were carried out:

A. Team meetings: the professionals involved (the wide difference in the higher education of the professionals involved) in the development of the game held weekly meetings in order to establish the content to be addressed and the way in which this content would be developed. Each of the professionals brought to the meetings pertinent issues related to their expertise, in order to be discussed, reaching a consensus, since the knowledge is complementary and equally important for the success of the structure of operation of the serious game.

B. Transfer of medical concepts: considering that one of the main difficulties described in the process of developing a serious game in the medical field is the difficulty of transmitting medical knowledge to non-medical developers. As highlighted (MUNRO; CLARK, 2013) there are few professionals who are able to articulate knowledge of the IT areas within health, developing projects with developers who understand the challenges and nuances of the health area. DiagRadQuiz also has the educational dimension, making the software project even more complex. Specific meetings were held between the RDDI specialist and the programmer in order to establish specific criteria in relation to the quality of the images and their manipulation, both in the part related specifically to the quiz and in the part related to the explanatory videos. The programmer's previous knowledge in the health area, as he works with clinical engineering, was fundamental for the success of the proposal, which was put into practice with a fluid transit of information exchanges between the knowledge of medical education and the development standards of gamified mobile applications. To create applications, it is necessary to bring together a "multiprofessional team composed of health professionals (responsible for the technical-scientific aspects), designer and programmers (development of the graphic interface and application programming), other professionals with knowledge that contributes to the project" (MELLO, SOUZA, 2019, p.262).

C. Content production: The RDDI specialist selected the diseases to be addressed, choosing representative images from a real image bank with authorization from a health service. Elaborating together with the education specialist the questions to be asked in the quiz, with the possible diagnostic hypotheses, and the creation of the descriptive content of the explanatory videos. For the production of this content, the RDDI specialist used her knowledge acquired in twenty years of practice as a specialist and data from the specific medical literature. The production of content for the serious game was based on the chaining of the images, of the diseases presented, with a gradual

escalation in the level of complexity of the images/pathological patterns. In this sense, DiagRadQuiz enables the "chaining of content to be assimilated, in a gradual and correlated way. On the other hand, from the perspective of Behaviorism, it is understood that through these objects (gamified software), it is possible for the user to repeat tasks" (CELESTINO, 2019, p.25).

D. Learning process mapping: the RDDI specialist, the programmer, and the health information technology education professional discussed and collaborated in order to determine the characteristics of game functionality, layout, flow, feedback, and scoring based on the game development theory and the proposed game modeling. As pointed out by Awan (2019), the ability of a game to meet the proposed pedagogical objectives needs to be established from the process of creation and development of the game, considering everything from the design of the game to the scoring process, with well-established rules about the proposed challenges and the objectives to be achieved.

HOW THE GAME WORKS

DiagRadQuiz was developed for smartphones with the Android operating system and later adapted to the iOS operating system. It was developed using the Unity software, available for free on the web. To create the animations used in the game's manual, the Adobe Photoshop software was used.

The game consists of 50 images that represent the main lung diseases presented by patients who seek emergency medical services. DiagRadQuiz is aimed at physicians who are not specialists in RDDI and brings tomographic pathological patterns to be known even by non-specialists. The player is invited to rate an image and answer a question about the probable cause of that pattern presented. There are four possible answer alternatives. If the player hits the first option, he receives 2 points, if he hits the second option, he receives 1.5 points, if he hits the third option, he receives 1 pointand if he hits the fourth (hit by exclusion), he receives no points. The maximum total points to be achieved is 100 points. "Considering the potential of gamification in the context of digital education, such elements were incorporated into the platform. The incentive to participate in the platform is given by the distribution of points" (SANTOS, SZTAJNBERG, 2020, p.528). In addition to the score, when the user advances in the game and realizes the knowledge acquired with the videocasts, the motivation to learn and deepen knowledge increases engagement.

DiagRadQuiz is not only an evaluative serious game that aims to assess exclusively the degree of knowledge of physicians regarding pathological pulmonary

patterns at CT scans. DiagRadQuiz has a formative function since for each image made available, there is an explanatory video in which the RDDI specialist describes the observed change in a very didactic way.

Several versions of the game were made and discussed among the members of the development team, before the beta version, which was forwarded to Information Technology professionals with experience in game development and RDDI specialists for validation, a process that led to the refinement of the initial version, and successive improvements until the final version.

DIAGRADQUIZ STRUCTURE (BETA VERSION)

This item details the screens of the application of its beta version as developed until September 2020 with a description of its purpose and functionality. This is the version that is available for evaluation with IT and RDDI specialists. It is important for the purpose of this research to present the original version to understand the changes made after the two validation processes. After this version, another, now definitive, was made available in February 2021 for the process of medical education as doctors who are not specialists in diagnostic imaging, by performing pre and post tests.

On the home screen, it is possible to click on the manual to receive instructions on how to use the serious game or start using it. It was decided to create a tutorial with icons (Image 2), which for semiology, are visual signs that represent another object by similarity (GREIMAS, COURTÉS, 2008), traditionally used in applications and video games, aiming at a full understanding of the general instructions for using the game, since the icons become intuitive throughout the use of information systems. The icons used were obtained from a public image bank with open copyright. The basic instructions were about the need to rotate the cell phone to a horizontal position to enlarge the images, use of the movement between the thumb and index finger to zoom in (as occurs in many applications), lateral movement with the fingers to move the images, icon to access the training content (videocast) regarding the radiological images and diseases presented, button to access the next image/disease..

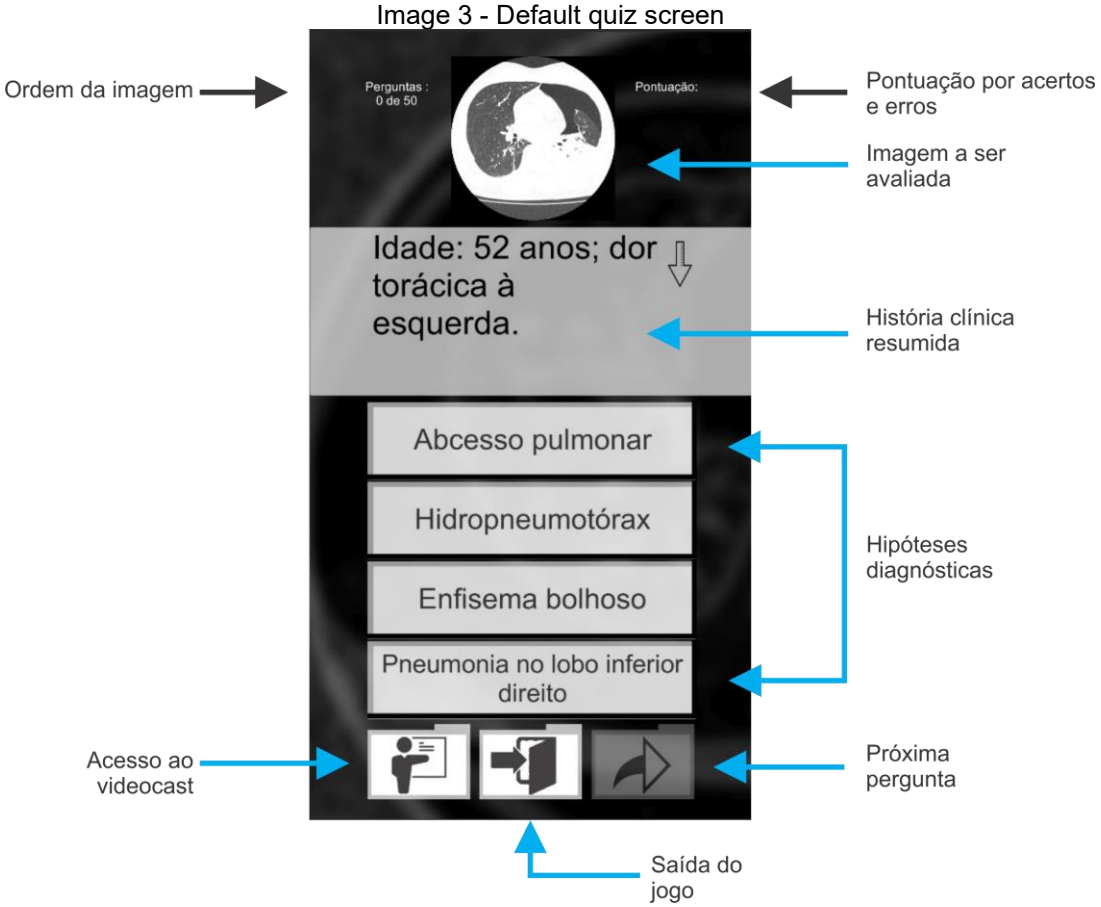
Image 2 - Manual (first version)



Source: DiagRadQuiz, 2021

Image 2 refers to the layout of the main screen during the use of the application, in which the functionalities accessible when the user is playing are described, demonstrating the standard operation of the game for all images, clinical data, response options, access to the video with the explanation of each pathological pattern and diagnostic details of the image, in addition to the exit icon and the next image.

Image 3 - Default quiz screen



Source: DiagRadQuiz, 2021

DiagRadQuiz consists of 50 screens similar to Image 3, with different images, representing a wide range of diseases, including Sars-Cov2 infection. To complete the game, each image is evaluated and the correct diagnostic hypothesis is chosen. If the hit is on the first attempt, the player receives 2 points, if it is on the second attempt, it receives 1.5 points and if it is on the third attempt, 1 point. Access to the next question is only available with the correct diagnosis, hence the importance of access to the videocast that describes each image in detail, helping the autonomous learning of physicians who are not specialists in RDDI through anatomical, radiological and pathological description.

"The quiz makes a differentiated (higher) score for users who answer correctly" (BOTTENTUIT JR, 2017, p.1597) on the first attempt. The pedagogical rationale for the 50 videocasts created is detailed in item 4.2. On the standard DiagRadQuiz screen, the player can, by accessing a specific icon, access an explanatory video about the pathological pattern presented.

VIDEOCAST FOR MEDICAL EDUCATION IN PULMONARY PARENCHYMAL PATHOLOGIES

The linking of a videocast to each tomographic image of the game brings the component of continuing education of non-specialist RDDI physicians. In addition to the mistakes and successes in the game, as it is a serious game, the purpose is to provide the user with a reflection on their more or less in-depth knowledge about the tomographic diagnosis of the diseases addressed. Thus, each image/disease is presented as a videocast with explanations for nonspecialists, providing training for the recognition of tomographic patterns that lead to the diagnosis of diseases of the lung parenchyma.

It is worth clarifying the didactic-pedagogical option for the use of videocast as a formative resource in the game. Videocast is a type of resource derived from the podcast, using the suffix cast to indicate the evolution from its predecessor. Podcast means:

> mode of production/dissemination of musical content and/or focused on oral reproduction, distributed on demand [...], accessible via direct download or content subscription, for use at times and places of the users' choice (FREIRE, 2012, p. 202).

Understanding the podcast as a particular mode of reproduction of orality, the reported definition includes both audio podcasts that reproduce oral content, as well as videocasts in which, in addition to orality, images are used to contextualize the content. Videocast is "very similar to the podcast, the basic difference is that the file is made available in video when the presence of some images added to the audio is relevant" (COUTINHO, 2020), but it differs from video because the main content is in audio with complementary images, while in videos the audiovisual narrative has images as the main basis.

The proposal to create educational content through videocasts added to the game is based on the technological and educational characteristics of this type of resources: 1) Easy distribution through availability on open social networks such as Youtube, contributing to the democratization of access to content included in platforms such as open [4]educational resources; 2) Lighter and easier to share files, allowing you to study at any time and place (multiplatform); 3) Democratization of knowledge through the use of formats that stimulate the production and sharing of information independently of publishers or institutions.

[4] Open Educational Resource (OER) - "teaching, learning and research materials, in any medium or medium, in the public domain, or openly licensed, allowing them to be used by third parties. The use of open technical formats facilitates access and reuse of digitally published resources" (CAPES, 2019).

Among the added advantages of the use of videocasts in an educational context, especially continuing education of professionals, Santos (2014, p.31) highlights:

> a) Greater interest in learning content: students and professionals do not recognize virtual media as a monotonous equivalent, novelties gain attention and podcasts/videocasts enable the use of platforms widely accessed on smartphones; b) Learning at the pace of each one: a support resource for different learning rhythms that can be heard countless times for a better understanding of the content covered. c) Accessibility: accessible audio explanation with the support of images asynchronously, allowing flexibility in a busy routine d) Possibility of learning outside formal education: adoption of pod/videocast allows students/professionals freedom of choice regarding the appropriate learning environment for moments of reflection in any place and time; e) Knowledge construction through a creative process: professionals, when adapting to the format of the resource, are also encouraged to create playlists and repositories to share this knowledge with their peers, and create their own.

The videocasts produced, linked to each image of the serious game are listed below, in chart 1, along with the theme and access link.

Chart 1 - List of 50 educational videocasts on diagnostic imaging of pulmonary parenchymal pathologies from DiagRadQuiz

Videocast Title	Access Link	Videocast Title	Access Link
Frosted glass with consolidation	https://youtu.be/DmB-iP7e2_E	Paramediastinal fibrotic changes	https://youtu.be/Ckof1HM2Oa4
Peripheral Frosted Glass	https://youtu.be/KIcvHfGBPHY	Node "in candle flame"	https://youtu.be/QZVkxG6ZKDg
Bronchiectasis	https://youtu.be/VQPzJmkTIWs	Consolidation with distal airspace injury	https://youtu.be/3pbEPU6WOrA
Grounded glass and cross-linked changes	https://youtu.be/u_Kt8azYhU4	Ground-glass halo nodule	https://youtu.be/vqEwqNkq6Vs
Smooth thickening of the septa	https://youtu.be/aSwc_luIQDs	Consolidation	https://youtu.be/1ZD5Ju8veT4
Distal airspace injuries	https://youtu.be/hhAqRpr3keo	Peripheral ground-glass with cross-linking	https://youtu.be/J9KR5Hhmfs8
Pleural changes	https://youtu.be/iorsyIrbAJ4	Diffused Hydro Fosco	https://youtu.be/xcS0HakAbCY
Nodular septal thickening	https://youtu.be/UVLyik9e24k	Peripheral Grounded Glass with Consolidation	https://youtu.be/FnYB_LnAoHk
Radiolucent round lesion	https://youtu.be/GULKYL7NLhw	Rounded frosted glass with consolidation	https://youtu.be/1quD3KoQJXY
Rounded consolidation	https://youtu.be/yBcUS08CCqY	Frosted glass with cross-linking	https://youtu.be/oW-FDwjP110
Consolidation with fissure bulging	https://youtu.be/85S5oH5vAVc	Rounded frosted glass and peripheral	https://youtu.be/EI3qetz7rL8

Poorly defined centrolobular nodules	https://youtu.be/hWv5QHQzrgo	Frosted glass with consolidation	https://youtu.be/8GbkAVyfE4g
Multiple pulmonary nodules	https://youtu.be/1Zw3B-28puE	Peripheral Frosted Glass	https://youtu.be/yOwypwCcE3s
Peribronchovascular and subpleural ground-glass	https://youtu.be/ajstg7sFHJo	Peripheral Frosted Glass	https://youtu.be/8mbDrEFVdAY
Diffused Hydro Fosco	https://youtu.be/fJMP-wpS8tc	Peripheral Grounded Glass with Consolidation	https://youtu.be/Yg6UJno0W24
Randomic micronodules	https://youtu.be/e1itT2E2Q20	Frosted glass with consolidation	https://youtu.be/zJkL7vd5sZM
Multiple pulmonary nodules	https://youtu.be/1z6Ehy0kqqg	Ground-glass with vascular ectasia	https://youtu.be/Df74awHO0eU
Poorly defined centrolobular nodules	https://youtu.be/YdoBQ8IBpXI	Peripheral and rounded frosted glass	https://youtu.be/0vgPLo6IIII
Multiple pulmonary nodules	https://youtu.be/CAk09w6adVM	Rounded frosted glass	https://youtu.be/QnWceJ7PaH4
Fibrotic changes	https://youtu.be/PnpzWUGHrMI	Frosted glass with consolidation	https://youtu.be/pH6sX--HgE8
Poorly defined centrolobular nodules	https://youtu.be/WBlp3RY2dIU	Peripheral Frosted Glass	https://youtu.be/i6Nmhy7rRjM
Multiple pulmonary nodules	https://youtu.be/ttk_N0guqa8	Peripheral Consolidations & Ground-Glass	https://youtu.be/REmpPZgjC8g
Nodular thickening of the interlobular septa	https://youtu.be/OTDpz2kIe-s	Rounded and Peripheral Frosted Glass	https://youtu.be/yydZNKAlybo
Diffuse ground-glass with cysts	https://youtu.be/7Qib3V9q6Ww	Lung Base Flaveling	https://youtu.be/DJGXhlUoztk
Glove-finger injury	https://youtu.be/KD4z93xUUWw	Bronchiectasis with Mucoid Impaction	https://youtu.be/Xv2GGLBi1Fw

Source: survey data, 2021

VALIDATION BY EXPERTS

Expert validation covered two groups. The first was formed by Information Technology professionals with experience in game development. The validation with these experts took place between October and November 2020. The second group was RDDI specialists and the validation took place between December 2020 and January 2021. The DiagRadQuiz validation process adapted the criteria created by Graafland, Schraagen and Schijven (2012) shown in table 2:

Chart 2 - Validity criteria for games designed for radiology

Validation Type	Criteria for Validation
Content validity	The content of the game must adequately cover the medical knowledge it aims to impart, as determined by the expert in that content (medical)
Interface validity	The medical construct presented in the game must be sufficiently similar to reality, determined by the medical specialist.
Construct validity	The game metrics must demonstrate significant differences between players according to the level of previous and acquired knowledge
Concurrent Game Validity	The game design should correlate the result with the choice of an alternative, as well as direct an established training method for the construction of the proposed knowledge.
Predictive Validity	The development of the game provides for post-training performance, with the construction of knowledge to be used in the real life of the trained doctor. The acquisition of this knowledge must be correlated with a well-explained scoring system.

Source: prepared by the authors based on Graafland et.al. 2012.

Considering the types of validation and criteria proposed, two specific validation instruments were developed. One of them for doctors specializing in RDDI and the other for Information Technology professionals with experience in creating and developing games. These validation instruments were sent to the experts through the GoogleForms platform along with a free and informed consent form for participation in the research project according to the guidance of the CEP of Faculdades Pequeno Príncipe.

VALIDATION BY INFORMATION TECHNOLOGY SPECIALIST

Six specialists in Information Technology participated in the validation of the Application, who analyzed the DiagRadQuiz from the point of view of programming, usability, design and production models of internet applications. Of these specialists, there were five men and one woman, aged between 25 and 48 years, with an average age of 39 years. 66.7% of these professionals had already developed or participated in the development process of a game. The criteria evaluated by the Information Technology experts were:

- User interface (by the definition of Rogers, Sharp and Preece, in 2013, it refers to the link between the game and the player, as it allows the player to take control of the action to be performed, navigate the environment and make decisions in the game, its elements range from the controls, keys and mouse to the features that appear on the screens, as important information for the players' decision-making), and the DiagRadQuiz was approved by 50% of the evaluators.
- Gameplay (defined by Sánchez *et al* in 2009, as the set of characteristics that describe the player's experience when using a game, whose main objective is

to provide fun and entertainment, and, in the case of serious games, the achievement of a specific pedagogical objective) with approval by 50% of the evaluators.

- Quality of the images made available, considered regular by 66.7% and excellent by 33.3% of the evaluators. - Video quality considered regular by 100% of the evaluators. - Quality of the audios made available being evaluated as excellent by 66.7% and regular by 33.3% of the evaluators.

A field was also opened for criticism and suggestions to improve the game. Among the relevant criticisms, the absence of introductory content dealing with the objectives of the game stands out, as highlighted by participant 2 "There was a lack of an introduction talking about the objective of the Quiz in the tool itself". Caveats were also made regarding the scoring system, as explained by participant 4 "The score is not accounting correctly. I didn't identify the score at the end of the game (sum of points and final total points)". This position is important, since Werbach and Hunter, in 2012, pointed out that in the process of developing a Serious Game, it is essential to create reward mechanisms that stimulate the player's sense of fun, curiosity and competition with himself or with his peers, thus leading to greater adherence to the game (WERBACH; HUNTER, 2012).

Participant 4 took a position on the audio quality of the videocast explanatory videos "In the explanatory video I thought that the audio has a little interference in the background, maybe if you apply a noise filter at the time of recording it will improve the quality". To solve this issue, the audio was treated to reduce noise and make the volume in the foreground more comfortable. The developers of DiagRadQuiz are fully aware that sound quality is an important dimension within audiovisual media and have opted for the recording of videocast audios in mp3 format, despite the lower quality of this format compared to high definition recordings, since the game was created to be used on smartphones whose audio system is low resolution (McELHEARN, 2016). To improve the quality of the audios, they were equalized using the Audacity software.

There was no specific manifestation regarding the quality of the images made available, although these were considered regular by most of the IT expert evaluators. It should be noted that the images used were exported directly from the computed tomography machines, in JPEG format and are, therefore, of a different quality, due to their compression, from those used by RDDI specialists to perform the diagnoses (VARMA, 2012). However, the resolution matrix of the images used in DiagRadQuiz remains the same as that used by RDDI specialists to perform diagnoses (512 x 512 pixels), serving the images used for the purpose of the game.

The images used in the DiagRadQuiz followed the quality standard of the Diagnostic Imaging Accreditation Program (PADI) of the Brazilian College of Radiology (CBR, 2018) and were acquired with a thickness of 1 mm, with Kv and mAs variables according to the patient's thickness, and the AUTO mAs technique was used (where the device automatically calculates the value of the mAs to be used). It is noteworthy that the images used are real, obtained with authorization from a health service and, therefore, for learning the radiological pattern of the diseases addressed by DiagRadQuiz, real images equivalent to those that the physician has access to in practice in health services were made available.

Some criticisms regarding the game are beyond the scope of the game. For example, the statement of participant 1: "Evaluating it as a quiz, in which I do not master the content, the visual design can improve, the scoring rules are not clear, I cannot select questions that might be interesting, only a linear process, no return, repetitive, low background music, without any other sound effect. Monochromatic". This type of criticism was not accepted, since DiagRadQuiz is not an instrument made within commercial game standards, having not had financial support or a dedicated development team. Therefore, a game of commercial standard is not expected. An educational game was developed for the teaching of basic tomography patterns. Therefore, even the color palette and elements on the screen were thematic in line with the area of origin (radiology).

VALIDATION BY MEDICAL SPECIALISTS IN DIAGNOSTIC IMAGING

Eleven RDDI specialists, ranging in age from 28 to 50 years old, evaluated the DiagRadQuiz. The average length of experience in the specialty was 9 years, and none of the doctors had experience in creating games. The criteria evaluated by the specialists in Diagnostic Imaging were:

- resolution of the images from a technical point of view, with 72.7% of the evaluators fully agreeing with the quality of the images.
- adequacy of the images for the target audience (physicians who are not specialists in RDDI), having been fully approved by 72.7% of the evaluators.
- correlation between images and diagnoses, with approval by about 72.7 % of the evaluators.
- relevance of the diseases presented for medical training with approval by 100% of the evaluators.
- Pedagogical content, structure and quality of the explanatory videos with approval by 100% of the evaluators

- ease of understanding and self-explanatory character of the game manual: 63.6% of the evaluators agreed with this statement.
- possibility of recommendation as a pedagogical tool for medical training: 100% of the evaluators recommend DiagRadQuiz.

In the game validation process, in the open field for "Suggestions for DiagRadQuiz improvement". Among the suggestions, there were complaints about the size of the images from 3 experts: participants 2 "The resolution of the images in the quiz is good, but I found it a little small, I would like to be able to increase them", participant 5 "Small image" and participant 8 "Increase the size of the images". It can be concluded that it is not usual for RDDI specialists to read the explanatory manual that clarifies how to enlarge the image (by rotating the cell phone and enlarging it with the movement of the thumb and forefinger).

The difficulty in accessing the clinical history mentioned by 2 participants was also mentioned, such as the contribution of participant 3 "Include, in the manual, an explanation for reading the clinical history", participant 7 "Does not inform the clinical picture". Regarding access to the clinical history, it was observed that there was no icon in the manual that showed how to access these data, which was corrected.

Another point mentioned was the difficulty among users to understand the scoring system, as explained by participant 10 "Scoring system a little confusing". There was also criticism of the scoring system, as said by participant 6 "The quiz score is not counting correctly". In view of these observations, it was decided to include in the explanation manual an item referring to the scoring system in order to make it clear to the player how the score would be, depending on the order of the correct diagnosis. The algorithm for scoring was also revised, and it was corrected in the final version of the game.

In view of the issues highlighted, the developers concluded that it was necessary to reformulate the tutorial for using the serious game, since part of the information was contained in it, but was not understood by users generally because they did not access the manual. Information not available in the first version of the explanation manual (such as access to the clinical history) was included in the final version.

As a suggestion, the creation of a menu with the diseases was indicated so that the clinical doctor could access and consult the images in a situation of doubt in his daily practice, without having to enter the game. The suggestion was noted for later versions of serious games.

CHANGES AFTER VALIDATION WITH EXPERTS

After analyzing the suggestions and criticisms, the final version of the game prototype was reached, with the following changes in relation to the beta version (table 4.3):

Chart 3 - Changes in the DiagRadQuiz after validation with experts

Mudded Aspects	Description
Access to the Game's tutorial (manual)	Access was optional as a menu item and became mandatory. The home screen now automatically displays the usage tutorial for all game users on first access
Game manual structure	The manual was static and used internationally renowned icons, as well as succinct texts, to guide the main commands of the game. The manual became dynamic, with videos explaining exactly how to proceed to achieve a certain goal, such as enlarging the image
Lack of introductory content	In the manual of the final version, an item was added explaining what the DiagRadQuiz is about
Access to the patient's medical history	An icon on how to access the clinical history has been added and explained in the manual
Difficulty understanding the scoring system	An explanation about the score was added to the manual, demonstrating the difference in points achieved according to the order of correct answers
Error in the accounting of the hits	The scoring system was reviewed and reprogrammed and it was correctly counted in the final version.
Hissing in the audio of the explainer videos	An equalization software (Audacity) was applied in order to reduce the background noise in the available audios

Source: the authors, 2021.

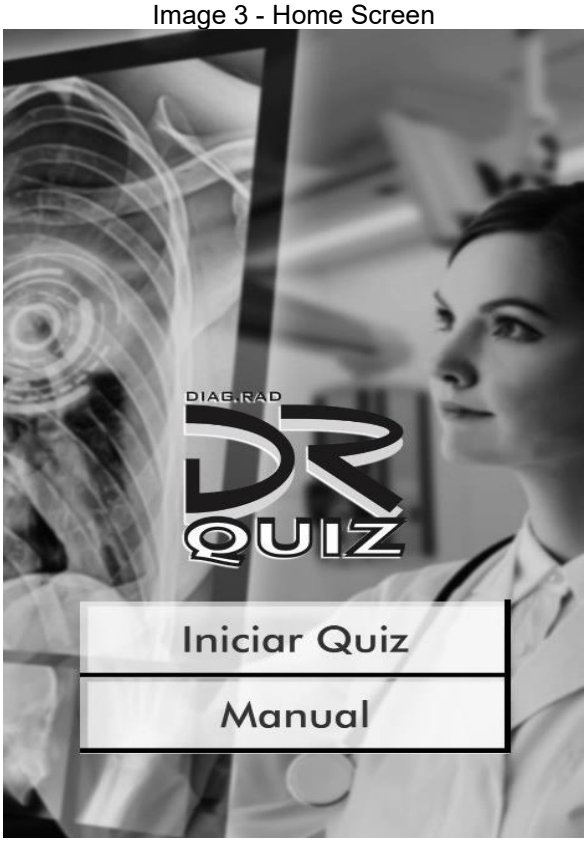
Chart 3 shows the changes made in the structure of DiagRadQuiz after the evaluation of Information Technology professionals specialized in game creation and RDDI specialists, who validated the use of DiagRadQuiz for pedagogical purposes.

The modifications made between the beta and definitive versions were about access to the game manual, as well as the structure of this manual, and an icon was included in the definitive version that guided how to access the patient's clinical history and clarified the scoring system. It was also revised in the definitive version, as suggested by evaluators, the algorithm for scoring was corrected. As a final adjustment, a filter was applied to reduce noise in the videocast audios on the image patterns presented on the various screens of the game.

POST-VALIDATION VERSION OF DIAGRadQuiz

The definitive version of the DiagRad Quiz can be accessed through the following link: https://drive.google.com/file/d/1HVZf-21F3akwCbTnpTXLe-Z9wLZDrA3S/view?usp=shari

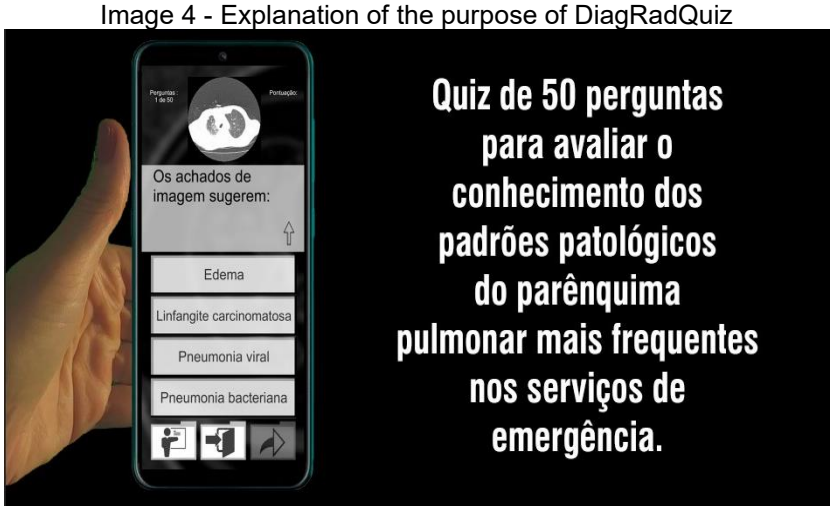
Image 3 - Home Screen



Source: DiagRadQuiz, 2021

Image 3 represents the opening screen (cover) of the definitive version, and no changes were made in relation to the beta version, whose particularities were described in a previous item (item 4). The manual was reformulated to be dynamic, in video, with succinct texts to support the images. Screenshots of the topics covered in the manual follow.

Image 4 - Explanation of the purpose of DiagRadQuiz



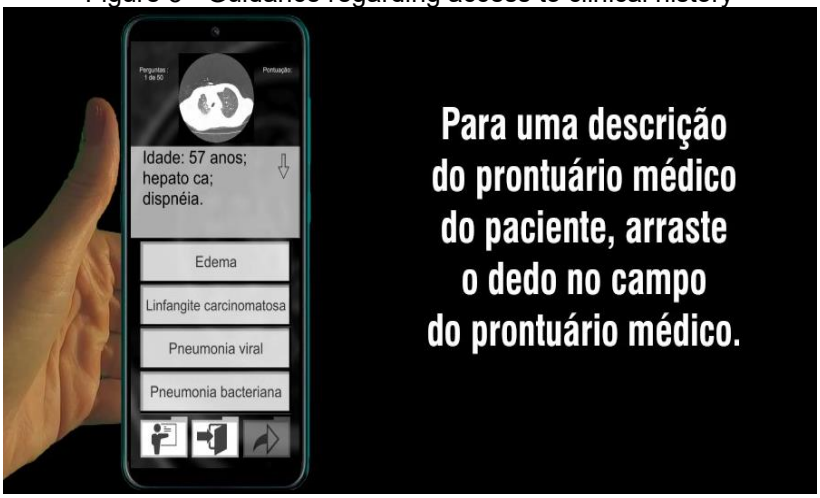
Source: DiagRadQuiz, 2021

Image 4 shows an introduction about the objective of the DiagRadQuiz as suggested by the evaluators. This screen did not exist in the beta version of the game, having been

added in order to establish the specific objective of the game, fundamental to player engagement. The pedagogical objective of the game is highlighted, since educational games should help students acquire skills that are directly transferable to patient care (most frequent diseases). Therefore, the practice and application of the skills learned should be the focus of the curriculum (AWAN, *et al*, 2019).

1) Guidance for access to the clinical history (absent in the beta version):

Figure 5 - Guidance regarding access to clinical history



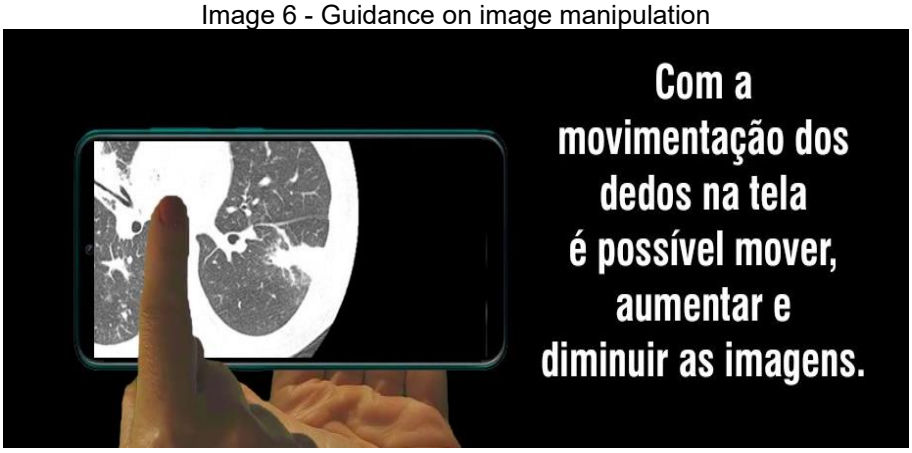
Source: DiagRadQuiz, 2021

The evaluators also pointed out the lack of an icon that showed how access to the patient's clinical history was given. This flaw has been fixed with the addition of Image 5. Chest computed tomography is a complementary exam, and correlation with clinical data is always necessary in order to reach a correct diagnosis.

2) Guidance on image manipulation (improved compared to the beta version):

Image 6 deals with the guidelines regarding the possible ways of enlarging and manipulating the available images, as requested by the evaluators. The images can be automatically enlarged by rotating the smartphone in the horizontal plane and by moving with your fingers it is possible to increase, decrease or move them.

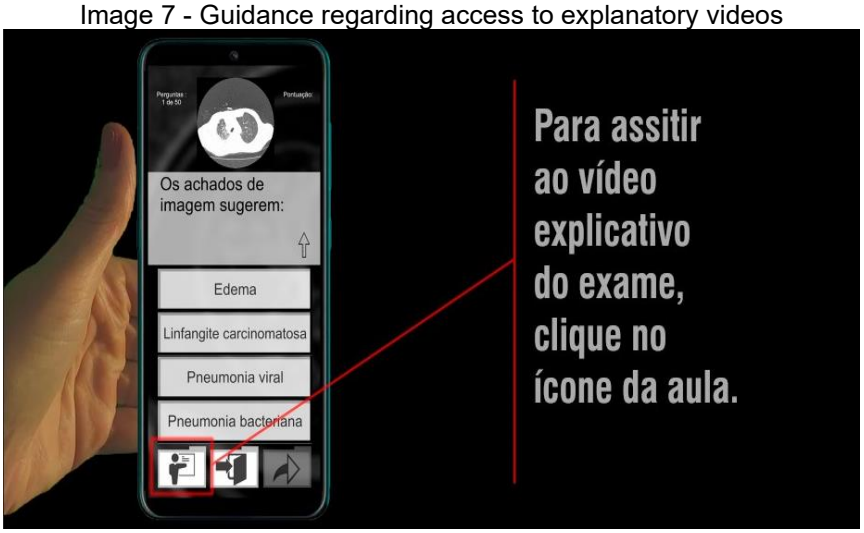
Image 6 - Guidance on image manipulation



Source: DiagRadQuiz, 2021

3) Guidance regarding access to explanatory videos (improved compared to the beta version):

Image 7 - Guidance regarding access to explanatory videos

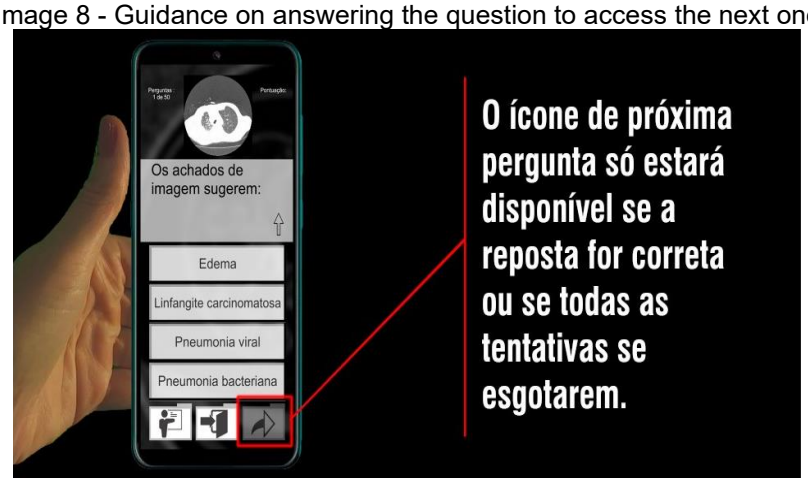


Source: DiagRadQuiz, 2021.

Image 7 shows how access to videocasts on the pathological patterns related to each image presented in the 50 questions addressed is given.

4) Guidance regarding the obligation to answer a question to access the next one (absent in the beta version):

Image 8 - Guidance on answering the question to access the next one

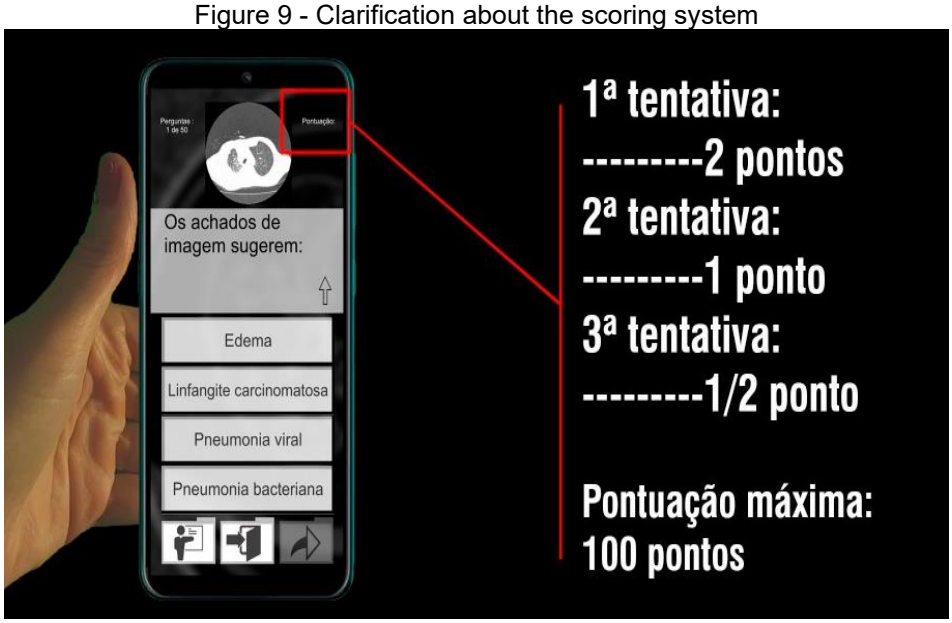


Source: DiagRadQuiz, 2021

In the beta version of DiagRad Quiz there was no guidance regarding the need to get the answer to the question right or to exhaust all alternatives before having access to the next question. This flaw has been fixed in the definitive version as explained in Image 8.

5) Clarification about the scoring system (absent in the beta version):

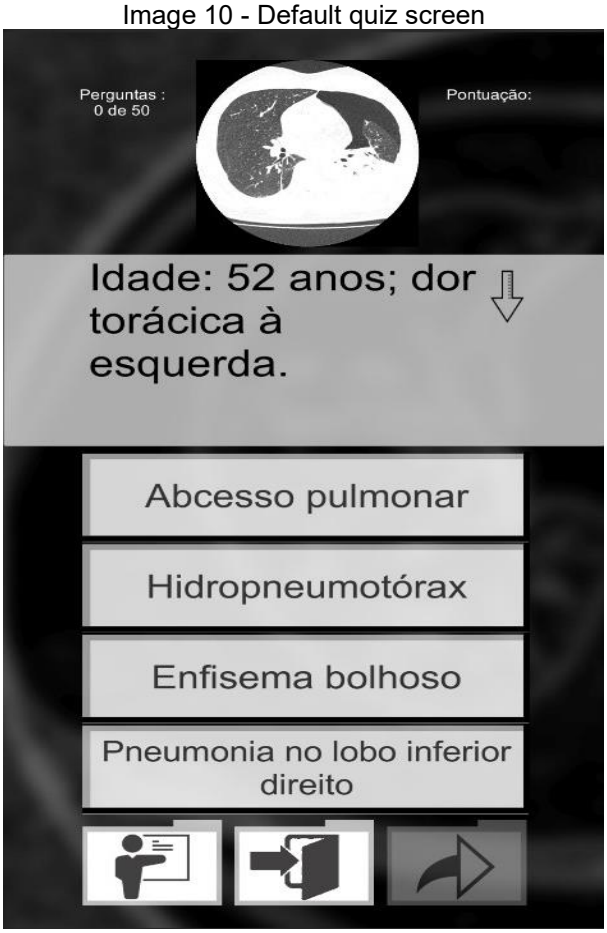
Figure 9 - Clarification about the scoring system



Source: DiagRadQuiz, 2021

Image 9 deals with the explanation of the DiagRadQuiz scoring system, showing the number of points to be achieved according to the order of the correct answers. That explanation was absent in the beta version and raised doubts among the evaluators and was therefore included in the definitive version. On the standard quiz screen there was no significant change compared to the beta version, except for a centering of the image made available.

Image 10 - Default quiz screen



Source: DiagRadQuiz, 2021

Image 12 shows the standard DiagRadQuiz screen. The game consists of 50 screens similar to this one, with different images representing the most varied pathologies.

FINAL CONSIDERATIONS

The use of *serious games* as an educational platform meets numerous learning objectives in Health Sciences. These resources share the same advantages as the use of simulators for student training and continuing education of professionals, allowing practice in safe environments without exposing patients to risks, standardizing training and stimulating the acquisition of well-defined specific knowledge, in a more economical way and with a greater reach (WANG *et al*., 2016).

Despite the propagated advantages of the use of *serious games* for medical education, their development is complex and there are many obstacles to be overcome. The development of a serious game for medical education requires knowledge in the areas of medicine, education and information technology (web development for mobile devices) to create a product that meets the basic requirements of a game: modeling, specific design and scoring system (OLSZEWSKI, WOLBRINK, 2017).

The creation and development of DiagRadQuiz, without external financial support or a dedicated team of developers, was possible due to the proximity between the professionals involved in the development who collaborated, sharing specific knowledge of their expertise, in order to achieve a common goal, in addition to the necessary process of technical validation by physicians specialized in Radiology and Diagnostic Imaging and by Information Technology professionals for substantiation scientific product developed.

The quality of DiagRadQuiz has been validated by specialists in Information Technology and physicians specialized in Radiology and Diagnostic Imaging. All medical evaluators stated that they would indicate DiagRadQuiz as a pedagogical tool for teaching pathological patterns in chest computed tomography prevalent in Emergency Care services, including those related to Covid-19.

The next step of the research is to evaluate the pedagogical effectiveness of DiagRadQuiz for the target audience, by conducting a pre-test of knowledge before using the game, use of the tool, and post-test to assess knowledge acquired after use.

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PATHS TO RESEARCH: A LITERATURE REVIEW ON THE REFORM OF SECONDARY EDUCATION, LAW 13.415/2017

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ABSTRACT

This article presents data and reflections on the reform of secondary education, based on a systematic literature review carried out between September 2021 and January 2022. The objective was to search for the possible gaps left by the selected scientific articles, in order to understand which research paths are possible in the face of the high school reform. This is a qualitative, documentary-type investigation, based on journals from the CAPES Qualis System database (quadrennium 2013–2016, last evaluation available at the time of this investigation), in the area of evaluation in education. A1 journals whose databases were in Federal and State Universities, in the period from 2017 to 2021, were analyzed, using the descriptors "high school reform" and "new high school". We found a large production of works related to Law 13.415/2017, which shows a multiplicity of paths and themes of investigation, covering Brazil from North to South. These studies highlight the researchers' concern with cultural diversity, the diverse youth, the scarcity and precariousness of public schools, and the neglect and devaluation of the teaching profession, serving as a theoretical basis for many other ongoing studies.

Keywords: Law 13.415/2017. New high school. Reform of secondary education.

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INTRODUCTION

The Law of Guidelines and Bases (LDB) 1996 in its article 22 ensures that "basic education has the purpose of developing the student, ensuring him the common education indispensable for the exercise of citizenship and providing him with the means to progress in work and in further studies", ratifying secondary education as a stage of basic education in Brazil and endorsing the importance of this moment of education for our young people. Thus, evidencing the character of its purpose as basic education, it infers the "deepening of knowledge - scientific, ethical and aesthetic - acquired throughout basic school" (SILVA, 2018b, p. 51). However, the way the 2018 National Curriculum Guidelines for Secondary Education (DCNEM) were documented, it is possible that they do not ensure, in the course of the New Secondary Education, the last stage of basic education recommended by the LDB of 1996.

Reflections on this subject have placed us in front of a multiplicity of paths of investigation. In a context of changes like this, in the face of so many doubts and uncertainties, possibilities arise to explore various themes, which range from the way in which the changes were planned – without the participation of the school community – to the way in which the suggested restructurings will be implemented, such as: workload, the new disciplines called Training Itineraries. In view of this, we face a scenario in which multiple paths of research and analysis are outlined, in the face of this reform that proclaims the "new" high school for youth.

This law announces itself as "new", however, since its origin, it has been full of somewhat obscure intentionalities due to its speed of enactment and since it appears in the context of the 2016 coup, "[...] a reform filed by provisional measure (MP 746/16; Law 13.415/17), through the elaboration and imposition of a National Common Curriculum Base (BNCC), without any involvement of schools and educators" (Silva, 2018b, p. 41). Understanding it requires us to research from a historical point of view, in order to understand its true roots (or motivations), as a possible way to resist and continue fighting for quality education for all, by adopting a fully aware posture that high school is the last stage of basic education and is intended: "to contribute to the development of young people's intellectual and moral autonomy [...] to see themselves as subjects capable of intervening in reality and in the world in which they live" (Silva, 2018b, p. 51).

Thus, the present work presents data and reflections on the reform of secondary education, based on a systematic literature review (RSL), carried out between September 2021 and January 2022, with the purpose of seeking which research paths are possible in the face of the announced restructuring. According to Okoli (2019, n.p.), a systematic

literature review is "a systematic, explicit (comprehensive), and reproducible method for identifying, evaluating, and synthesizing the body of complete and registered works produced by researchers, scholars, and professionals." When we consider the components to be part of the present study, we believe that, in the meantime, the scientific production works that deal with the New High School bring fruitful discussions on the theme and expand the possibilities of investigation.

During the elaboration of the RSL, we formulated the following research question : what are the perspectives and/or expectations about the reform of secondary education in the different regions of Brazil? We set the objective of searching for the possible gaps left by the selected scientific articles, in order to understand which research paths are possible in the face of the high school reform.

In order to organize the discussion, we divided the present work into three sections: 1) Methodological paths; 2) Data and discussions; and 3) Final considerations. In the section that begins below, we present the path used to collect the data.

METHODOLOGICAL PATHS

The investigation has a qualitative character (Creswell, 2007), since the data were extracted from a multiplicity of texts that enabled a privileged analysis of the information collected, as they bring the perspectives of several states of the federation, address the changes intended by the law intertwined with the themes of the curriculum, youth, work and teacher training. As for the type, it is a bibliographic investigation (Gil, 2002), since it directs research based on published materials (articles in journals), assuming the character of a systematic literature review (RSL), (Okoli, 2019), with the intention of seeking scientific production in works that deal with the reform of secondary education, Law 13.415/2017, in view of the time frame between 2017 and 2021, as a way to establish reflections on the discussions already established and expand the possibilities of ongoing research.

When performing the initial research procedures to carry out the RSL, first, we searched the CAPES Journal Portal and, soon after, the Scielo Portal. From this movement, we observed that some articles in the Scielo portals were not included in the Capes Portal, which resulted in a certain difficulty in refining the search, both in one portal and in another, given the expressive amount of articles produced on the subject. It should also be noted that the Scielo portal had a higher number of publications than the Capes portal, which led us to infer that the Capes website, at the time of the investigation, was most likely outdated in terms of updates. Due to the discrepancies perceived in both journal platforms, we turn our attention to the study prepared by Oliveira (2021), entitled "Youth and education: state

of the art of publications in A1 journals of Brazilian Federal Universities (2010 – 2019)", in which a survey was carried out with the CAPES system database (quadrennium 2013-2016, last evaluation available at the time) and one hundred and twenty A1 journals were located, nine of which are linked to Federal Universities.

Thus, we considered the nine journals in education with databases based in the Federal Universities, in addition to also searching for scientific journals in education linked to the State Universities. In this new search, we found four more volumes to compose the research.

In order to form the *corpus* of the research, between the months of September 2021 and January 2022, based on Journals of the CAPES Qualis System Database (quadrennium 2013-2016), we observed the journals that had the area of evaluation in education, classification of A1 journals, whose databases were associated with Federal and State Universities, published in the period from 2017 to 2021. For the inclusion/exclusion of the articles, the key terms "high school reform" and "new high school" were used.

With the selected journals, in the databases of each of the journals, using the same descriptors, which resulted in the total selection of thirty-nine articles published in journals with databases linked to Federal Universities and two hundred and forty-three papers in journals with databases linked to State Universities. The following is a systematization of the selection:

Table 1. Selection of Articles by Journal

Periódicos Universidades Federais/Busca e Seleção (Artigos)			
Revista	**Universidade**	**Encontrados**	**Selecionados com o critério "descritor no título"**
Educação & Realidade	Universidade Federal do Rio Grande do Sul – RS	03	01
Educação em Revista	Universidade Federal de Minas Gerais - MG	07	03
Educação	Universidade Federal de Santa Maria – RS	17	04
Educar em Revista	Universidade Federal do Paraná – PR	01	-
História da Educação	Universidade Federal do Rio Grande do Sul – RS	05	-
Psicologia: reflexão e crítica	Universidade Federal do Rio Grande do Sul – RS	-	-
Psicologia; teoria e pesquisa	Universidade de Brasília - DF	-	-
Sociologias	Universidade Federal do Rio Grande do Sul – RS	06	-
Tempo	Universidade Federal Fluminense - RJ	-	-
Periódicos Universidades Estaduais/Busca e Seleção (Artigos)			
Ciência e Educação	Universidade Estadual Paulista Júlio de Mesquita Filho – SP	-	-
Educação e Pesquisa	Universidade de São Paulo – SP	01	-
Educação & Sociedade	Universidade de Campinas – SP	222	03
Paidéia	Universidade de São Paulo – SP	03	-
Pró-posiçoes	Universidade de Campinas - SP	17	-

Source: Authors (2024).

Therefore, as a final selection criterion, we established that the key terms should be explicit in the titles of the articles, which resulted in the final selection of eleven papers,

which form our research *corpus*, as shown in the following table, specifying the year of publication, the title and the author:

Table 2. *Corpus* of the investigation

Revista	Ano, volume, número	Título	Autor (es)
Educação & Realidade	2018, v.43 n. 4	Educação Profissional e a Reforma do Ensino Médio: lei nº 13.415/2017	COSTA, Maria Adélia; COUTINHO, Eduardo Henrique Lacerda Coutinho (CEFET/MG)
Educação em Revista	2018, v.34	A BNCC da reforma do ensino médio: o resgate de um empoeirado discurso	SILVA , Monica Ribeiro (Universidade Federal do Paraná/PR)
	2018, v.34	O que os jovens podem esperar da reforma do ensino médio brasileiro?	LEÃO, Geraldo(Universidade Federal de Minas Gerais/PR)
	2020, v.36	A tríade da reforma do ensino médio brasileiro: Lei nº 13.415/2017, BNCC e DCNEM	KOEPSEL, Eliana Cláudia Navarro; (Universidade Estadual de Maringá/PR) GARCIA, Sandra Regina de Oliveira; (Universidade Estadual de Londrina/PR) CZERNISZ, Eliane Cleide da Silva Universidade Estadual de Londrina/PR)
Educação	2018, v. 43, n.3	Novo ensino médio e educação integral: contextos, conceitos e polêmicas sobre a reforma	SILVA, Karen Cristina; BOUTIN, Aldimara Catarina (Universidade Estadual de Ponta Grossa/PR)
	2019, v. 44 public. contínua	A Reforma do Ensino Médio e a produção de desigualdades na educação escolar	HERNANDES, Paulo Romualdo (Universidade Federal de Alfenas/MG)
	2020, v.45 public. contínua	O novo Ensino Médio e a liberdade de escolha	RIBEIRO, Márden Pádua; ZANARDI Teodoro Adriano Costa (Pontifícia Universidade Católica de Minas Gerais/MG)
	2020, v.45 public. contínua	O direito à educação na perspectiva da justiça distributiva: uma análise sobre a Reforma do Ensino Médio	SANTOS, Émina Márcia Nery; LÉLIS, Luziane Said Cometti; VALE, Cassio (Universidade Federal do Pará/PA)
Educação & Sociedade	2017, v. 38 n 139	A reforma do ensino médio no contexto da medida provisória nº 746/2016: estado, currículo e disputas por hegemonia	FERRETI, Celso; (Pontifícia Universidade Católica de São Paulo/SP) SILVA, Monica Ribeiro (Universidade Federal do Paraná/PR)
	2017, v. 38 n.139	Por que a urgência da reforma do ensino médio? Medida provisória nº 746/2016 (Lei nº 13.415/2017)	MOTTA, Vânia Cardoso da; (Universidade Federal do Rio de Janiero/RJ); FRIGOTTO, Gaudêncio (Universidade Estadual do Rio de Janeiro/RJ)
	2017, v.38 n. 139	A contrarreforma do ensino médio no contexto da nova ordem e progresso	FERREIRA, Eliza Bartolozzi (Universidade Federal do Espírito Santo)

Source: Authors (2024).

With the eleven selected texts, we move on to individual reading, observing the multiple ways in which the theme of the reform of secondary education is presented in the discussions and reflections that were established. In this way, the data were able to combine statistical and content analyses (Bardin, 2020), which helped us to systematize it in word clouds, graphs, and charts, enabling us to understand the advances in debates and silencing that Law 13.415/2017 has caused, since its enactment, in the academic community and in researchers from all over Brazil, which was directly reflected in the scientific production of the A1 journals. In observance of the ethical care with research in the area of human sciences, this study dispensed with the analysis of the Research Ethics Committee (CEP), as it is a bibliographic/documentary research that used materials already published, having been supported by Resolution 510/2016 (BRASIL, 2016) that exempts this type of investigation from submission to the CEP.

From the *established corpus* , we understand that approaching the restructuring of secondary education in a conceptual way is equivalent to exploring the fundamental principles of educational philosophy, as well as sociology, history and education policy. In continuity, we carried out a critical reading of the official documents and the observation of the new propositions that have emerged through the numerous researches, which also

present themselves as potential vectors for the emergence of other ongoing researches, as discussed in the next section.

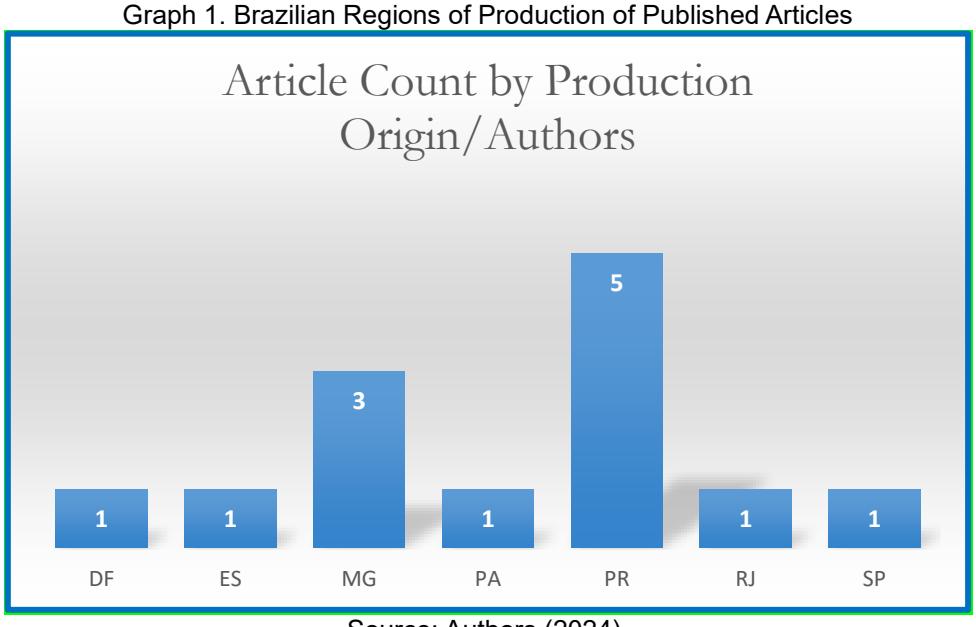
DATA AND DISCUSSIONS

Initially, we observed that the journals selected in the study ratified the data pointed out by Oliveira (2021) in his research, when he explains the concentration of A1 Journals in the south and southeast regions, as he proposed:

> Santos (1986) based on the regionalization of the Brazilian Institute of Geography and Statistics, the discussion about a "concentrated region", which would encompass precisely the south and southeast regions. These studies showed, already at the time, that the proposed region concentrated the production of the country's wealth, not only the materials, but also those that could hardly be materialized, as is the case of scientific production. (Oliveira, 2021, p. 363)

When we expand the research to the journals available in the databases of the State Universities, we notice that they are also predominantly concentrated in the same regions. Thus, given the objectives, we carried out a survey to verify the local origin of the publications, as shown in the following graph:

Graph 1. Brazilian Regions of Production of Published Articles



Source: Authors (2024).

Although the scientific publications are concentrated in the south and southeast regions, the selected articles include other regions, such as the Midwest and North, which expresses the concern of researchers from all over the country with the reform of secondary education and its possible consequences for the formation of Brazilian youth. The wide diversity of perspectives enriches the objective of the investigation, allowing us to perceive,

from the analysis of *the corpus*, that the authors offer debates and analyses that approach Law 13.415/2017 in different directions. This is due, in part, to the fact that there are numerous gaps in studies, or we could say, purposeful, to meet the most distinct interests, especially those of capital and those of the formation of cheap and fast labor. In the way the law is presented, some studies point to the possibility of increasing Brazilian social inequalities and devaluing teacher training, since removing from the State all commitment to the development of educational agents "[...] they transfer to teachers, students and schools the responsibility for their success or failure." (Leão, 2018, p. 20), perpetuating a segmented and selective high school.

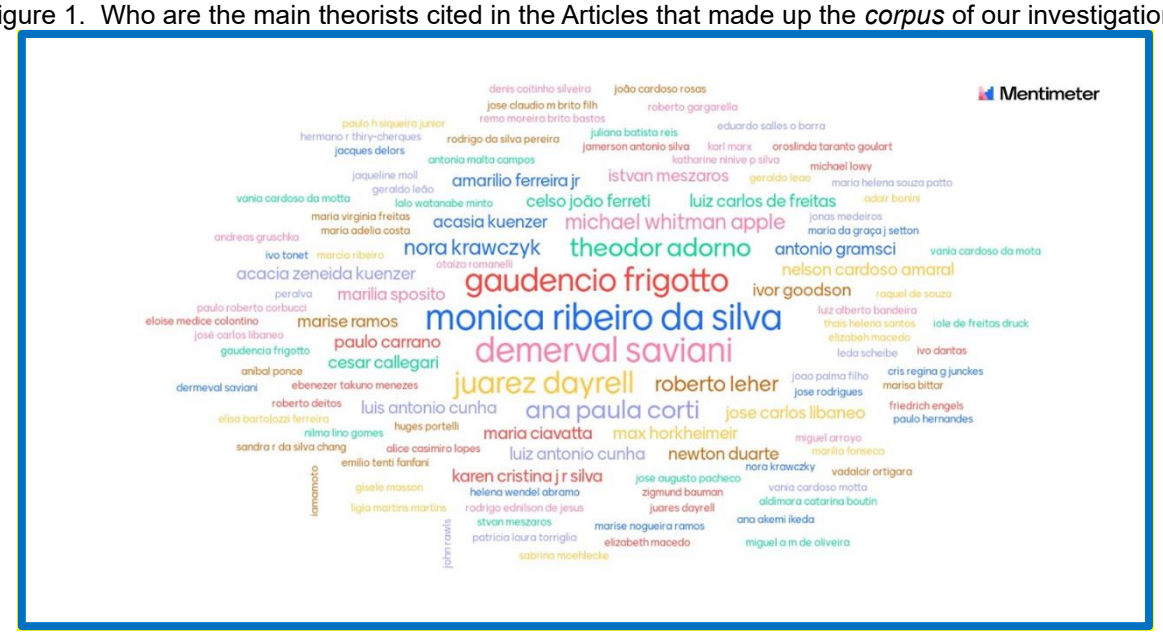
From a detailed view, considering that the publications originate from the most distinct Brazilian regions, we observed some more specific data, as a way to broaden the understanding of the theme, including: a) methodologies used by the authors; b) basic theories that supported the discussions; c) theorists cited; and d) evidence/gaps that the articles reveal.

Regarding the methodologies, most of the articles analyzed expressed either in the abstract (only) or in the introduction "documentary analysis" as the most used methodology. As research tools, the authors reveal the use of legislation, searches of official databases, official advertisements published in the mass media, as well as bibliographic discussions. Relevant and understandable data due to the short time period of the enactment of Law 13,415/2017.

Among the theoretical lines, historical-dialectical materialism was the theory evidenced, as a result of its power of articulation and criticality, since, for this theoretical approach, scientific knowledge is built in human social practice, that is, while social life itself is developing, enabling individuals to assume "socially and culturally determined conditions to reflect and theorize (with increasingly developed methods) on this same social practice and its constitutive objects and phenomena". (Martins; Lavoura, 2018, n.p.), providing an understanding of the social moment of the announced high school reform.

In the course of this investigation, in order to build a theoretical reference relationship in the researched theme, from the references of each of the articles, we built a word cloud, produced with the use of the *online mentimenter* platform for the creation and sharing of slide presentations with interactivity. All authors referenced in the "References" section of the 11 articles were placed on the platform, as shown in Figure 1:

Figure 1. Who are the main theorists cited in the Articles that made up the *corpus* of our investigation?

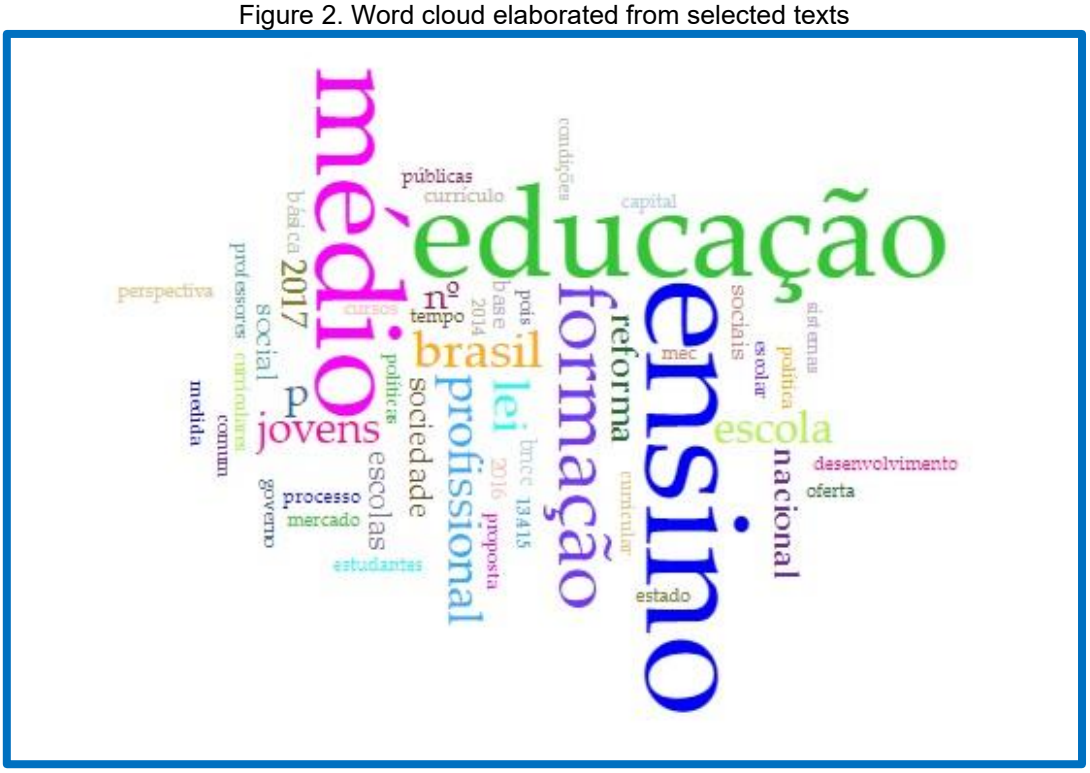


Source: Authors (2024).

The word cloud highlights the theorists used by most of the authors in the selected articles, ratifying the use of the theoretical line of historical-dialectical materialism. It highlights the importance of Demerval Saviani and Gaudêncio Frigotto in education discussions and presents theorists who are references in discussions of educational policy in high school and youth, such as research teachers Monica Ribeiro da Silva, Nora Krawczyk, Celso João Ferretti, Juarez Dayrell and Paulo Carrano. Researchers who guide and direct studies provide starting points for each of the areas and themes to which they are dedicated, which open horizons and stimulate new investigations.

The body of authors that is constituted from the references used also reveals an intertwining of themes addressed: public policies, secondary education, basic education, youth; in view of this, the field of debates expands to include pertinent themes, which converge with the reform of secondary education. During the analysis of the eleven selected articles, we highlighted the number of fifty-five terms (considering only the text from the introduction to the final considerations, excluding the abstract and references from the search), from which we produced a word cloud, elaborated with the use of the *voyante tolls* tool (an *online* and *open source text* analysis application (*text analysis*) so that preliminary data can be referenced. In order to articulate with the most recurrent words in the selected articles, we observed which concepts would stand out. The words "education", "high school", "training", "youth", "law", "school", "politics", "public" and "curriculum", among others, reveal that many concepts and conceptions are intertwined, as shown in figure 2 below:

Figure 2. Word cloud elaborated from selected texts



Source: Authors (2023).

Among intersecting concepts and conceptions, following the research, we analyzed Law 13.415/2017 that legislates on the reform for the "new" high school and proclaims a series of changes in the current school structure. We found five main points that are impacted and corroborate with concepts and conceptions announced in scientific articles: curriculum, workload, young people, teachers and funding. We list the categories as shown in the following table:

Table 3. Main changes Law 13,415/2017

PRINCIPAIS ALTERAÇÕES	
CURRÍCULO	Currículo separado em duas partes: formação básica e diversificada; Currículo "flexível" ou melhor dito "oferta de diferentes arranjos curriculares"; Obrigatoriedade somente dos componentes curriculares de língua portuguesa e matemática para todos os três anos do ensino médio; os demais podem ser considerados nas áreas do conhecimento; Itinerários formativos oferecidos de acordo com as "possibilidades dos sistemas de ensino"; Flexibilização por "arranjos curriculares" concebidos como "seleção de competências que promovam o aprofundamento das aprendizagens essenciais demandadas pela natureza do respectivo itinerário formativo" (BRASIL, DCNEM, 2018, s/p);
CARGA HORÁRIA	Ampliação da carga horária geral do ensino médio de 2.400h para 3.000h, em um total de 1000h anuais e devendo ser ampliada no ensino médio diurno para 1.400h em um prazo de cinco anos; Possibilidade de oferecimento da carga horária à distância: 20% no ensino médio diurno, podendo chegar a 30% no noturno e 80% na modalidade educação para jovens e adultos, tanto na formação geral quanto nos itinerários formativos
JOVEM	Formação integral como "desenvolvimento intencional dos aspectos físicos, cognitivos e socioemocionais do estudante por meio de processos educativos significativos" que consigam promover "a autonomia, o comportamento cidadão e o protagonismo na construção de seu projeto de vida" (BRASIL, DCNEM, 2018, s/p); Projeto de Vida (quase que um "carro chefe" nas minutas de competências e habilidades); "Protagonismo" juvenil
PROFESSOR	Viabilidade de contratação de profissionais com "notório saber" na formação técnica e profissional;
FINANCIAMENTO	Possiilidade de realizar parcerias público-privadas; Mudanças no Fundo de Manutenção e Desenvolvimento da Educação Básica e Valorização dos Profissionais da Educação (Fundeb), onde foram alteradas algumas regras do financiamento público.

Source: Authors (2024).

Having then listed the main changes mentioned directly in the text of Law 13.415/2017, we relate four of them (curriculum, workload, young person and teacher) with the data that the selected articles highlighted regarding the discussions. They were directed to four categories: a) curricular structure (curriculum divided into two parts; basic and diversified training, flexibility and training itineraries); b) workload (expansion of the face-to-face workload and possibility of distance education, full-time school); c) young people (life project, free choice of itineraries); d) teaching work (devaluation of the teaching profession; precariousness of training; notorious knowledge). All of them strengthen arguments for researchers to point to a setback in rights in a flirtation with a not too distant past, which takes us back to Law 5692/1971 (Law of Guidelines for the Teaching of First and Second Degrees, in the period of the Military Dictatorship), when there was a major reform in secondary education.

While Law 13.415/2017, as an official discourse in its origin, announces a new high school capable of improving the performance of young people at this stage of basic education and argues that this reform is essential for teaching-learning to have greater meaning for students, preparing them for the full performance of citizenship and skills in the labor market, The researchers analyze these narratives and propose reasoned reflections. Official discourse fostered by the reform law and a whole official framework of documents (LDB, DCNEM) ratified in the national media in massive propaganda and with the use of young people as a tool of persuasion.

Thus, in the category "curricular structure", Silva (2018a, p. 2) emphasizes that "under the appearance of new, the current reform of secondary education covers up old discourses and old purposes", which are far from the inseparability of social and educational relations. The National Common Curricular Base (BNCC) itself is in charge of this possibility, since its prescriptive character is presented through "[...] a list of temporally sequenced objectives [...] is an expression of a regulatory and restrictive dimension and reinforces the idea that it is something that leads to training *under control".* (Silva, 2018a, p. 6). Thus, thinking about the restructuring of secondary education based on a curricular reform that lists tasks proclaimed through skills and competencies is also a way of veiled evidence of educational inequalities. The author concludes that it is evident that the centrality given to the notion of competencies in the document allows us to recover a discourse present in the texts of curricular policies of the late 1990s, demonstrating that it is an approach limited by its pragmatic and ahistorical character.

Ferreti and Silva (2017), based on the conception of curriculum in its restricted (curricular matrix) and broad (as social technology at the service of hegemonic and/or counter-hegemonic actions) make an analysis of Provisional Measure 746/2016 that originated Law 13.415/2017 and characterize education

> [...] as a broad social process that could be called socialization [...] the set of knowledge and experiences that culture has provided/imposed on the individual and collective subjects who have built the historical heritage of a given society throughout its existence. (Ferreti; Silva, 2017, p. 389).

Thinking of education as a broad process of socialization, according to the authors, due to the dynamics of the historical process, those who oppose the current situation must make efforts to transform it. This is due to the expanded character of the State to which Gramsci refers, as well as to his considerations that this process of transformation requires actions to promote the construction of a more proper way of thinking and acting. (Ferreti; Silva, 2017). It is worth reflecting in the authors' analysis that a law originating from a provisional measure presents its contradictions, not only in the proposed curricular structure, but also with regard to changed workloads, as well as the possibilities of flexibility.

Dialoguing with the reflections of Ferreti and Silva (2017), Hernandes (2019, p. 2) discusses the expansion of the workload based on the "establishment of a maximum ceiling of 1,800 hours" for the fulfillment of teaching and learning, relating them to the "new compositions of the curriculum and their possible flexibilizations" (*ibidem*, 2019, p.3) concluding that the flexibility of the curriculum based on a discourse of modernization of the curricular organization will bring several challenges to the schools, especially those

managed by the Government. It reflects on the fulfillment of the social function of education of "transmission and assimilation of elaborate, scientific knowledge" denouncing the possible marked promotion of inequalities in secondary education (Hernandes, 2019).

In Hernandes' (2019) statement regarding the possibility of increasing social inequalities in the educational stage of high school, Silva and Boutin (2018) make a discussion centered on the proposal of "integral education" contained in Law 13.415/2017, evidencing the fact that "the concept of integral education is directly linked to the idea of extended school time, both with regard to the number of school days, as well as, and mainly, the increase in the daily workload that the same student spends at school" (Silva; Boutin, 2018, p. 524), as well as questioning "which project of society interests the student who spends the most time in school and why the most complete education is not truly understood in this project." (*ibidem*, 2018, p.525). They present the discussions on "integral education" and "full-time school" and conclude that

> [...] It was possible to perceive that the reform that integrates integral education in the so-called New High School is committed to a more technical and less propaedeutic education, thus serving the game of interests that governs the society of capital, since it contributes to the formation of the productive man, the mass man, distancing itself from the concept of omnilaterality that presupposes an effectively integral education. (Silva; Boutin, 2018, p. 530)

The authors, by concluding that integral education, proposed in the reform of the new high school, serves the game of interests of capital and moves away from an integral education that should focus on the integral development of human capacities in all its dimensions, both physical and intellectual, bring their reflections closer to the discussions that bring young people as a theme intertwined with the reform of high school. Thus, in the youth category, Leão (2018, p. 1) postulates that "high school is characterized as a field of disputes around different educational projects that differ in terms of political conceptions and perspectives in relation to the issues of Brazilian youth." and argues that the proclaimed reform is a way of "reforming so as not to change" (*ibidem*, 2018, p. 4) since it maintains a permanent tension "between a perspective that is guided by the idea of general and common education as a right of all students and a vision that defends principles of selectivity and segmentation at this level of education." (*ibidem*, 2018, p. 5). It reinforces the recognition that our young people need and should be considered historical-social subjects, questions who are the current young people and, through already published research, asserts that:

> [...] diversity is a mark of the contemporary youth condition and its recognition should be the basis for any pedagogical project in high school. If differences produce tensions in the school routine, their silencing and the denial of the right to

> difference mean reinforcing the already tense relationship between youth and school. (Leo, 2018, p. 15).

Finally, he concludes that we should not be deceived "by reheated curricular recipes, coming from above and that do not break the selective and excluding logic of Brazilian education. They only transfer to teachers, students and schools the responsibility for their success or failure." (Leo, 2018, p. 20), dialoguing with Motta and Frigotto (2017, p.355) who highlight "the subjects of this reform" and indicate elements to verify that this "reform", in fact, expresses an entire ethical-political contradiction of thought. They conclude that the urgency of reform has as its "background the administration of the social question, denying the foundations of the sciences that allow young people to understand and master the functioning of the world of things and human society." (Motta; Frigotto, 2017, p. 369) concluding in general that:

> [...] It is a counter-reform that expresses and consolidates the project of the Brazilian ruling class in its anti-national, anti-people, anti-public education brand, in its political-economic bases of dependent capitalism, uneven and combined development, which condemns generations to simple work. (Motta; Frigotto, 2017, p.369).

A counter-reform that denies young people the foundations of the sciences that allow them to understand the world corroborates the postulates of Koepsel, Garcia and Czernisz (2020), who seeking to identify the legal impact on the relationship of the documentary triad composed of Law 13.415/2017, BNCC, DCNEM in the future perspectives of young people, conclude that:

> [...] the most perverse consequence of this reform, whose elaboration is closely nested in three instruments – Law No. 13,415/2017, BNCC and DCNEM – is the construction of an education that is fixed on presentism, utilitarianism, and immediacy that results in the loss of the perspective of the young subject as a social being, as a subject. (Koepsel; Garcia; Czernisz, 2020, p. 12).

The authors, realizing that the reform of secondary education loses sight of the young person as a social subject, dialogue with the reflections of Ribeiro and Zanardi (2020) who discuss the freedom of choice that appears in the legal text of the reform, propagated and disseminated in the official media, based on the theoretical framework of "bourgeois coldness" (Gruschka, 2014 *apud* Ribeiro; Zanardi, 2020), understanding how "indifference to the destinies of the subjects" becomes effective (*ibidem*, 2020, p.3). They conclude that "schooled education, in all its stages, continues to play an important role in the struggle for projects that materialize freedom and equality" (Ribeiro; Zanardi, 2020, p.

17-18). They show that these principles cannot be implemented with the approved proposal for a National Common Curricular Base, much less with the New High School.

In the category of teaching work, Costa and Coutinho (2018), in addition to evidencing the origin of the contested reform (Law 13.415/2017), which was effectively born through Provisional Measure 746/2016, postulate that discussions in the educational sphere permeate the need to resume critical discourses that actually consider the relations between education and social conditions, in such a way that social practices are inseparable from educational practices. They conclude that "the current law has not contributed to the valorization of technical education, nor has it favored teacher training policies for this type of education" (*ibidem*, 2018, p. 1633), revealing that it acted in the opposite direction, since it "induced the notorious knowledge that it is a way to guarantee professionals, not teachers, classroom regents for technical professional education at the secondary level" (*ibidem*, 2018, p. 1648).

And finally, two articles show the strong bias of inequality and regression that the high school reform, provided for by Law 13.415/2017, presents. Ferreira (2017, p. 293) maintains,

> [...] that this law has the same spirit as the educational policies that took place in Brazilian high school during the Vargas dictatorship, the military dictatorship and the 1990s [because] in addition to presenting content that tends to deepen school inequalities [...] it was forged by a restricted group of actors strongly linked to private interests.

Concluding that the reform goes against all the experiences lived during the popular-democratic government (2003-2015) of social inclusion and participation of the various social segments. A reform that will not be able to improve the quality of secondary education, on the contrary, tends to increase school inequality and worsen the performance of our students.

In Ferreira's (2017) reflections, the growth of school inequalities and worsening of young people's learning talks to Santos, Lélis and Vale (2020) who analyze the conception of education and social justice submitted to the educational policy proposed by the high school reform and conclude that "although based on the principle of equality as a social right, the reform of Secondary Education in Brazil reveals a utilitarian vision of human formation" (*ibidem*, 2020, p. 1) making it possible to legalize "the existence of different educational purposes to meet the interests of capital" (*ibidem*, 2020, p. 2), thus not constituting itself "as distributive and equitable, but as a reproducer of the social inequality present in the project of maintaining the *status quo*." (*ibidem*, 2020, p. 21), evidencing the

different conceptions of education that may be assumed by the different States of the Federation.

From the selection of articles that are part of the theoretical foundation, selected and analyzed in the RSL of this and other ongoing studies on this theme, it is possible to perceive that Law 13.415/2017 enables research and argumentation in the most distinct theoretical-methodological paths. Therefore, it is up to researchers to direct their efforts to each of the controversial parts of the aforementioned high school reform and its interfaces, having them as a fruitful field of investigation.

Reinforcing and fighting to ensure the constitution of a field of knowledge is a fundamental task to recognize those who build research in a field. The difficulties that researchers face also shape research and create trajectories that are constantly built on the knowledge and practices of research. The human sciences have been the target of constant attacks, however researchers continue to focus on issues such as guaranteeing the autonomy of researchers, guaranteeing freedom of expression and professorship, increasing the promotion and funding of research, among other issues. The fight for more social justice can give us hope for better times. (Oliveira, 2021)

FINAL CONSIDERATIONS

This investigation aimed to answer the perspectives and/or expectations about the reform of secondary education in the various regions of Brazil, seeking the possible gaps left by the research on this theme, presented in the selected articles as a way to guide possible research paths in the face of the reform of secondary education. Our first issue stands out in the considerable volume of articles on the subject in the selected journals that reveal the relevance of the research, perspectives and expectations of Brazilian researchers with regard to the directions proposed by the announced legal reformulation in this final phase of basic education.

By searching for paths and possible gaps left by the selected scientific articles, in order to understand which research paths are possible in the face of the reform of secondary education, we found that there is a large production of works related to the reform of Brazilian secondary education that reveal several fronts of reflection, especially with regard to the curricular arrangements proposed by the reform and the inequalities that may be created. Reflections and concerns that cross Brazil from North to South, resulting in relevant studies on the many issues brought by the new high school, taking into account the Brazilian cultural diversity, the diverse youth, the scarcity and precariousness of public

schools, the negligence and devaluation of the teaching profession. Studies and research that already present themselves as the theoretical basis for many other studies in progress.

Thus, in view of this RSL, we observe that the reform of secondary education indicates, according to the authors of the selected articles: a) Contradictions regarding the freedom of choices and educational itineraries, revealing possible and distinct perspectives in each of the States of the Federation; b) A siege of the most diverse intentionalities on High School, transforming it into a field of disputes in the different educational projects that are divided into two strands: on the one hand in terms of political conceptions (democratic x selective) and on the other of perspectives related to the issues of Brazilian youth; c) Delegation to the States of all responsibility for implementation, and consequently the transfer of responsibility for the frustration or implementation of this project to the school community; d) Overload of the education networks, since the implementation of the changes remains the responsibility of the schools, which in this process end up redimensioning their meanings; e) Strengthening and expansion of social inequalities, revealed by a secondary education that is born and remains unequal, with a dual, selective and segmented configuration. Each of the questions defended by the researchers is relevant for us to understand that many other investigations are possible with regard to the reform of the public educational policy of secondary education and all its future developments, since its discussion and even resistance to the request for revocation remained in progress during the period of this study.

The gap found in the articles selected for further research was ratified by the authors in the importance of also listening to the segment represented by young students in this basic stage of education. Young people who in the selected articles are considered in their youth and conceived as historical and social subjects who have their education directly affected and not just young people in the sense used by law 13.415/2017 which designates that individual who will attend high school within the legal context without further historical, cultural and social considerations or conceptions.

We show that, as a methodological approach, a systematic review of the literature is essential, as it has provided us with the perception of outstanding points in the reform. The work of RSL presents possible and already trodden research paths, as well as gaps for new research on the theme of high school reform, emphasizes the critical consideration of the speed of high school reform and the importance of giving voice to young people considering their conception of youth.

In view of the findings in the academic productions that we analyzed, there are many research paths that can be taken by scholars and researchers, however the gap found in

the lack of listening to young people allows concerns about the multiple facets of the new high school: who are the young people who are and will be subjected to the reflections of this reform? What are they thinking about this "education project"? How are you experiencing the process of high school reform? Will these young people be able to have the discernment to choose their paths critically based on what the reform proposes? These are some of the questions that arise and that we perceive to be part of the questions raised by the authors of the selected articles. We believe that by reflecting on them we can deepen the problematizations that circulate this very complex theme and bring to the debate and discussion the students, understood by the authors of the selected articles with whom we corroborate our thinking as belonging to plural youths, since they are the subjects who will be most affected by these changes.

Some reflections are still in order at this point, as the effective implementation of Law 13,415/2017 is in progress: what to do? To maintain the ongoing implementation, even in the state in which it is, or to seek ways to transgress, even if between the lines of the law itself, as a way of minimizing possible and foreseen losses in the formation of a generation? What do young people have to say about this whole process, especially due to the circumstances they experienced during the period of the international health crisis caused by covid-19, in 2020 that resulted in social isolation for approximately two years, causing the closure of schools and the installation of diversified virtual forms for the continuation of teaching/learning while Law 13.415/2017 was implemented in pilot schools across the country?

These questions continue to unsettle us. We understand and defend that young people need to be heard once, that they are effectively the subjects for whom the high school reform was designed (or not?). Their contributions and worldviews can contribute significantly to the understanding of an education that is intended and integral both in its construction of knowledge and in its constitution of humanizing formation.

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NARRATIVE THERAPY AND ORGANIZATIONAL CULTURE MANAGEMENT: POSSIBLE ARTICULATIONS

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ABSTRACT

The word narrative has become popular in recent times. Disseminated by the media, among other contexts, it appears in political analyses and in discussions about fictional works. In addition to its strictly communicational aspects, the narrative element plays a central role in a clinical, therapeutic, psychological and social approach: narrative therapy. The present study aimed to analyze a possible approximation of the use of practices developed in the field of narrative therapy in works focused on the management of organizational culture (a field traditionally more associated with other knowledge, such as organizational psychology and business administration). In this approach, we sought points of discussion and concepts from studies on organizational culture and others derived from narrative practices, originally developed in the field of narrative therapy. Despite the practical and epistemological challenges, the approximation of the knowledge that emerges from these two fields of study is fruitful, rich in possibilities for organizations and for people who experience their professional activities in them or who can benefit from their social impacts.

Keywords: Narrative therapy. Organizational culture. Narratives.

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INTRODUCTION

The term narrative has been increasingly present in everyday life. The media often resort to it to refer to the way in which the various social actors describe their positions, worldviews, versions of the facts. The term is even used in political analysis: understanding how public men weave their stories and seek to consolidate the best version of themselves before public opinion. The expression "war of narratives" is not uncommon when it comes to reading controversial facts or events. In a view of the term extracted from the dictionary entry, the word narrative refers, in summary, to the report of one or several events chained together, which may be real, imaginary or fictional (Dicionário Online de Portuguese, n.d.).

In companies, as in other institutions (human groups), the act of telling stories is also present. In a more systematized way, it has been present for decades in case studies, often presented in the format of *storytelling* – in synthesis and bringing the term to Portuguese, narration of a story. The main objective of these studies involving narratives in companies is the training of employees and the dissemination of lessons learned – successful or unsuccessful experiences lived by the organization itself or by similar organizations. Oral memory projects have also been developed in companies for many years. In this type of project, the employees themselves or other stakeholders of the organization take the lead in the history of their institutions and tell the history of the company from their personal experiences. Thus, a very rich mosaic of views of the institution is produced, enabling a much broader and more detailed understanding of the organization than that produced by carefully edited versions. These versions (the edited ones) evidently have their space and fulfill their role in the world of marketing and business, but which may miss important nuances of organizations. Nuances, in turn, precious for the managers of the companies themselves in their efforts to manage the culture of the organizations.

In Brazil, oral memory projects have been carried out in institutions such as Banco Itaú, Votorantim, Petrobras and others (Museu da Pessoa, n.d.)*element.* The basis of this type of work is the view that each subject is an agent of history and, therefore, a source of knowledge for their organizations and for society itself. The story, narrated by each person, forms a picture of perceptions about the events that took place in the institution. In this narration of events, cultural traits are transmitted and can be perpetuated through stories. And, as Nassar and Parente (2020) underline, companies are their stories. Organizations, in order to be noticed and remembered by their stakeholders, create, constitute and feed the visions of their brands with narratives.

In fact, narratives are one of the main elements of the communicational act (Sá Martino, 2016). Through the stories told, in addition to the transmission of content, bonds

(cognitive and affective) are established. An act of encounter takes place between the one who tells and the one who listens to the story. And, being an act of encounter, it is also an act of bonding, of bonding, and of social and political constitution (Gerbner, 1999; Motta, 2012). Observing the narrative bases on which organizational culture is transmitted and perpetuated brings with it, in turn, a strong potential for understanding the elements of the culture itself (Schein, 2004/2020).

From another perspective, diverse and very rich in possibilities, we have the field of narrative in the context of a therapeutic approach: narrative therapy. Having become better known among specialists in the humanities and social sciences (notably psychologists and social workers) due to the work of Michael White (social worker, author and narrative therapist), narrative therapy proposes, based on post-structuralist philosophical bases, a decentered therapeutic practice (in which the therapist's knowledge is not the central axis of the therapeutic work). It also proposes the search, in diversity and richness, narratives of broader horizons for those who seek help. From this perspective, regardless of their social, historical or biological conditioning factors and beyond psychological or psychiatric disorders, the subject cannot be reduced to their problem. The subject, the human being that he is, is also seen as an agent of his history, the protagonist of his narrative.

The objective of the present work is to discuss the possible use of concepts and techniques, originally developed in the field of narrative therapy, in works for companies (or other organizations, in general). More specifically, consulting work that, with a focus on observing the organizational culture, aims to improve people management and internal communication processes.

It is understood that the approximation of this knowledge can broaden the perspectives of action in the organizational field, benefiting it with reflections and practices that have already been used in the clinical field and in social work. It should be noted here that, as relevant economic and social agents that they are, companies have an immense possibility of social transformation.

METHODOLOGY

The methodology for this work will be the review of texts on organizational culture and the literature on narrative therapy. A brief synthesis of organizational culture and narratives will be presented. Next, some practices and concepts of narrative therapy will be discussed. Finally, the risks and possibilities of the articulation of different fields of knowledge will be discussed.

ORGANIZATIONAL CULTURE AND NARRATIVES

Companies, in the face of their management challenges, understood the relevance of studying their organizational cultures. It is already common sense in the business environment that, without working on the organizational culture, the desired management changes are not sustainable. Efforts and resources are invested aiming at cultural changes. Analyzed in detail, HR management processes or internal communication plans generally have this objective: to transform or consolidate a certain organizational culture. The degree of clarity that organizations have about this when they invest in campaigns or redesigns of processes or structures is varied, but, in general, there is, to some extent, this intention (Loureiro, 2006). Programs aimed at the internal public usually aim to influence and transform values, attitudes and behaviors of employees. With this, they seek to promote the meeting or, in business jargon, the "alignment" with the values established by the organization and engagement in the execution of the business strategy.

As is well known, however, the human and social phenomenon is complex, and, even with a lot of investment, the efforts of organizations to manage their cultures and generate identification with their employees or other stakeholders are not always successful (Loureiro, 2006; Figueiredo, 2006). The contemporary world, with its intense and rapid transformations, brings additional challenges to this endeavor. The transparency and visibility that the media currently allow, notably social networks, means that inconsistencies, no matter how small, can be perceived, often destroying the reputations of organizations. Reputation, in turn, has become a highly coveted attribute for companies, an increasingly important differential in times of consumer and investor choices. Likewise, *the identification with the values and purposes of the brands they consume, the organizations where they invest their capital, the companies with which they do business or for which they work* gains relevance for the relationship audiences (company stakeholders).

In this scenario, superficiality is a risk. It is essential for companies to be well grounded in purposes and values. And, for this to occur, it is important that there is an identification and dissemination of these same purposes and values among the groups of people that compose them. The organization needs to make sense to the subjects who are part of it. Attention to narratives in the business environment is part of this context. Narratives understood as a communicational element, as structured stories, capable of producing meaning, but not only that: elements of creation of cognitive and affective bonds and, therefore, also capable of constituting social groups (Sá Martino, 2016; Motta, 2012; Gerbner, 1999), such as those that make up organizations. That is, narratives as elements that help structure the cultural framework of an organization.

In a globalized and fast-paced world, in which distances are overcome in clicks from notebooks and smartphones, the traditional human habit of sitting in a circle and telling and listening to stories is reconfigured in form, but maintains its essential components. The concern with relating, describing, telling and sharing their story and trying to make explicit the meaning of their choices becomes part of the daily life of groups and organizations. Social networks have become the great contemporary "bonfires" around which people and organizations gather and tell their stories. They do so in a contemporary way: fragmented, in strobe rhythm, sometimes excessive. However, they cannot do without coherence in their speeches, nor a basis in terms of purpose and values in the common thread of their narratives, because if something disconnected transpires, the risk of seeing their reputations destroyed is quite great, see all the discussion about "cancel culture" now in vogue.

NARRATIVE THERAPY

Narratives, which, as mentioned in item 3 of the present study, are most commonly seen in their communicational aspects in the business environment, in narrative therapy are associated with therapeutic objectives. But, despite the differences in objectives regarding the narrative element, the idea of a logical chain, the formation of meaning and the presence of psychological aspects are common to both approaches: communicational and therapeutic. Narrative therapy, which became well known in specialized circles for the teachings of Michel White (White, 2012), was constituted from a post-structuralist philosophical proposal. And, in this sense, in the view of the present author, despite its specificities, it is a little closer to the philosophical bases of the psychological approaches traditionally called "third force" in psychology (as opposed to behaviorism and psychoanalysis, which would be the other two other "forces"). Thus, associating the view that the knowledge of the human and social sciences, different from the knowledge of the natural sciences, would be of another order – more properly human and sociocultural, moving somewhat away from the determinisms of biology or the other natural sciences.

One of the maxims of narrative therapy, perhaps the best known, is the idea that the person should not be confused with the problem they experience: the person is the person, the problem is the problem. To reduce the human being to his vicissitudes, whatever they may be, is, in a way, to limit him even in his potentialities to solve the problems he faces. From this view, the practices of externalization emerge in narrative therapy (White & Epston, 1990) And, in this sense, it is also worth mentioning the proximity of the approach to one of the lines of the "third force" in psychology, specifically the phenomenological-

existential approach: the view that a human being is not an "in himself" but an unfinished work, a "for himself". The view that existence precedes essence, the idea that the subject is built throughout his existential journey. The concept so present in narrative therapy that the subject "is" not the problem, resonates with the existentialist idea of the possibility of the human being to construct himself based on the circumstances that surround him. With emphasis on the works of Heidegger and Sartre (Heidegger, 1990; Sartre, 1970), the human being, in this view, cannot be defined purely and only as "something", as an "in itself". Therefore, to confuse him with the problem he experiences would be to limit him and incarcerate him in his suffering.

From the organizational point of view, in an analogous way, thinking of the institution also as openness and possibilities, not confusing it with the difficulties that the group that composes it faces, separating it from the problem, externalizing it, can also be a path rich in possibilities. Especially if we think about small or medium-sized organizations, often of family origin. Facilitating their processes by strengthening their powers, their base values, can be very positive. And in view of the percentage participation of this type of organization in the Brazilian (and world) economy, the effects of this type of facilitation also have a lot of potential for social transformation.

On the other hand, the practice of "narrative maps" (White, 2012), without concern for objectively associating them with the starting point, in philosophical terms, for Michael White and the other authors to develop them (in his writings Michael White speaks of his own attraction and curiosity for maps from an early age), seems to the present author, a perspective that starts from the vision of a multifaceted reality (and with multiple paths or routes) and of a subject that is author and protagonist of his story. It is up to the therapist, then, from the decentered posture that the approach proposes, to facilitate the unveiling of a journey that belongs to the subject. For this, in addition to the suggestions of the maps, the interest and respectful curiosity of a subject when meeting another subject – both agents of his stories – capable of feeling the feelings of the other resonate in him.

Once again here, the technique of narrative therapy should be useful in the business environment. The posture of a consultant can be like a narrative therapist, decentered. The use of maps for this facilitation can also be beneficial. A realistic and respectful understanding of the self-determination of the group of subjects that make up the organization can be valuable for the group to build its own solutions to face the challenges of the institution.

Another very interesting concept developed within the scope of narrative therapy practices is that of "absent, but implicit". In a "free understanding" of the concept, a kind of

"background" of perceptions. That is, what is "absent" can be understood as what plays the background role, so that the problem in focus is the figure. What the concept and the technique arising from the "absent but implicit" propose is the focus on this "background", with the possible question: what premises would be underlying the action that develops in the plane that stands out - in the "foreground" often experienced as the problem? Beyond the manifest issue (or problem), it is possible to observe what was not said, but what also made the existence of the "scene" (experienced situation) possible. By making explicit the absent, which is actually more implicit than actually absent, the person, the subject, the agent of his own history, has the possibility of retelling it in other terms, perhaps more generous with himself. Richer terms of existential possibilities.

Here, once again seeking the articulation of knowledge from narrative therapy and studies in the field of organizational culture, it is worth remembering the concept of premises in the work of Professor Edgar Schein (2004/2020). According to Schein, there are three levels in what is called organizational culture: the most basic of them would be the level of the organization's premises or purposes; the intermediate level would be that of values and norms; and, finally, at a more easily observable level, there would be the so-called artifacts of culture – myths, rites, symbols, etc. The premises, as mentioned, have a central role and relevance in the author's view, but as well as in the idea contained in the concept of "more implicit absentee", they are not always highlighted. In a bridge between these two theoretical frameworks, one can think that what Schein calls premises often fulfill the role of the "absent but implicit" in organizations. Facilitating the connection of organizations with their own premises (not always postulated in their communication pieces and not always so explicit), can be very relevant. It can help them in their management efforts and relationship with their stakeholders.

THE ARTICULATION OF DIFFERENT FIELDS OF KNOWLEDGE

The present work articulates different theories and fields of knowledge (associated with clinical practice and organizational culture). Each of the fields has its own authors and constructs, which in itself carries with it epistemological and methodological issues. If within the field of psychology alone – citing one of the disciplines involved – there is already a profusion of distinct philosophical and epistemological matrices (Figueiredo, 1991), providing the basis for practices in the application of this discipline that, in order to coexist in an articulated way in research, require clarity from the researcher (Loureiro & Silva, 1997), when the articulation extends to other fields of knowledge, The challenge of convergence is

further radicalized. However, the premise here is that bridges between knowledge, in addition to complexity, generate a wealth of possibilities.

Articulating different fields of knowledge, involving some of the so-called human and social sciences, seems to be an overlapping of challenges. However, despite the complexity and difficulty it brings to research and practice, clinical or organizational, the problems as they present themselves in the existential reality of people and their organizations do not obey the rigors of disciplinary cuts. And therefore, there is a need to build bridges between the various fields of knowledge and practices. The ability to, through reason, shed light on knowledge about problems that afflict human beings, in the various dimensions of their lives, and contribute to the construction of solutions, is a promise of science and should also be a commitment of the various professionals who work socially, whether in their clinical, academic or organizational practices.

FINAL CONSIDERATIONS

The clinical, therapeutic, psychological or social care field is complex and fertile for the development of various techniques and approaches. In the same way, working on or with an organization or even, more specifically, a company, is also very complex, although the factors that make up such complexity are different: legal, economic, productive, accounting, safety-related, environmental, and social aspects, in short, innumerable. In common to these two fields: the human. And, in this sense, all the learning that the concepts and practices derived from narrative therapy provide, adapted to the needs and demands of organizations when they request help, can be quite powerful. Especially when the help requested refers to management issues and relationships with its stakeholders (especially its employees) or, in a more focused way, to the management of its culture.

In the present work, the concepts of externalizing narrative therapy, off-center posture, narrative maps, "absent plus implicit" were mentioned. Many other concepts and practices could be analyzed and investigated in terms of possible adaptations for use in the organizational field. Future research or theoretical developments can launch themselves on this path. Organizations, especially business organizations, have a strong potential for social transformation: due to the productive possibility, capacity to generate jobs, environmental and social impact in the regions in which they operate or that can influence their supply chains – in short, due to the economic power they have. As is unfortunately known, countless times, in a conservative way, such economic power only maintains the status quo and reproduces inequalities. There is no room or time for naivety. However, on the other hand, two points need to be remembered: first, there is a very large diversity of

companies, from large conglomerates to small family-owned companies. Jobs that focus on the group of small and medium-sized companies can play a very relevant social role, just by helping them to survive in the market. Large companies, in turn, are starting to pay more attention to topics such as sustainability, social responsibility, and others related to the so-called ESG (*environmental, social, and governance*) agenda. Second and perhaps the most central point at this moment: organizations are made up of people. Therefore, humans, agents and protagonists of their stories. Living beings immersed in their vicissitudes, their doubts and the need to fulfill the value and meaning of their own existences. Subjects of history, in turn, collectively constructed. Reconnecting organizations – this very special group of people – with their premises, their most fundamental values, with the power of being agents of their own stories, can be an interesting path of social transformation.

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IMPACTS OF HIV ON PREGNANCY: A LITERATURE REVIEW

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ABSTRACT

The Human Immunodeficiency Virus (HIV) is a pathogenic agent associated with consequences that involve, above all, the impairment of the immune system of the affected patient, resulting in vulnerability to opportunistic infections. The methodology used in this study was a qualitative review of the literature, where ten articles found in the Pubmed, SciELO and Google Scholar databases of the last five years were selected, aiming to understand the impacts of HIV on pregnancy. In the results found, it was possible to observe that HIV in the gestational period has the impacts of increasing the possibility of developing congenital malformations, intrauterine growth restriction, low birth weight and birth in small size for gestational age; in addition to the chance of dysregulation of the maternal-fetal binomial, when associated with the use of illicit drugs. It is therefore concluded that there is a need for constant surveillance and preparation of the health system for the management of HIV cases during the completion of pregnancy, in view of the possible negative complications associated with this condition.

Keywords: Impacts. HIV. Gestation.

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INTRODUCTION

The human immunodeficiency virus (HIV) is the causative agent of acquired immunodeficiency syndrome (AIDS), which is responsible for a large-scale deterioration of the immune system, and which most determinantly infects CD4+ T lymphocytes (LT) and macrophages, as well as dendritic cells (Pinto Neto *et al.*, 2021).

Once the amount of LT-CD4+ decreases below the acceptable threshold, the body loses its cell-mediated immunity, which makes it more susceptible to opportunistic infections (Farias; Souza; Leal, 2021). In this context, vertical transmission can occur during the gestational period, in the peripartum period, which includes labor and birth, or in the postpartum period through breastfeeding. About 35% of transmissions happen in the intrauterine period. (Bekker *et al.*, 2024).

Prenatal care is of fundamental importance. The first care and the first guidelines will guide the pregnant woman in addition to providing security and safe support. Thus, the nursing professional is a figure of substance, not only at the beginning of the gestational period, but throughout it. Efficient care leads pregnant women to develop healthy and self-care habits (Caetano *et al.*, 2024).

Therefore, the present study sought to interpret the data obtained in recent scientific productions that addressed the theme of the impacts of HIV in the gestational period, interspersing the results with discussions about the measures currently taken for the treatment and prevention of the repercussions of the virus on the development of the fetus and the maternal-fetal binomial.

METHODOLOGY

The study is a qualitative literature review, which used the PubMed, Scientific Electronic Library On-line (SciELO) and Google Scholar platforms as a database for searching the scientific articles used as a theoretical basis. Literature published with a time frame from 2019 to 2024 was used. Articles from all languages were selected, but the materials found were full in English and Portuguese, which addressed the impacts of HIV on pregnancy.

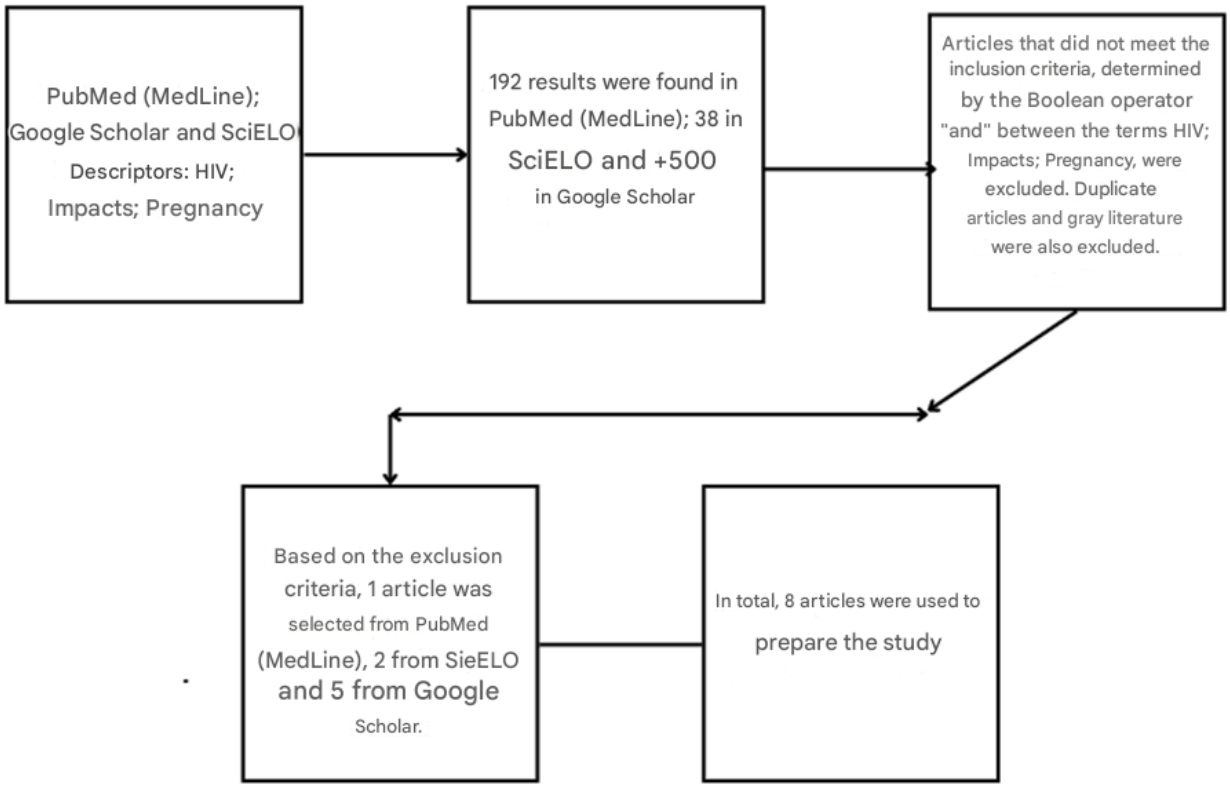
The descriptors used followed the description of the terms DeCs (Health Descriptors) and Medical Subject Headings (MeSH) in English, as shown in Chart 1.

Chart 1 - Search strategy for the study.
“HIV” [MeSH terms] AND “Impacts” [MeSH terms] AND “Pregnancy” [MeSH terms]

Source: Authors (2024).

In this review, the inclusion criteria for filtering the research were three: "HIV"; "Impacts" and "Pregnancy". The choice of these terms and their subsequent search is justified by their relevance to the subject and the way in which the five terms are interrelated in a non-exclusive way, thus justifying their position as inclusion criteria. On the other hand, the exclusion criteria used were books, dissertation project documents, abstracts at events, editorials, literature reviews, isolated case reports, articles that did not meet the inclusion criteria, and duplicate articles, according to Flowchart 1.

Flowchart 1 - Systematization of the filtering of articles for the preparation of the study



Source: Authors (2024).

RESULTS AND DISCUSSION

The choice of articles to be used in this literature review was made by reading the title, abstract and, finally, reading the article in full, with a categorical and thorough analysis of the articles based on the inclusion and exclusion criteria in vogue in the search filters in the databases.

The observations made from the studies used in the present study will be described in Chart 2, according to the title, author and year, following the order of year of publication.

Chart 2 - Articles selected from the PubMed, SciELO and Google Scholar databases

TITLE	AUTHOR, YEAR	OBSERVATIONS
HIV in pregnancy – An update	Chilaka; Horses, 2021	Due to immunosuppression, HIV has the ability to affect the course of various infections during pregnancy, including genital herpes simplex, human papillomavirus, vulvovaginal candidiasis, bacterial vaginosis, syphilis, trichomoniasis, cytomegalovirus, toxoplasmosis, hepatitis B and C, malaria, urinary tract infections, and bacterial pneumonia. tuberculosis and pneumonia caused by *Pneumocystis jirovecii*, appear to be frequent during pregnancy and in the puerperium.
Outcomes in fetuses and newborns exposed to infections during pregnancy.	Da Silva *et al.*, 2021	There was a relative increase in the occurrence of congenital syphilis (28.8%), low birth weight (39%), respiratory distress (20.5%), oligohydramnios (20%), congenital malformation and small for gestational age (10.8%) in cases of gestational HIV in the first trimester. The data obtained indicate the occurrence of unfavorable outcomes for the fetus/newborn when related to neonatal infections.
HIV in pregnancy: Mother-to-child transmission, pharmacotherapy, and toxicity	Red; Murthi; Staud, 2021	There is a window for the teratogenic effects of medications: it is the first trimester of pregnancy. It is during this period that organogenesis takes place. Furthermore, most of the published research on antiretroviral therapy in this specific interval indicates a low association with teratogenicity. The most investigated drugs are efavirenz, zidovudine and dolutegravir. Until recently, dolutegravir was not recommended at conception and early pregnancy due to suspected neural tube defects. However, this recommendation was changed by the US Perinatal Guidelines, and now dolutegravir is considered the most commonly adopted antiretroviral drug throughout pregnancy.
HIV in pregnant women and the challenges for prenatal care	Fernandes *et al.*, 2022	The use of illicit drugs by pregnant women is already critical, and in women with HIV/AIDS the restlessness and distress on the part of health professionals increases even more, due to the negative impacts, physiological consequences that the drug causes for the mother and child binomial. The situation of these women increases the risk of intrauterine HIV transmission, obstetric and fetal complications.
Monocytes and macrophages in pregnancy: The good, the bad, and the ugly	True *et al.*, 2022	A successful pregnancy requires coordinated changes by the maternal immune system to support fetal growth, while simultaneously protecting mother and fetus against microbial biodiversity. As it is the first trimester, it is characterized by a considerable increase in innate immune activity, in particular. This phenomenon favors blastocyst implantation and placental development.
Sociodemographic profile and gestational aspects of	Perotta *et al.*, 2023	The sample was composed mainly of white women in the age group of 13-30 years.

women with HIV/AIDS in Curitiba, Brazil		Regarding prenatal care, this was performed by 93.8% of the pregnant women surveyed, and 45% of them received the diagnosis in the 1st trimester. Access to antiretroviral medication occurred for 82.4% of the pregnant women and for 74.6% the pregnancy outcome was a live birth, regardless of other criteria.
The impact of seropositivity on the mother-infant bond in pregnant women diagnosed with HIV	Rique *et al.*, 2023	Psychological support is important to cultivate feelings and, especially, the maternal-fetal binomial. The relevance of the health team's performance is also highlighted, which understands the moment that the woman is experiencing, making it necessary to provide information about HIV, treatment and everything that involves it, attitudes that provide integrated care that has repercussions on the construction of the bond between mother and baby.
The complications generated by HIV/AIDS in pregnancy: an integrative review	Lisboa *et al.*, 2024	Regarding fetal and neonatal complications, there is an association between small placentas for gestational age (SGA) and low birth weight in newborns of pregnant women living with HIV, as a result of the use of antiretrovirals that include protease inhibitors. In addition, pregnant women with AIDS have a significantly higher risk of preterm birth. It is also observed that a considerable percentage of newborns born to these mothers are born with low birth weight, prematurity and SGA.

Source: Authors (2024).

First of all, Chilaka; Konje (2021) makes a general analysis regarding the possible repercussions of an infectious condition during pregnancy. It is widely evidenced, according to the authors, that immunosuppression from HIV acts as a causative agent of parallel infections, in order to potentiate the harm and probable negative gestational complications.

Similarly, Lisboa *et al.* (2024) states that with regard to fetal and neonatal complications, there is a significant correlation between the presence of SGA placentas and low birth weight in newborns of HIV-positive pregnant women, a phenomenon attributed to the administration of antiretrovirals, particularly those that include protease inhibitors. In addition, pregnant women affected by AIDS show a markedly higher risk of premature births. It is also observed that a significant portion of neonates from these pregnancies manifest conditions of low birth weight, prematurity and SGA.

The cause of these risk factors arising from immunosuppression lies in the relevance that the first trimester has for fetal formation. It is during this time, according to True *et al.* (2022), that the embryonic organism will develop not only the limbs and various tissues of the body, but also the initial mechanisms of the immune system. It is therefore clear that the

immunosuppression caused by HIV prevents the immune development of the embryo, leaving it more susceptible to pregnancy infections.

Due to this situation, Da Silva *et al.* (2021) understands that, in the scenario of gestational seropositivity in the first trimester, there is a clear correlation between the occurrence of congenital syphilis in cases of HIV seropositivity, with an increase of 28.8% in cases than in relation to seronegative pregnancies, as well as a percentage increase in low birth weight cases by 39%, and respiratory distress with a percentage increase of 20.5%. The data obtained generally culminate in the description of negative outcomes for the embryo that will become a fetus and later a newborn.

The reality of the HIV scenario in the first trimester is statistically demonstrated by Perotta *et al.* (2023), pointing out that, in the sample carried out, 93.8% of pregnant women received prenatal care in a coherent way, of which 45% received notification of seropositivity in the 1st trimester of pregnancy. Access to antiretroviral medication occurred for 82.4% of the pregnant women and for 74.6% the pregnancy outcome was a live birth.

Regarding the treatment offered, Cerveny; Murthi; Staud (2021) points out that caution is essential in relation to teratogenicity characteristic of the first trimester of pregnancy. However, the low risk of antiretroviral administration has been evidenced, even in the teratogenic window.

In addition, another relevant criterion addressed was the use of illicit drugs in the first trimester and its correlation with HIV seropositivity. In this context, Fernandes *et al.* (2022), demonstrates that the main aspect impacted is that of the mother-child binomial after birth, due to the dysregulation of the physiological mechanisms that act in the maintenance of the relationship, caused by drugs.

Finally, Rique *et al.* (2023) discusses that there are negative complications in issues ranging from breastfeeding to the mother's self-perception of motherhood. Focus is given to the psychological requirements of HIV infection in the first trimester of pregnancy and how psychological support is essential for maintaining the bond during the gestational process, until delivery and postpartum.

FINAL CONSIDERATIONS

Understanding the relationship between the involvement of pregnancy by the HIV virus and the impacts related to it is essential to guide the direction of public policies necessary for the treatment of complications, as well as the prevention of infection, especially in view of the physiological delicacy of the pregnancy period.

HIV infection during pregnancy is considered a teratogenic risk not only due to the direct action of the virus, but also due to the antiretrovirals administered to pregnant women, whose systemic repercussions throughout pregnancy are not yet fully understood. This risk involves potential impacts on both fetal development and maternal health at different stages of pregnancy, from the first trimester to the perinatal period.

Therefore, the analysis of the literature allows us to understand that the continuous collaboration between the most varied organizational devices available to the health system is of essential importance for the prevention and treatment of the impacts of HIV during pregnancy.

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USE OF APITOXIN AS AN INTERVENTION IN THE TREATMENT OF DERMATOLOGICAL INFLAMMATION

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ABSTRACT

Bee venom (BV), produced by the species Apis mellifera, is one of the most recognized and widely studied natural toxins, with increasing use in integrative medicine. This venom contains a variety of chemicals, including peptides such as melittin, apamine, adolapin, and the peptide MCD, as well as enzymes such as phospholipase A2 (PLA2), hyaluronidase, acid phosphomonoesterase, and lysophospholipase. Amines such as histamine, dopamine, and norepinephrine are also present, which contribute to antimicrobial, anti-inflammatory, immunomodulatory, and anticancer properties. Studies suggest that it has promising pharmacological effects, especially in the treatment of inflammation. OBJECTIVE: This study aims to investigate the therapeutic effects of bee venom in the treatment of dermatological inflammations, exploring its potential as a natural alternative with proven anti-inflammatory properties. METHODOLOGY: A systematic review of the literature was carried out, focusing on primary articles and results of randomized controlled trials (RCTs) conducted in vivo and in vitro, published between 2014 and 2024. RESULTS: In mouse models of induced atopic dermatitis (AD), phospholipase A2 (PLA2), a BV-derived compound, has been shown to significantly reduce skin thickness and inflammatory cytokine levels, both in animal and human models, highlighting the importance of confirming its clinical applicability. As a result, therapies can include everything from the topical application of BV to the use of emollients and cosmetics with these compounds, based on their pharmacological properties. CONCLUSION: This review evidenced the potential of bee venom as a promising alternative in the treatment of dermatological inflammation, due to its anti-inflammatory and immunomodulatory properties. Studies in animal models and in vitro suggest that compounds such as melittin and phospholipase A2 (PLA2) inhibit inflammatory mediators and relieve symptoms of atopic dermatitis and acne. In addition, research indicates that BV can block inflammatory signaling pathways, such as NF-κB and MAPK, reinforcing its therapeutic potential in the management of skin inflammation, especially in topical applications.

Keywords: Apitoxin. Dermatological Disease. Inflammation. Bee Venom. Treatment.

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INTRODUCTION

The skin is the largest organ in the human body, it performs vital functions as a protective barrier against allergens, toxins and pathogens, as well as regulating body temperature and water and electrolyte homeostasis. When these functions are disrupted, several dermatological diseases can arise, significantly impacting the quality of life of affected individuals (Dinu *et al.,* 2024) .

The damage caused to the skin has as one of the reactions inflammation, a generalized response activated by the innate and adaptive immune systems to maintain the body's balance. Under normal conditions, this response promotes recovery from infections and healing, however, when it does not occur in a controlled way, inflammation can lead to immune disorders. (Lee; Bae, 2016)

It is estimated that there are about 3,000 recognized dermatological diseases. In the United States, approximately 11.8% of the population between the ages of 1 and 74 suffer from at least one skin disease, and 75% of Americans report concerns about conditions that affect visible areas of the body, such as the face and neck. In Canada the prevalence rate is 28.4% and 7.05 million people are disabled in China annually. Among dermatological inflammations, atopic dermatitis is considered one of the diseases commonly found in approximately 20% of children worldwide and in 1% of adults (Liang *et al.,* 2024) (You *et al.,* 2016) .

Dermatological inflammations have a different classification, depending on several factors such as cause and manifestation. The most frequently found in addition to atopic dermatitis and psoriasis and acne, which causes thick, scaly plaques and inflammation of the sebaceous glands, respectively. Other inflammations that affect the population are contact dermatitis, caused by exposure to allergens or irritants, and urticaria, an allergic reaction that causes red rashes and itching. These conditions vary in severity and can be triggered by immune, environmental, or infectious factors (Dong; Li; Shi, 2024) (Ashbaugh; Abel; Murase, 2021; Lauritano *et al.,* 2020) .

Currently, there are several drugs used in conventional medicine for skin disorders, but a complexity arises that has several limitations, such as adverse effects or limited penetration, so a new interest arises in discovering molecules that are effective and safe to combat these conditions (Majtan; Bučeková; Jesenak, 2021) .

Bee venom (BV), produced by bees of the species *Apis mellifera*, is one of the most widely recognized natural toxins, currently used in integrative medicine. This venom is composed of a wide variety of chemicals, including peptides such as melittin, apamine, adolapine and the peptide MCD. These components, as well as enzymes such as

phospholipase A2 (PLA2), hyaluronidase, acid phosphomonoesterase, and lysophospholipase, several amines (histamine, dopamine, and norepinephrine) contribute to the biological effects of BV, including antimicrobial, anti-inflammatory, immunomodulatory, and anticancer attributes. (Kim *et al.,* 2017 Cui *et al.,* 2024)

BV has promising pharmacological effects, especially in the treatment of inflammation. Recent studies have shown that by detoxifying bee venom, it is possible to significantly reduce its cytotoxicity and allergenicity while maintaining its potent anti-inflammatory and antioxidant properties. Detoxification involves modifying components of the venom, such as melittin, resulting in a significant reduction in the expression of pro-inflammatory cytokines and the phosphorylation of IκBα, without causing damage to cells (Lee et al., 2021) .

Melittin, the most relevant component of bee venom (representing 50% of its dry weight), has anti-inflammatory and antiarthritic properties, activated by the inhibition of nuclear factor kappa B (NF-κB). Melittine has also demonstrated anticancer, antibacterial, and antiviral activities. Studies report that the PLA2 enzyme, also present in bee venom, contributes to the improvement of skin lesions similar to those of atopic dermatitis (Kim *et al*., 2019).

Due to the significant impact that skin diseases, such as atopic dermatitis, acne and psoriasis, have on the quality of life of individuals, the aim of this study is to investigate the therapeutic effects of apitoxin (Venom produced by the bee *Apis mellifera*) in the treatment of dermatological inflammations, seeking to explore a natural alternative with proven anti-inflammatory properties. It is intended to evaluate its effectiveness in reducing inflammation and in this way, the study aims to contribute to the development of safer and more effective treatments for dermatological conditions.

MATERIAL AND METHODS

The present study is a systematic review of the literature that aims to identify, select, evaluate and synthesize the relevant evidence available in the literature on the subject. To develop the review, the following steps were carried out: 1) elaboration of the research question; 2) literature search; 3) selection of articles and definition of inclusion criteria; 4) data extraction.

The conduct of this review was based on the following research question: "Do apitoxin and its derivatives present in the venom of the bee *Apis mellifera*, have anti-inflammatory properties safe for use in dermatological inflammation?".

From the definition of the problem, inclusion and exclusion criteria were delimited and keywords were defined. In the second stage, there was a search in the literature to locate and select relevant studies. To identify all studies, the following databases were used: *PubMed* and *Scopus,* it is important to emphasize that more searches were carried out in other databases such as *Web of Science*, but the studies found in it had already been selected in the databases mentioned above. The following keywords were used in Portuguese: apitoxin, dermatological disease, inflammation, bee venom, treatment. These descriptors were combined with the Boolean operators "AND" and "OR", to form the search *string*, used in the search strategy in the databases.

Table 01. Database search strategies

Scopus	(("Apitoxin" OR "Bee Venom" OR "Apitoxina") AND ("Skin Inflammation" OR "Dermatitis" OR "Inflammatory Skin Condition" OR "Dermatological Disease") AND ("Therapy" OR "Intervention" OR "Treatment" OR "Anti-Inflammatory Therapy"))
Pubmed	

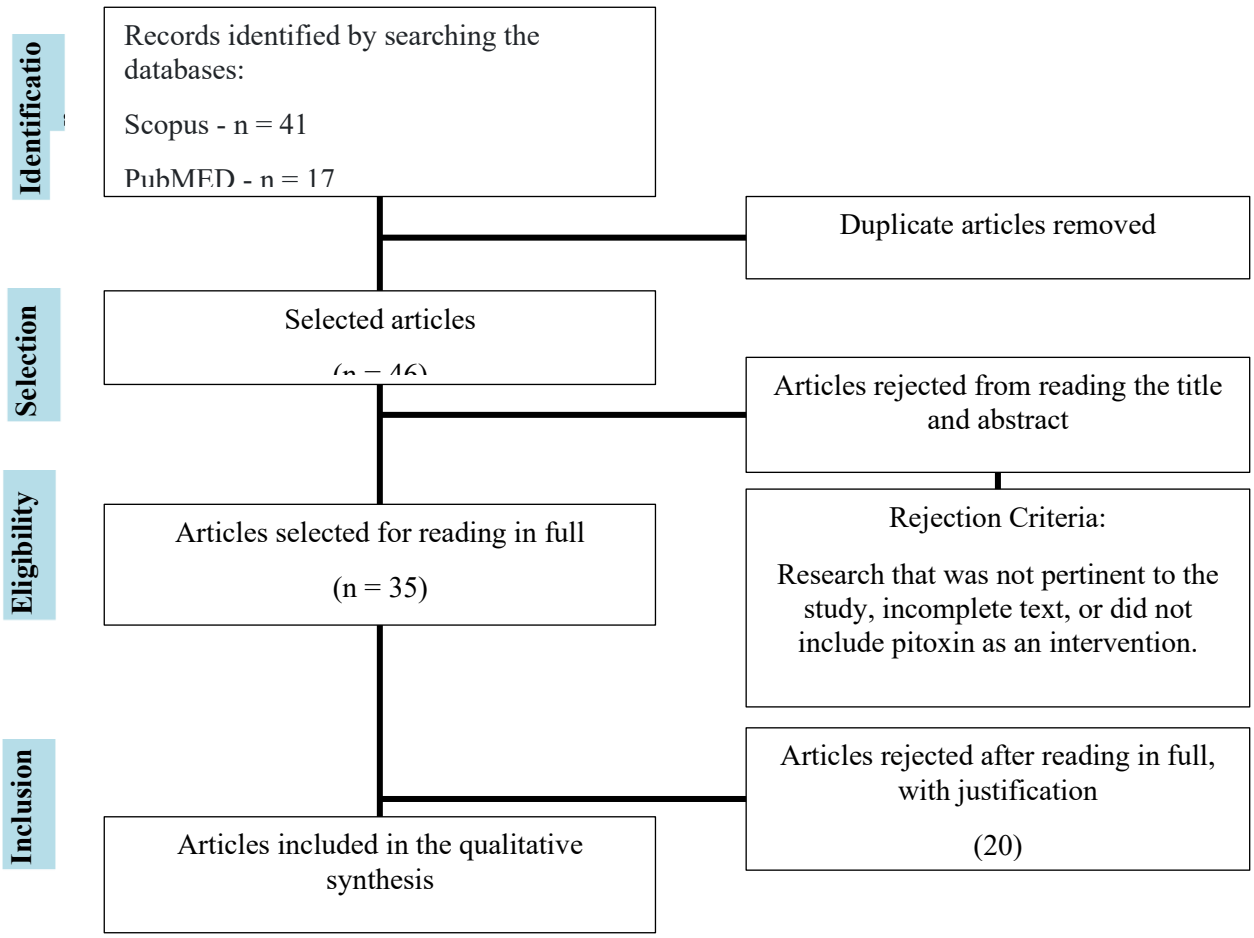
Source: Survey Data, (2024)

In the third stage, the articles were selected and the inclusion and exclusion criteria were defined. We chose to include primary articles results of randomized clinical trials (RCTs) conducted *in vivo* and *in vitro*; published between 2014 and 2024 with the aim of analyzing both more recent publications and previous studies, expanding the understanding of the relationship between the constructs; in Portuguese, English, and Spanish, which are related to apitoxin, skin inflammation and treatment. As exclusion criteria, articles that do not answer the guiding question, that do not deal with apitoxin and/or its derivatives in the treatment of dermatological diseases, theses, theoretical articles, review articles, meta-analysis, editorials, comments on articles, books and book chapters.

The extracted data were collected, combined, and summarized to draw logical conclusions from the results of the individual studies. The synthesis considered the strength of the evidence and whether the observed effect is consistent across studies, as well as explanations for possible inconsistencies. After gathering, assessing the quality and extracting the data, the conclusions were made through a narrative approach.

Carried out through a narrative approach.

Figure 01. Search and selection of studies for inclusion in the systematic review



Source: Research Data, (2024).

RESULTS

The present systematic review aimed to investigate the effectiveness of bee venom in the treatment of skin inflammation, that is, in order to provide a comprehensive review of the evidence available in the literature to understand the potential of bee venom as a therapeutic alternative in the management of inflammatory skin conditions. For this, based on the use of the descriptors and databases mentioned above, a total of 69 studies were identified, among which 46 articles were selected for analysis. 23 articles were removed due to duplication in the databases. In addition, 11 papers were rejected due to previous reading of the title and abstract of the text. Thus, a total of 35 articles were selected for full reading and correlation analysis with the proposed theme. Thus, respecting the rejection and inclusion criteria established in the research methodology, 20 studies were rejected. Summatizing 15 articles for the qualitative synthesis of the literature review.

Table 1: Summary of results

Base data	Author/Year	Sample	Intervention	Objective	Denouement	Method	Results
Scopus	Lee; Bae, 2016	Mice (N= 30) (Mean age = 08 months of age).	I use melittin mixed with petroleum jelly.	To analyze the effect of melittin in mice with induced (*P. acnes*).	Effectiveness of the use of melittin in the treatment of acne.	HaCaT (5.0 × 105 cells ml−1) were seeded in complete medium. After 24 hours, the cells were switched to serum-free medium containing the indicated concentrations of melittin (0.1, 0.5, and 1 μg ml−1).	Administration of melittin significantly decreased the expression of several inflammatory cytokines in keratinocytes treated with *P. acnes*. In addition, it exerted anti-inflammatory effects against the live animal model treated with *P. acnes*. These protective effects were mainly due to the suppression of NF-κB and AP-1, which regulate the production of inflammatory cytokines.
PubMed	Han *et al.*, 2017	The experiments were carried out on 39 healthy male guinea pigs of 5 weeks of age	Bee venom gel	Analyze the effects of bee venom as well as evaluate the safety of cutaneous application	Observes skin reaction through phototoxicity and photosensitization of the skin after use of VB	Purified bee venom was collected and diluted in sterile cold water and centrifuged at 10,000×g for 5 minutes at 4°C. The residues in the supernatant were discarded. PBVTM was lyophilized and refrigerated at 4°C for later use. BV gel has been prepared with MFDS-approved materials and formulated. The gel containing 0.06% BV	Erythema and edema were observed after 24, 48, and 72 hours in the positive control group, but not in the negative control and BV gel groups. In summary, Bv has shown great potential in the development of cosmetics.
Scopus	Kim *et al.*, 2019	Cell culture (*in vitro*) and Male mice (7 weeks of age).	Use of melittin and unpurified bee venom.	Observe the effect of purified bee venom and melittin *in vitro and in vivo*.	Effectiveness of the use of melittin in the treatment of atopic dermatitis.	Cultivation of HaCat and THP-1 cells, dilution of bee venom, dissolved in Dulbecco phosphate-buffered saline solution, use of PCR.	From the experiments, it was possible to observe that bee venom relieves atopic dermatitis by inactivating the complement system, especially by inducing CD55.

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PubMed	Kim *et al* ., 2017	Camundongos HaCaT cells (keratinocytes)	Use of melittin, a component of bee venom	Effect of melittin on ovalbumin-induced atopic dermatitis-like skin lesions	To observe the benefit of melittin in lesions similar to induced atopic dermatitis	HaCaT cells (CLS, Eppelheim, Germany) were cultured in modified Dulbecco Eagle medium (DMEM) supplemented with 10% fetal bovine serum and 1% antibiotics at 37 °C in a 5% CO2 humidified incubator. HaCaT cells were seeded in 1.0 × 106 cells through a complete 3 ml medium in a 100 mm CT-treated cell culture dish. The cells were seeded in a 96-well plate at 5.0 × 103 cells per well and pre-incubated for 24 h. After pre-incubation, the cells were treated with melittin (0.1, 0.5, 1 and 2 μg ml−1) and 50 ng ml−1 each of IL-4 and IL-13 for 24 or 48 h.	The results showed that OVA-induced skin thickening and inflammatory infiltration decreased in the melittin-treated group. Melitin prevented OVA-induced filaggrin deficiency and unbalanced inflammatory mediators. In addition, melittin inhibited IL-4/IL-13-induced filaggrin downregulation through blocking STAT3 activation in human keratinocytes.
PubMed	An *et al.* , 2018	Female mice and in human keratinocyte cultures	Bee venom and melittin	Analyze the efficacy of bee venom and melittin are suitable for epicutaneous application	Describe the potential effects of bee venom and melittin in the treatment of induced atopic dermatitis *in vivo* and *in vitro*	The effects of bee venom and melittin were studied in an in vivo 1-chloro-2,4-dinitrobenzene (DNCB)-induced AD model in female Balb/c mice and in human keratinocyte cultures, stimulated by TNF-α/IFN-γ.	Bee venom and melittin exhibited potent anti-atopic activities, demonstrated by the decrease of AD-like skin lesions induced by DNCB in mice. In vitro studies using human keratinocytes stimulated by TNF-α/IFN-γ showed that bee venom and melittin inhibited increased expression of chemokines, such as CCL17 and CCL22, and pro-inflammatory

							cytokines, including IL-1β, IL-6, and IFN-γ, by blocking NF-κB and STAT signaling pathways.
PubMed	Jang S, *et al.*, 2024	2 patients. Mice	Acupuncture and phytotherapy associated with bee venom	To analyze the hypothesis that bee venom acupuncture (VA) is effective for eczema and contact dermatitis.	Suggest that bee venom and herbal medicine may be an alternative treatment for eczema and contact dermatitis.	Both patients with HS and contact dermatitis were treated with BVA BVA treatments for a total of 19 and 16 sessions. On the first day of treatment, a skin test for AVB was performed (0.3 mL of 10% diluted AVB in case 1, 0.2 mL of 10% diluted AVB in case 2). The BVA dose was increased to 2.4 mL (case 1) or 0.9 mL (case 2) on the last day of treatment. Eczema-like contact dermatitis was induced using 2,4-dinitrochlorobenzene (DNCB) as previously described. The six-week-old mice were exposed to 1% DNCB once weekly for 4 weeks. From the second week onwards, the mice were injected with BVA (50 μg/kg diluted in PBS) or saline solution and SWH (200 mg/kg, 3 times/week) was administered orally	This study reports the medical histories and treatment processes of two cases of hand eczema (HE), including contact dermatitis that were cured by bee venom acupuncture (BVA) combined with herbal medicine. This study also confirmed the effect of BVA and SWH co-treatment in a mouse model of eczema-like dermatitis. Bee venom therapy combined with herbal medicine is safe and effective for HS patients.

Scopus	Cherniack; govorushko, 2018	People with musculoskeletal and neurological diseases associated with depression	Acupuncture with bee venom applied to the tips of acupuncture needles.	To evaluate the efficacy and safety of acupuncture with bee venom in humans.	Treatment of musculoskeletal and neurological diseases, including lumbar disc disease, knee osteoarthritis, rheumatoid arthritis, adhesive capsulitis, lateral epicondylitis, peripheral neuropathies, stroke, and Parkinson's disease.	Review of small studies on the use of acupuncture with bee venom in humans.	Bee venom acupuncture has shown success in treating various musculoskeletal and neurological diseases, but there are significant concerns about safety, including the risk of anaphylaxis.
Scopus	Gazerani, 2021	Humans with Parkinson's Disease	Use of venoms from bees, scorpions, snakes, and lizards as therapeutic options for Parkinson's disease (PD).	To investigate the neuroprotective role of a diverse range of natural products, including venoms, in preclinical PD models and in humans.	Evaluation of the main findings of recent studies that investigated venoms as therapeutic options for PD.	Review of recent studies on the use of venoms in preclinical and human models for PD.	The venoms have shown neuroprotective potential in preclinical models of PD, suggesting that they may be promising therapeutic options for slowing disease progression.
Scopus	Shin; Choi; Bae, 2018	Mice	Application of phospholipase A2 (PLA2) derived from bee venom to treat skin lesions similar to atopic dermatitis induced by 2,4-dinitrochlorobenzene (DNCB) and house dust mite extract (DFE).	To investigate the underlying mechanisms of PLA2 action in atopic dermatitis.	Inhibition of epidermal thickness, serum immunoglobulin E (IgE) and cytokine levels, macrophage and mast cell infiltration into the ear of a DFE and DNCB-induced model of AD.	Application of DNCB and DFE to induce atopic dermatitis in mice, followed by treatment with PLA2. Evaluation of effects through clinical and histological measurements.	Treatment with PLA2 inhibited epidermal thickness, serum IgE and cytokine levels, and macrophage and mast cell infiltration into the ear of mice. These effects were nullified in CD206 mannose receptor-deficient mice exposed to DFE and DNCB.
Scopus	Kim *et al*., 2021	Epithelial cells of A549 airways	Application of bee venom (1.0 μg/mL) to inhibit IL-13-induced AKT phosphorylati	Investigate the effect of bee venom on IL-13-induced mucus metaplasia	Inhibition of MUC5AC production through regulation of SPDEF and FOXA2	In vitro study with A549 cells, using IL-13 to induce mucus metaplasia and bee venom to inhibit AKT	Bee venom inhibited AKT phosphorylation, increased SPDEF expression, and decreased FOXA2 expression, preventing IL-13-induced

			on (10 ng/mL)			phosphorylation	increase in MUC5AC expression
Scopus	Kim *et al*., 2015	Human keratinocytes (HaCaT) and monocytes (THP-1)	Bee Venom Treatment to Investigate Its Anti-inflammatory Properties in Propionibacterium acnes (P. acnes)-induced Skin Inflammation	To investigate the anti-inflammatory properties of bee venom on P. acnes-induced skin inflammation	Inhibition of the secretion of pro-inflammatory cytokines (IFN-γ, IL-1β, IL-8 and TNF-α) and the expression of IL-8 and toll-like receptor 2 (TLR2) in HaCaT and THP-1 cells treated with P. acnes	In vitro study using human keratinocytes (HaCaT) and monocytes (THP-1) treated with P. acnes and bee venom	Bee venom effectively inhibited the secretion of IFN-γ, IL-1β, IL-8 and TNF-α, as well as the expression of IL-8 and TLR2 in HaCaT and THP-1 cells treated with P. acnes
Scopus	Lee *et al*., 2021	Camundongos Balb/c	Topical application of 5% phthalic anhydride (PA) to the dorsal skin and ears to induce atopic dermatitis (AD), followed by treatment with bee venom (BV) three times a week for 4 weeks.	To investigate the anti-inflammatory and anti-DA effects of bee venom in an animal model of PA-induced AD.	Significant reduction in clinical AD score, epidermal thickness, IgE level, and immune cell infiltration into skin tissues.	Topical application of PA to induce AD, followed by treatment with BV. Evaluation of the effects through clinical and histological measurements, in addition to analysis of inflammatory cytokines in the serum.	Treatment with BV significantly reduced the clinical AD score, epidermal thickness, IgE level, and immune cell infiltration into skin tissues. In addition, VB inhibited the expression of iNOS and COX-2, as well as the activation of the MAPK and NF-κB signaling pathway.
Scopus	Jung *et al*., 2017	Mice	Topical application of phospholipase A2 (bvPLA2) derived from bee venom to treat skin lesions similar to atopic dermatitis induced by house dust mite extract (DFE) and 2,4-dinitrochlorobenzene (DNCB).	To determine whether treatment with bvPLA2 exacerbates DFE-induced atopic dermatitis-like allergic inflammations in a murine model.	Significant suppression of increased symptoms of atopic dermatitis, including ear thickness, serum IgE concentration, inflammatory cytokines, and histological changes.	Topical application of bvPLA2 in mice with DFE/DNCB-induced atopic dermatitis. Measurement of epidermal thickness, immune cell infiltration, serum immunoglobulin, and cytokines.	Treatment with bvPLA2 inhibited mast cell infiltration into the ear and significantly suppressed symptoms of atopic dermatitis, including ear thickness, serum IgE concentration, and inflammatory cytokines. Depletion of regulatory T cells abolished the anti-atopic effects of bvPLA2, suggesting that the effects depend on the existence of Tregs.
Scopus	You *et al*., 2016	136 patients with atopic dermatitis	Application of an emollient containing bee venom and silk	To discover the beneficial effect of an emollient containing	Eczema Area and Severity Index (EASI) score, transepiderm	Double-blind, randomized, base-controlled, multicenter study	Patients who applied emollient containing bee venom had significantly lower EASI scores and VAS value compared to

			protein or an identical vehicle, except for bee venom, for 4 weeks	bee venom in the treatment of patients with atopic dermatitis	al water loss, and pruritus visual analogue scale (VAS) score		patients who applied emollient without bee venom
Scopus	Tender *et al.*, 2024	Ratos Wistar	Application of melittin to induce toxicity, followed by treatment with mini-αA-crystalline gel (MAC) and its modified version (MAC-GRD).	To compare the skin permeation, anti-inflammatory and analgesic activities of the natural peptide MAC and its modified version (MAC-GRD).	Improvement in skin permeability and anti-inflammatory, analgesic, and antioxidant activities of MAC-GRD compared to MAC and 1% hydrocortisone cream.	Study of ex-vivo skin permeation using a vertical-type Franz's diffusion apparatus and in vivo preclinical experiments in Wistar rats.	MAC-GRD gel demonstrated greater skin permeability and superior anti-inflammatory, analgesic, and antioxidant activities compared to MAC gel and 1% hydrocortisone cream.

Source: survey data, 2024.

The studies in this review are generally characterized as studies of variable dates, but occurring mainly in the years 2017 and 2018. Among the studies selected for the review, most were conducted in experimental models with mice, indicating a predominance of animal model research to evaluate the effect and efficacy of BV. For example, Lee and Bae (2016) evaluated the effect of melittin in topical preparations, while Shin, Choi and Bae (2018) investigated the application of phospholipase A2 (PLA2), derived from BV to treat skin lesions that simulate inflammatory conditions, such as atopic dermatitis induced by environmental chemical agents, being an experimental model widely used to evaluate immunological and anti-inflammatory properties.

In addition to the *in vivo model,* a considerable additional portion used cell culture, i.e., *in vitro model*. For example, Kim *et al* (2019) used both the in vivo model and cell culture in order to explore the activity of melittin and unpurified venom. In addition, Kim *et al.* (2021) focused on the use of the venom in airway epithelial cells (A549), which demonstrated its potential to inhibit AKT phosphorylation, induced by IL-13. A relevant point of such a methodology is the provision of the detailed molecular mechanism that is involved in the therapeutic properties of BV, which allows an accurate analysis of cellular responses of different concentrations and composition of the venom.

In addition, some studies have applied alternative methodology such as clinical trials, which explore the use of venom in alternative medical applications, such as acupuncture, as indicated by Cherniack and Govorushko (2018), as well as topical formulations for patients with chronic inflammatory conditions, as demonstrated by You *et al.* (2016); even

by people with neurological conditions, such as Parkinson's disease, as demonstrated by Gazerani (2021). Three studies complement the experimental models previously mentioned, in addition to being able to expand the understanding of the effects of BV in diversified therapeutic environments.

DISCUSSION

The analyzed research shows patterns regarding the widespread use of animal models, especially Wistar mice and rats, to explore the therapeutic effects of bee venom including substances present in its composition such as melittin. For example, studies such as those by Bae *et al.* (2018) and Jung *et al.* (2017) tested in mice the effectiveness of phospholipase A2 (PLA2), a compound derived from VA, in reducing the symptoms of atopic dermatitis (AD), noting a considerable decrease in skin thickness and levels of inflammatory cytokines.

On the other hand, Tender *et al.* (2024) conducted studies in Wistar rats, showing that the application of melittin, followed by treatment with mini-αA-crystalline gel (MAC-GRD), led to superior skin permeability and more effective anti-inflammatory activities compared to conventional treatment with 1% hydrocortisone.

For Kim *et al.* (2019) and Kim *et al.* (2017) in vivo studies with mice and HaCaT cell cultures were used to examine the effects of melittin. In both cases, there is evidence that melittin blocks inflammatory mediators such as NF-κB and AP-1, decreasing the production of cytokines that favor inflammation. The research by Kim *et al.* (2017) also highlights the protection against the downregulation of filaggrin, essential for the preservation of the skin barrier, indicating that melittin may be advantageous in preventing problems in the epidermis.

Unlike preclinical studies, there is research that seeks to apply these results to human models. You *et al.* (2016) conducted a clinical study with 136 patients, analyzing an emollient that contained BV. The research revealed a remarkable advance in clinical AD scores, with a decrease in the EASI score and the visual analogue scale (VAS) of pruritus. This underscores the clinical efficacy of BV-derived compounds in the treatment of inflammatory conditions. This shift from animal to human models is crucial to confirm the clinical applicability of the findings.

Therapies can vary greatly, ranging from the topical application of BV to the use of products such as emollients, specifically made with these compounds based on their pharmacological properties and studies. For example, Jung *et al.* (2017) focused on the topical use of melittin, while You *et al.* (2016) analyzed the impacts of an EBV-enhanced

emollient. The variety of therapeutic methods reflects the constant search for treatment techniques that are both efficient and safe, reducing possible adverse effects.

The purposes of these studies are consistent in evaluating the anti-inflammatory and anti-allergic effects of BV. For example, Jung *et al.* (2017) reported a reduction in skin lesions and inflammatory cell infiltration, whereas You *et al.* (2016) noted a significant improvement in the clinical symptoms of patients. These findings underline the promising possibility of these compounds in the control of chronic inflammatory conditions. The action processes addressed in the surveys also offer valuable insights into the effectiveness of treatments. Inhibition of NF-kappa B and STAT signaling pathways is often cited as a crucial process in modulating the inflammatory response. Tender *et al.* (2024) proved that melittin has the ability to block the production of pro-inflammatory chemokines and cytokines, indicating a solid mechanism that underpins the observed anti-inflammatory effects. These results highlight the therapeutic efficacy of melittin and BV in the treatment of inflammatory diseases, laying a robust foundation for future clinical research.

Bee venom, in addition to being used as an intervention in the treatment of atopic dermatitis, studies have also shown a great effectiveness of this substance in the treatment of acne, as described by Lee; Bee (2016). The researchers investigated the anti-inflammatory effects of melittin treatment on heat-inactivated HaCaT cells exposed to *Propionibacterium acnes* . The results showed that treatment with melittin reduced the increase in phosphorylation of IKK, IκB, NF-κB, and p38, caused by *P. acnes* in HaCaT cells. Thus, the data indicate that melittin inhibits the production of inflammatory cytokines induced by *P. acnes* by blocking NF-κB and p38 MAPK signaling in these cells.

In addition to the applicability of bee venom in dermatological inflammations, research has suggested its use in the composition of cosmetics according to the results obtained by . Due to its anti-inflammatory, antibacterial, and healing properties, purified bee venom can help reduce inflammation and fight infection-causing bacteria on the skin. In this way, the use of VB in cosmetics has shown great potential based on its supposed anti-aging and regenerative properties. The venom, composed of melittin, apamine, and phospholipase A2, is promoted as an active ingredient that can stimulate collagen and elastin production, helping to improve skin firmness and elasticity. Han *et al* (2017)

FINAL CONSIDERATIONS

The present review showed that bee venom has been shown to be a promising alternative in the treatment of dermatological inflammations, due to its anti-inflammatory and immunomodulatory properties. Studies in animal models and in vitro have shown that

compounds such as melittin and phospholipase A2 (PLA2) have the ability to inhibit inflammatory mediators and reduce symptoms of conditions such as atopic dermatitis and acne. In addition, research indicates that BV may be effective in blocking crucial signaling pathways, such as NF-κB and MAPK, which are involved in exacerbated inflammatory responses. These findings reinforce the therapeutic potential of BV in the management of skin inflammation, especially in topical applications.

However, despite the promising results, there is still a need for additional studies, especially in human models, to confirm the clinical efficacy and long-term safety of BV. Although preliminary studies in humans, such as those by You *et al.* (2016), have demonstrated significant improvements in chronic inflammatory conditions, it is essential to ensure that risks, such as cytotoxicity and allergic reactions, are minimized. Thus, the continuity of clinical research and the search for methods that detoxify the venom without compromising its efficacy are fundamental steps for the validation of BV as a viable and safe option in the treatment of dermatological inflammation.

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AGRICULTURE 4.0: DIGITAL TRANSFORMATION IN THE PRODUCTION CHAIN FOR EFFICIENCY AND SUSTAINABILITY IN THE AGRO-INDUSTRIAL SECTOR

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ABSTRACT

The use of high technology in agro-industrial production is a reality in crops, reinforcing the relevance of Agriculture 4.0 as a transforming agent through digitalization and integration of processes. Digital transformation connects all links in the production chain, allowing real-time data from the field to be disseminated and used to improve the control of operations and support strategic decisions with precision. This advancement facilitates more efficient practices, continuous monitoring, and agile responses to environmental and market variables. In this context, this article presents a Systematic Literature Review, addressing the state of the art of Agriculture 4.0, its technologies and practices applied to the agro-industrial sector. In sequence, a case study is applied with data collection in a company that provides technological solutions aimed at the management of the agro-industrial process of the sugar-energy sector. The objective is to analyze and relate the challenges in the integration between the field, technology and the user of the data, in order to identify critical factors that influence the adherence and success of digital solutions. The research seeks to explore how digitalization can optimize operational efficiency, increase productivity, and create opportunities for knowledge management and sustainability in the agribusiness. It was highlighted in the results that the digital transformation in agribusiness, driven by technology 4.0, is changing the way agricultural activities are managed, bringing significant gains in productivity, sustainability and competitiveness, but the growing presence of technologies 4.0 on farms and organizations indicates the importance of a continuous knowledge management plan, which covers both implementation and after-sales monitoring, in order to ensure that users have the skills to deal with innovations. This approach allows not only the technological updating of operations, but also the strengthening of human capital, creating a collaborative environment that is adaptable to changes. It was observed that strengthening the practical knowledge base, with a focus on good practices and use models, is essential for Brazilian agribusiness to make the most of the potential of Agriculture 4.0.

Keywords: Digital Agriculture. Project Implementation. Agroindustry. Sugar-energy.

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INTRODUCTION

Digital Agriculture, also known as Agriculture 4.0 (Agro 4.0), has advanced remarkably with technological development and innovations that bring positive and significant impacts to the agro-industrial sector. It is understood that, in addition to producing efficiently, the sector must adopt innovative and sustainable practices, driving the emergence of scalable systems that allow not only increased productivity, but also effective cost control. These systems are capable of storing and processing large volumes of data, interconnecting mobile devices and online platforms to support real-time decision-making (MASSRUHÁ, 2017).

The technological processes used by Agriculture 4.0 contribute to more efficient rural production, that is, increasing productivity, reducing the use of natural resources, such as water, and reducing the use of fertilizers and pesticides, contributing to the reduction of environmental impacts (CLERCQ; VATS; BIEL, 2018). According to Schumpeter (1988), technological innovation is a fundamental force for economic development, made possible by the incorporation of new production techniques, industrial reorganization, and the use of new combinations of productive resources (SEIDLER and FRITZ FILHO, 2016). In this context, the development of smart agriculture becomes essential to achieve the global goals of food security and sustainability, defined by FAO (2010).

Brazil is the world's largest exporter of soybeans, coffee, sugar, orange juice, sugarcane ethanol, beef and chicken. In 2019, agribusiness exports reached US$ 96.8 billion, representing 43.2% of the total exported by the country. Brazilian agriculture is diversified, with more than 300 species cultivated, and exports 350 types of products to 200 markets around the world. Brazil stands out as a major producer of grains, meat, and fruits, and the agricultural sector contributes 21.1% of GDP and employs 20% of the workforce (Embrapa, 2019).

For Silva (2018), Information and Communication Technologies (ICTs) play an auxiliary role in the innovation process by acting as targeted and efficient tools for specific functions. Composed of *hardware* and *software*, these technologies allow the automation of processes such as data collection, transcription, and communication, facilitating interaction between devices and users and integrating information into digital platforms that support agricultural management.

Agriculture 4.0 therefore connects all links in the production chain, promoting the sharing of real data from the field and improving operational control. However, agricultural modernization demands an analysis of technological adoption and diffusion: while adoption represents the individual or organizational decision to incorporate modern technologies,

often influenced by microeconomic factors, diffusion is characterized as a more comprehensive process, which evaluates the general and integrated impacts of technology at the strategic, tactical, and operational levels. This distinction is fundamental to understand how different agents – farmers and companies – use these innovations and at what organizational levels they are implemented (MASSRUHÁ, 2017). The success or failure of agricultural technology depends largely on the perception of value and benefits provided by *hardware* and *software* among end users.

The bibliographic review is essential to establish the limits and theoretical foundation of a research, according to the scientific perspective presented by Dane (1990). The author points out that this process involves the definition of key topics, authors, keywords, journals, and preliminary data sources. In this context, the literature review is considered a crucial initial stage for any scientific investigation that, according to Webster and Watson (2002), serves as a foundation for the construction and delimitation of the study.

In view of this scenario, this article carries out a Systematic Bibliographic Review (RBS) of an exploratory nature, bringing together technological solutions highlighted in the literature that dialogue with the context investigated in the case study. This process seeks to provide a critical and structured analysis of the factors that influence the adoption and effectiveness of digital technologies in agribusiness. Based on the data collected, the research explores the panorama of the agro-industrial market and the state of the art on Digital Agriculture, analyzing the connection of these data with knowledge management practices. The case study highlights the importance of data generated by technology 4.0 for agents involved in rural territories, reinforcing the strategic value of this information in the management and operation of the agricultural sector.

LITERATURE REVIEW

The concept of digital agriculture refers to the insertion of information and communication technologies (ICTs), as well as data collection and transmission processes, in agriculture and livestock. Through *hardware* and *software*, this data is converted into strategic tools to increase efficiency, allowing rural producers to reach new levels of productivity and sustainability in the field. Also known as Agriculture 4.0, this approach includes a range of technologies already in operation or under development, such as robotics, nanotechnology, synthetic proteins, cellular agriculture, gene editing, artificial intelligence, *blockchain*, and machine learning, whose transformative effects are expected to shape the future of agriculture and agri-food systems (KLERKXA; ROSEB, 2020).

In the last 30 years, the Brazilian agricultural sector has experienced significant growth, driven by the ability to adapt and improve its cultivation and management techniques, reaching productivity levels similar to those of North America (REVISTA MERCOSUR, 2017). This advance highlights the role of technology as an essential engine for Brazil's global competitiveness in agribusiness. According to Bolfe and Massruhá (2020), digital transformation in Brazilian rural properties is no longer an option, but a vital need to increase competitiveness and value integration throughout the production chain. Agriculture 4.0, therefore, not only modernizes the sector, but also enables a vision of the future where innovation and technology improve the sustainability and efficiency of agri-food systems.

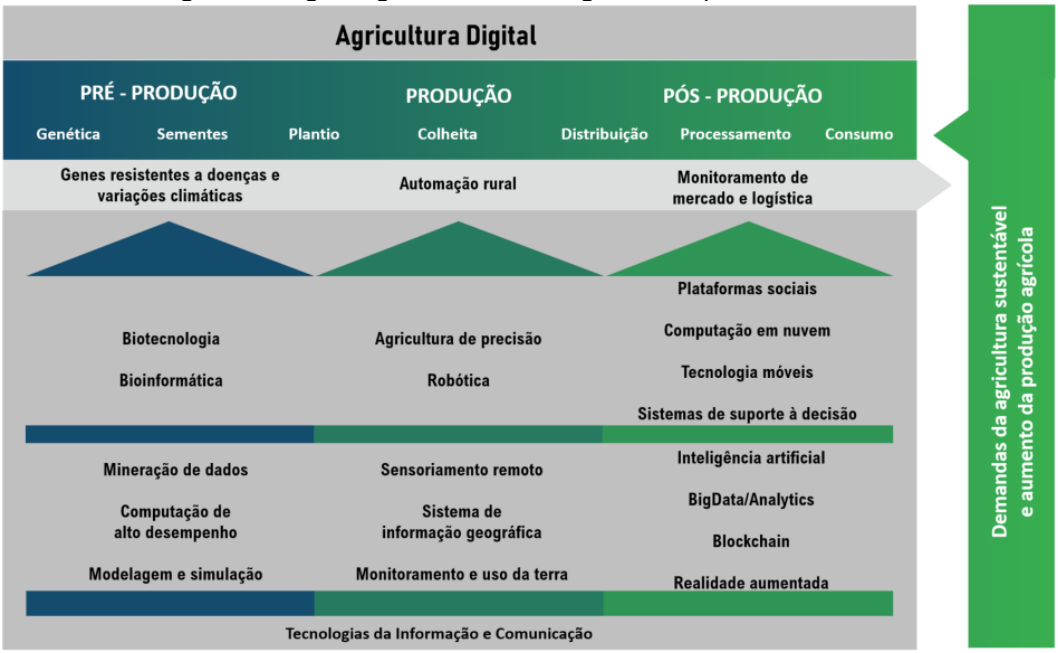
INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

In agriculture, Information and Communication Technologies (ICTs) emerge as innovation opportunities to face challenges such as increasing productivity without expanding the planted area and, especially, to improve the management of data, information and knowledge throughout the production chain (MASSRUHÁ, 2017). In the agro-industrial sector, the adoption of ICTs creates an environment rich in possibilities to reduce informational asymmetry. The role of technology, therefore, is not to centralize knowledge, but to apply it in a way that contributes to the generation of new knowledge and innovations (CASTELLS, 1999).

Digital agriculture in rural areas encompasses the generation and processing of large volumes of digital data, which has the potential to drive innovation at all stages of production, including pre-production, production, and post-production (BOLFE et al., 2021). In Figure 1, Massruhá et al. (2020) present a detailed overview of this digital transformation scenario, showing how ICTs permeate the agricultural production chain.

Figure 1 presents a structured view of digital agriculture along three stages of the production chain: pre-production, production, and post-production. In each of these phases, technologies such as biotechnology, precision agriculture, and artificial intelligence are applied to improve the efficiency and sustainability of production. Pre-production focuses on genetics and disease resistance; the production emphasizes rural automation and remote sensing; while post-production uses logistical monitoring and social platforms. This set of innovations meets the demands for a more sustainable agriculture with greater productive capacity.

Figure 1 - Digital agriculture in the agricultural production chain



Source: Masshurá *et al.* (2020)

INTERNET OF THINGS (IOT)

According to Lee and Lee (2015), the Internet of Things (IoT) is an innovative technological trend that encompasses a network of machines and devices capable of interacting autonomously. In the context of automation, IoT collects data through sensors, processes this information with controllers, and completes the automation process through actuators, allowing for greater precision and efficiency in operations. Triantafyllou et al. (2019) highlight that smart farming is based on the integration of modern technologies, such as IoT and Cloud Computing, in a cyber-physical field management cycle. These technologies accelerate the digital transformation of traditional agricultural practices, promoting an increase in productivity and improvement in the quality of agricultural products.

Atzori, Iera, and Marobito (2010) complement the concept of IoT by stating that the various devices that surround us – including sensors, *smartphones*, actuators, and electronic identifiers – can interact and cooperate with each other through integrated communication and addressing schemes, with the aim of achieving a common purpose, such as precise monitoring and automated control. In the Brazilian context, the expansion of connectivity in rural areas, associated with the integration of sensory systems, remote sensors, agricultural equipment and mobile devices, has driven the adoption of digital agriculture. In Chart 1, Bolfe et al. (2020) present a survey carried out with 504 Brazilian farmers, which lists the digital technologies in use and the respective implementation complexities.

Frame 1 - Digital agriculture technologies

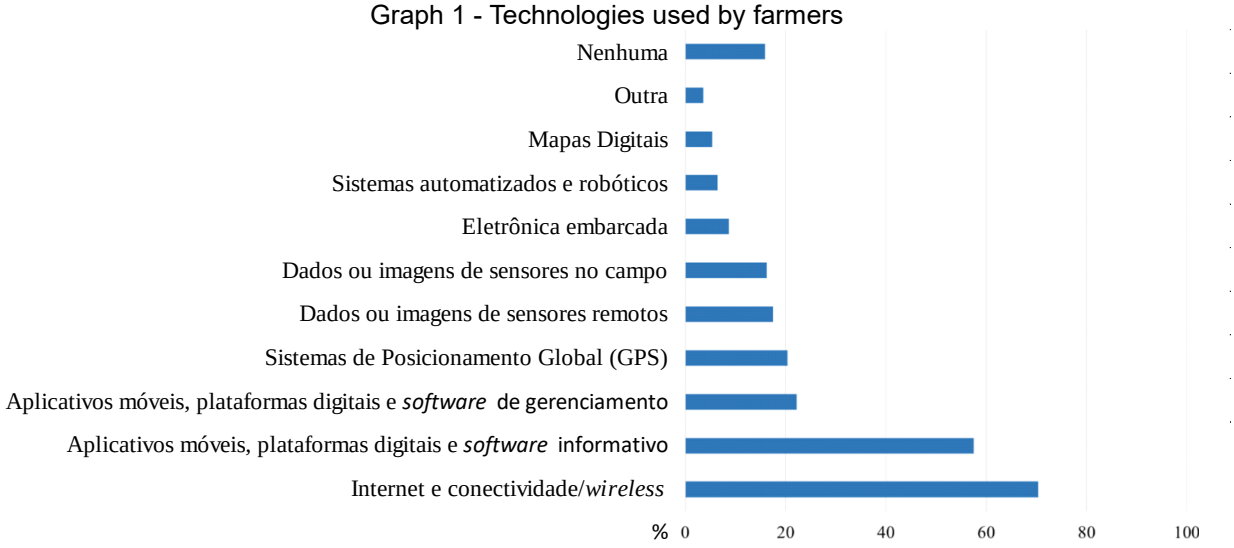
Tecnologias	Complexidade das Aplicações
Internet e Conectividade/*Wireless*	Baixa
Aplicativos Móveis, Plataformas Digitais e *Software*	
Sistemas de Posicionamento Global (GPS)	
Mapas Digitais	
Sensores de Proximidade e de Campo	Média
Sensores Remotos	
Eletrônica embarcada, telemetria e automação	
Deep Machine Learning e Internet das Coisas	Alta
Computação em Nuvem, *Big Data, Blockchain* e Criptografia	
Inteligência Artificial	

Source: Bolfe et al. (2020)

The case study presented in this article incorporates, in its application technology, the three layers of complexity, contemplating the low, medium and high classifications, in order to provide a comprehensive analysis of the different scales of implementation and their impacts on the effectiveness and performance of the system in different scenarios.

Graph 1, also mentioned by Bolfe et al. (2020), allows us to visualize the technologies currently employed by these farmers.

Graph 1 - Technologies used by farmers



Source: Bolfe et al. (2020)

ORGANIZATIONAL PLANNING

According to Kotler (2020), strategic planning is the process of developing an action plan for each business area, with the aim of achieving long-term goals, taking into account the company's position in the sector and taking advantage of its capabilities and resources. In the context of agribusiness, strategic planning focuses on the search for competitive

advantage, with an emphasis on efficient and sustainable agricultural practices, aiming to maximize profits while minimizing operating costs. Detailed planning is essential to guide the organization in the sector, understand its current situation, and draw projections for future investments.

In this scenario, when planning the technological upgrade, it is crucial to identify the best service and platform options available in the market. This process must consider the impacts and reflections on stakeholders, the learning time required, and finally, the quality of the information generated, ensuring a positive return on investment. For Heleno (2009), the lack of application of management techniques in Brazil, especially in the agricultural sector, results in significant losses for national agribusiness, including the absence of Rural Business Plans. The strategy adopted by an organization is decisive for its success or failure.

To understand the concept of strategic planning, it is necessary to address general planning, which is divided into three levels, according to Daft apud Fernandes (2022):

- Operational planning: short-term, focused on daily operations, being the responsibility of lower-level managers.
- Tactical planning: medium-term, focused on the company's sectors or divisions, responsibility of executives and managers.
- Strategic planning: long-term, which involves top management and deals with the organization as a whole.

This article discusses, through a case study, the impacts of the tactical and operational divisions in an industry in the sugar-energy sector. Analysis of these layers is essential because of the significant effects on the learning curve and data generation within the organization.

METHODOLOGY

The research had an exploratory character, starting with a bibliographic review on the state of the art of the theme in question, followed by a case study. The data collection was carried out in a company specialized in providing technological solutions aimed at the management of the agro-industrial process in mills in the sugar-energy sector.

This approach allowed a detailed analysis of the practices and challenges faced by companies in the sector, in addition to enabling the identification of trends and technological innovations that impact the operational efficiency and sustainability of the plants.

SYSTEMATIC LITERATURE REVIEW (RBS)

The method adopted was the Systematic Literature Review (RBS), as defined by Conforto (2011). This methodological approach aims to carry out a critical and in-depth analysis of the existing literature on a specific topic, following a rigorous and structured process. The main objective of RBS is to gather, analyze and synthesize the evidence already produced on the subject, identifying patterns, gaps and trends in the literature.

The search covered a period of five years, using the Scopus database to search for articles published between 2017 and 2022 in scientific journals. The following keywords were used for the bibliographic analysis, present in the title, abstract or keywords: "*digital agriculture*", "*technology application*" and "*farming*". For the initial analysis, a minimum of 15 citations was adopted as a qualification criterion. After applying this filter, 29 articles were selected, which allowed focusing on the most relevant and impactful publications within the theme, ensuring the quality of the subsequent analysis. This careful selection contributed to a more accurate view of the trends and significant contributions in the field of digital technologies in agribusiness. In the next stage, the abstracts of all 29 articles listed were read. From this analysis, 10 articles were selected for a more detailed evaluation, based on their relevance and depth. These articles served as a foundation for the construction of the theoretical framework of this case study, ensuring a solid and updated basis on the subject and conferring consistency and robustness to the research.

APPLICATION TO THE CASE STUDY

This topic presents a case study, in which digital data from an agroindustry focused on the cultivation of sugarcane are analyzed. The study follows the project timeline, offering a detailed analysis of both the technology implementation period and the two years following the digital transformation.

The company providing the technology

Fully adapted to the reality of the field, the company stood out when it was born with the mission of improving the efficiency of the sugar-energy sector, a market that faces the constant need for innovation and reinvention every year, aiming to ensure its competitiveness in the global market, improve the efficiency of its production and meet new demands and environmental and economic challenges. The company's first office was opened in Araçatuba, in the interior of São Paulo, and currently serves as its headquarters. With exponential growth, the company consolidated its global representation in Artificial Intelligence (AI) and Software as a Service (SaaS) for agribusiness, offering technologies

that integrate monitoring, productivity, traceability, and logistics. Its expansion was rapid and global, currently managing more than 9 million hectares in real time, in Brazil, the United States, Canada and several Latin American countries. In all, the company is present in more than 11 countries around the world, the company has about 850 employees.

Among the products offered to global agribusiness are on-board computers, telemetry systems, *software* for managing and controlling mobile assets, applications and specialized sensors, among others. The commercialization rates are impressive, with more than 3.7 trillion data collected annually, 6 thousand transactions carried out per second and estimates of return to the producer of up to 30% gain in productivity and efficiency. These innovations not only optimize the management process but also drive sustainability and competitiveness in the global agricultural sector.

The company that invested and implemented digital solutions in its agro-industrial process

The company has two industrial units in the interior of São Paulo, which, together, have the capacity to process 6.4 million tons of sugarcane per harvest. These units operate with about 420 active agricultural equipment in their machinery park, generating more than 2.6 thousand jobs in the agricultural, industrial and administrative areas. In this article, it was decided to extract data from the unit with the greatest representativeness for the company, which has approximately 263 agricultural machines in operation. This choice aims to provide a more in-depth analysis of the operations and impacts of the technology implemented in the larger unit.

IMPLEMENTED TECHNOLOGY

The proposed solution uses operational information generated in real time by the equipment, ensuring the reliability of the records and requiring minimal operational intervention during the execution of the processes. Through an integrated system of *hardware* and *software*, the solution offers the following benefits: Increased data reliability; Reduction of human intervention; Decision-making based on accurate data; Real-time monitoring of the equipment fleet of the harvesting front; Optimization of available resources.

The project incorporated automation and telemetry solutions, with the installation of on-board computers to capture and generate information from the operations carried out. This information is transmitted through the GPRS (*General Packet Radio Service*) network and processed in the company's database, allowing continuous monitoring of the fleet, the

monitoring of productive and unproductive operations, and the issuance of various management and operational reports, accessible through an *online* platform and cloud data storage.

Automated Pointing (Status Machine)

With the intelligence incorporated into the on-board computers and through the logic of analog and digital signals captured by the equipment, it is possible to automatically identify the operational states (effective, maneuver, displacement), without the need for human intervention during the operation cycle. However, it is necessary to record the reasons for the stoppages, such as maintenance, rain, meal, among others.

The on-board computer has an on-board software that offers dynamic and clear pointing options, allowing the operator to perform simple and efficient interventions to record operations typically classified as unproductive, which require manual intervention.

Automated Process Management System (SGPA)

The on-board computers enable the georeferenced identification of the equipment, recording its operations according to the defined parameterization, including categories such as productive, unproductive, auxiliary, maintenance and climatic. This information is stored on a memory card embedded in the *hardware* and sent to the monitoring system via GPRS.

The Automated Process Management System (SGPA) is the *software* responsible for receiving, processing and visualizing the data sent by the on-board computers installed in the equipment. This system allows the spatial visualization (on georeferenced maps) of the positioning of the equipment, along with its operational status, operator data and alerts. The transmission of data may vary according to the conditions of the GPRS network, and it is possible to generate *offline* reports, i.e. post-processing of the data.

Agricultural Operations Center (AOC)

The objective of the COA is to provide greater reliability in the analysis of customer data, ensuring the effective use of this information to maximize efficiency and reduce costs. The COA acts as a strategic sector within the business, identifying and acting quickly in situations that impact operational performance, in addition to analyzing and solving the main bottlenecks in real time. To achieve near-optimal routing, the COA should apply:

- Premises: Availability of resources for analysis, commitment of the project sponsors, effectiveness in the proposed activities and continuous monitoring.

- Restrictions: Training of operators and leaders of the cutting fronts, with the objective of forming analytical teams within the COA.

In section 2.3, the subdivisions of organizational planning are presented, as the concept of tactical implementation is directly connected with the strategic routine integrated in the activities of the Agricultural Operations Center. In this context, it is observed that the COA is the main recipient of information, offering a holistic view of each operation and connecting, at all times, business strategies to management. This integration makes the COA a key point of the operational gear in the agricultural environment. The main objective of this area is to ensure the maximum efficiency of agricultural assets, increasing the productivity of machines and, consequently, reducing operating costs.

THE IMPLEMENTATION OF THE PROJECT

In the 2019 harvest, an agreement was signed between the contractor and the contractor to develop a master plan for technological implementation, with the objective of serving the machinery park of the sugar-energy plant discussed in this article. The scope of the project included the creation of an operation that would cover the entire structure necessary for the technological insertion of the 263 agricultural equipment available, including an online monitoring solution with automated notes (machine status) and the management platform website of the Automated Process Management System (SGPA), in addition to the creation of the client's Agricultural Operations Center.

To ensure the successful implementation of the proposed solutions, it was essential to maintain high-performing teams, with specialized technical knowledge, project management skills, and well-defined flows by the Project Management Office (PE). The integration of the initiation, planning, execution, control and closure processes was essential to ensure the quality of the services provided.

The initial schedule estimated a total of 488 hours of effort, starting on 10/14/2019 and ending on 12/19/2019. However, due to adversities encountered during the deployment, the actual effort was 566 hours, exceeding the initial estimate. Even with this increase in hours, the project was completed on time. The activities foreseen in the project implementation plan are presented below.

Frame 2 - Detailed implementation schedule; *Software* Ms Project®

Task Name	Work	Beginning	End
CASE STUDY PROJECT	**488 hrs**	**Mon 14/10/19**	**Tue 24/12/19**
100 - Initiation	**8 hrs**	**Mon 14/10/19**	**Fri 18/10/19**
Document required for project definition	8 hrs	Mon 14/10/19	Mon 14/10/19
200 - Planning	**16 hrs**	**Tue 15/10/19**	**Thu 17/10/19**
Customer Visit	8 hrs	Tue 15/10/19	Tue 15/10/19
Request list of documents required for integration	0 hrs	Tue 15/10/19	Tue 15/10/19
Request - Parameterization Worksheet	1 hr	Cherilyn 16/10/19	Cherilyn 16/10/19
Validate - Responsibilities Matrix	1 hr	Cherilyn 16/10/19	Cherilyn 16/10/19
Validate - Delivery Schedule	1 hr	Cherilyn 16/10/19	Cherilyn 16/10/19
Validate - Communication Plan	1 hr	Cherilyn 16/10/19	Cherilyn 16/10/19
Validate - Timeline	3 hrs	Cherilyn 16/10/19	Cherilyn 16/10/19
Submit Firmware Request	1 hr	Thu 17/10/19	Who: 10/17/19
300 - Executing and controlling	**436 hrs**	**Late 21/10/19**	**Late 16/12/19**
KICK OFF MEETING	8 hrs	Late 21/10/19	Late 21/10/19
Prepare Formatters of Card and Folder Records - CCT	56 hrs	Who 10/24/19	Sex 01/11/19
Prepare Formatters for Card and Folder Records - TPL	80 hrs	Late 04/11/19	Sex 15/11/19
Integration	**8 hrs**	**Tue 22/10/19**	**Tue 22/10/19**
Prepare and submit documentation	4 hrs	Tue 22/10/19	Tue 22/10/19
Perform onboarding process	4 hrs	Tue 22/10/19	Tue 22/10/19
Deliveries and installations	**0 hrs**	**Late 21/10/19**	**Sex 13/12/19**
Delivery of Installation Kits	**0 hrs**	**Late 21/10/19**	**Sex 29/11/19**
Delivery of materials (Harvester Kits)	0 hrs	Late 21/10/19	Late 21/10/19
- Material Delivery (Transshipment Kits)	0 hrs	Late 21/10/19	Late 21/10/19
Delivery of materials (Sugarcane Kits)	0 hrs	Late 21/10/19	Late 21/10/19
Delivery of materials (TPL Kits)	0 hrs	Late 21/10/19	Late 21/10/19
Facilities	**0 hrs**	**Tue 22/10/19**	**Sex 13/12/19**
Validate Installation (F5/F4/F3/F2/F1 Harvesters)	0 hrs	Sex 08/11/19	Sex 08/11/19
Validate installation (F5/F4/F3/F2/F1 overflows)	0 hrs	Sex 08/11/19	Sex 08/11/19
Validate installation (Canavieiros)	0 hrs	Sex 15/11/19	Sex 15/11/19
Validate Installation (TPL)	0 hrs	Sex 13/12/19	Sex 13/12/19

Training	**8 hrs**	**Cherilyn 23/10/19**	**Cherilyn 23/10/19**
Conduct training for technicians and multipliers	8 hrs	Cherilyn 23/10/19	Cherilyn 23/10/19
SGPA	**4 hrs**	**Late 28/10/19**	**Cherilyn 13/11/19**
Sending information for the preparation of the Environment	4 hrs	Tue 22/10/19	Tue 22/10/19
Validate startup from the SGPA environment	0 hrs	Late 11/11/19	Late 11/11/19
Validate SGPA Training	0 hrs	Cherilyn 13/11/19	Cherilyn 13/11/19
Start-UP	**272 hrs**	**Late 11/11/19**	**Late 16/12/19**
Go-Live Online Monitoring - CCT	**36 hrs**	**Late 11/11/19**	**Sex 29/11/19**
Start-UP, Train and Instruct Operation - F5	24 hrs	Late 11/11/19	Cherilyn 13/11/19
Assisted Monitoring and Validation	8 hrs	Who 14/11/19	Who 14/11/19
Validar - Mo.	4 hrs	Sex 15/11/19	Sex 15/11/19
Front 4 and 3 Validation	**36 hrs**	**Late 18/11/19**	**Sex 22/11/19**
Start-UP, Train and Instruct Operation - Online Monitoring	24 hrs	Late 18/11/19	Cherilyn 20/11/19
Assisted Monitoring and Validation	8 hrs	Who 11/21/19	Who 11/21/19
Validar - Mo.	4 hrs	Sex 22/11/19	Sex 22/11/19
Front 2 and 1 Validation	**36 hrs**	**Late 25/11/19**	**Sex 29/11/19**
Start-UP, train and instruct operation - Mo.	24 hrs	Late 25/11/19	Cherilyn 27/11/19
Follow-up Mo.	8 hrs	Who 11/28/19	Who 11/28/19
Validar - Mo.	4 hrs	Sex 29/11/19	Sex 29/11/19
Go-Live Online Monitoring - TPL	**164 hrs**	**Late 18/11/19**	**Late 16/12/19**
Start-UP, train and instruct operation - Mo. TPL	120 hrs	Late 18/11/19	Sex 06/12/19
Follow-up Mo. TPL	40 hrs	Late 09/12/19	Sex 13/12/19
Validar - Mo. TPL	4 hrs	Late 16/12/19	Late 16/12/19
400 - Closing Phase	**28 hrs**	**Cherilyn 18/12/19**	**Who: 12/19/19**
Closing Meeting	12 hrs	Cherilyn 18/12/19	Cherilyn 18/12/19
Delivery of the Term of Acceptance	0 hrs	Wed 18/12/19	Wed 18/12/19
Lessons learned report	16 hrs	Thu 19/12/19	Thu 19/12/19

Source: The Authors. Adapted from Ms Project®

In the schedule of activities, it is observed that a large part of the efforts was dedicated to training and work instructions for the operational and tactical teams involved in the process. This is due to the fact that the success of the project depends directly on the

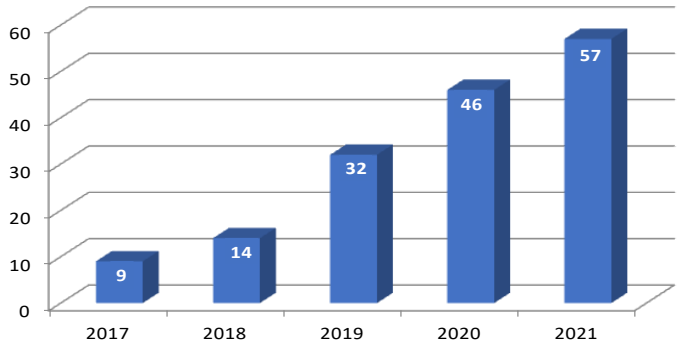
engagement and knowledge of these two layers, which are fundamental for the effective execution of the strategy and the implementation of the proposed technological solutions.

RESULTS

DETAILED ANALYSIS OF THE SYSTEMATIC LITERATURE REVIEW (RBS)

Throughout the period analyzed in this research, 158 articles were published, as illustrated in Graph 2, which presents the annual evolution of publications. This analysis made it possible to identify the main trends and innovations in the application of digital technologies in the agricultural sector, as well as to provide an overview of the pace of academic production and the areas of greatest research focus within digital agriculture.

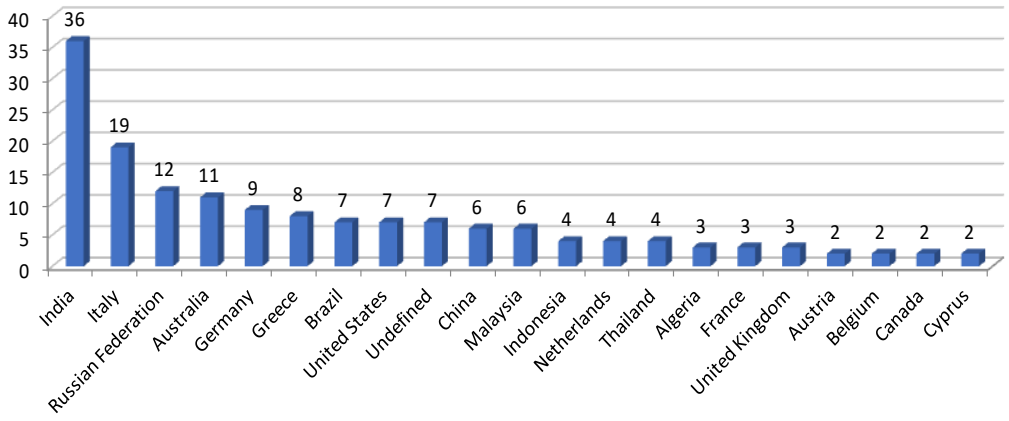
Graph 2 - Evolution of publications related to keywords



Source: Scopus (2022)

There is a growing production of works on the researched topic, reflecting the growing relevance of the use of digital technologies in agribusiness. In fact, researchers from different parts of the world have shared their experiences and advances in this field. Graph 3 illustrates the origin of the countries responsible for the publications, with India leading the list, with a share of 22.8%. Brazil occupies the seventh position, with 4.4% of publications, tied with the United States and ahead of China. This panorama highlights India's global role and the growing contribution of Brazil and other nations to the advancement of digital technologies in the agricultural sector.

Graph 3 - Countries of origin of the posts related to the keywords



Source: Scopus (2022)

The method of selecting articles, based on keyword filters such as "*digital agriculture*", "*technology application*" and "*farming*", resulted in the choice of 29 articles that highlight the most impactful and relevant research on digital technologies in agribusiness. This thoughtful approach has made it possible to accurately identify key trends and innovations, as well as highlight the field's significant contributions. In Tables 2 and 3, it is possible to view the selected articles, with each position categorized according to the number of citations, offering a consolidated view of the academic relevance of each study.

Frame 3 - Qualified articles with a minimum of 15 citations

Pos.	Título	Autores	Ano de publicação	Revista	Citações
1	A Survey on the Role of IoT in Agriculture for the Implementation of Smart Farming	Farooq, M.S., Riaz, S., Abid, A., Abid, K., Naeem, M.A.	2019	IEEE Access 7,8883163, pp. 156237-156271, 96(4), pp. 1540-1550, 293,126130	181
2	Managing Socio-Ethical Challenges in the Development of Smart Farming: From a Fragmented to a Comprehensive Approach for Responsible Research and Innovation	Eastwood, C., Klerkx, L., Ayre, M., Dela Rue, B.	2019	Journal of Agricultural and Environmental Ethics, 32(5-6), pp. 741-768, 4(2),8620543, pp. 1085-1092	96
3	"If they don't tell us what they do with it, why would we trust them?" Trust, transparency and benefit-sharing in Smart Farming	Jakku, E., Taylor, B., Fleming, A., (...), Sounness, C., Thorburn, P.	2019	NJAS - Wageningen Journal of Life Sciences, 90-91,100285, 340, pp. 234-248	89
4	Applications of remote sensing in precision agriculture: A review	Sishodia, R.P., Ray, R.L., Singh, S.K.	2020	Remote Sensing, 12(19), 3136, pp. 1-31, 350(1),012074	66
5	Plant phenotyping research trends, a science mapping approach	Costa, C., Schurr, U., Loreto, F., Menesatti, P., Carpentier, S.	2019	Frontiers in Plant Science, 9,1933	56
6	Adoption of the Internet of Things (IoT) in agriculture and smart farming towards urban greening: A review	Madushanki, A.A.R., Halgamuge, M.N., Wirasagoda, W.A.H.S., Syed, A.	2019	International Journal of Advanced Computer Science and Applications, 10(4), pp. 11-28	54
7	Spaceborne Imaging Spectroscopy for Sustainable Agriculture: Contributions and Challenges	Hank, T.B., Berger, K., Bach, H., (...), Zarco-Tejada, P., Mauser, W.,	2019	Surveys in Geophysics, 40(3), pp. 515-551	50
8	A smart decision system for digital farming	Baseca, C.C., Sendra, S., Lloret, J., Tomas, J.	2019	Agronomy, 9(5), 216	49
9	Experience versus expectation: farmers' perceptions of smart farming technologies for cropping systems across Europe	Kernecker, M., Knierim, A., Wurbs, A., Kraus, T., Borges, F.	2020	Precision Agriculture, 21(1), pp. 34-50	43
10	Development and evaluation of drone mounted sprayer for pesticide applications to crops	Yallappa, D., Veerangouda, M., Maski, D., Palled, V., Bheemanna, M.	2017	GHTC 2017 - IEEE Global Humanitarian Technology Conference, Proceedings, 2017-January, pp. 1-7	39
11	Machine Learning Applications for Precision Agriculture: A Comprehensive Review	Sharma, A., Jain, A., Gupta, P., Chowdary, V.	2021	IEEE Access, 9,9311735, pp. 4843-4873	38
12	Agro-tech: A digital model for monitoring soil and crops using internet of things (IOT)	Pandithurai, O., Aishwarya, S., Aparna, B., Kavitha, K.	2017	ICONSTEM 2017 - Proceedings: 3rd IEEE International Conference on Science Technology, Engineering and Management, 2018-January, pp. 342-346	36
13	Precision agriculture: A remote sensing monitoring system architecture	Triantafyllou, A., Sarigiannidis, P., Bibi, S.	2019	Information (Switzerland), 10(11),348	32
14	A survey on LoRa for IoT: Integrating edge computing	Sarker, V.K., Queralta, J.P., Gia, T.N., Tenhunen, H., Westerlund, T.	2019	2019 4th International Conference on Fog and Mobile Edge Computing, FMEC 2019, 8795313, pp. 295-300	31
15	IoT Solutions for Precision Farming and Food Manufacturing: Artificial Intelligence Applications in Digital Food	Dolci, R.	2017	Proceedings - International Computer Software and Applications Conference, 2,8029960, pp. 384-385	30
16	Smart farming technology innovations – Insights and reflections from the German Smart-AKIS hub	Knierim, A., Kernecker, M., Erdle, K., (...), Borges, F., Wurbs, A.	2019	NJAS - Wageningen Journal of Life Sciences, 90-91,100314	28
17	New directions for integrated weed management: Modern technologies, tools and knowledge discovery	Korres, N.E., Burgos, N.R., Travlos, I., (...), Rouse, C.E., Salas-Perez, R.	2019	Advances in Agronomy, 155, pp. 243-319	28
18	Farming smarter with big data: Insights from the case of Australia's national dairy herd milk recording scheme	Newton, J.E., Nettle, R., Pryce, J.E.	2020	Agricultural Systems, 181,102811	23
19	Smart agriculture – Urgent need of the day in developing countries	Goel, R.K., Yadav, C.S., Vishnoi, S., Rastogi, R.	2021	Sustainable Computing: Informatics and Systems, 30,100512	21
20	Precision agriculture as a driver for sustainable farming systems: State of art in litterature and research	Bucci, G., Bentivoglio, D., Finco, A.	2018	Quality - Access to Success, 19(S1), pp. 114-121	21
21	An operational workflow to assess rice nutritional status based on satellite imagery and smartphone apps	Nutini, F., Confalonieri, R., Crema, A., (...), Stavrakoudis, D., Boschetti, M.	2018	Computers and Electronics in Agriculture, 154, pp. 80-92	20
22	Precision and digital agriculture: Adoption of technologies and perception of Brazilian farmers	Bolfe, É.L., Jorge, L.A.C., Sanches, I.D., (...), Ferreira, V.R., Ramirez, A.R.	2020	Agriculture (Switzerland), 10(12),653, pp. 1-16	19
23	May smart technologies reduce the environmental impact of nitrogen fertilization? A case study for paddy rice	Bacenetti, J., Paleari, L., Tartarini, S., (...), Amicizia, F., Confalonieri, R.	2020	Science of the Total Environment, 715,136956	18
24	UAV application for precision agriculture	Perz, R., Wronowski, K.	2019	Aircraft Engineering and Aerospace Technology, 91(2), pp. 257-263	17
25	An architecture model for smart farming	Triantafyllou, A., Tsouros, D.C., Sarigiannidis, P., Bibi, S.	2019	Proceedings - 15th Annual International Conference on Distributed Computing in Sensor Systems, DCOSS 2019 8804834, pp. 385-392	16

Source: Scopus (2022)

Frame 4 - Continuation of qualified articles with a minimum of 15 citations

Pos.	Título	Autores	Ano de publicação	Revista	Citações
26	Putting agricultural equipment and digital technologies at the cutting edge of agroecology	Bellon-Maurel, V., Huyghe, C.	2017	OCL - Oilseeds and fats, Crops and Lipids, 24(3),D307	16
27	Reduction of fertilizer use in South China-Impacts and implications on smallholder rice farmers	Wehmeyer, H., de Guia, A.H., Connor, M.	2020	Sustainability (Switzerland), 12(6),2240	15
28	Anaerobic digestion, solid-liquid separation, and drying of dairy manure: Measuring constituents and modeling emission	Aguirre-Villegas, H.A., Larson, R.A., Sharara, M.A.	2019	Science of the Total Environment, 696,134059	15
29	A framework of cybersecurity approaches in precision agriculture	Chi, H., Welch, S., Vasserman, E., Kalaimannan, E.	2017	Proceedings of the 12th International Conference on Cyber Warfare and Security, ICCWS 2017, pp. 90-95	15

Source: Scopus (2022)

Among the 10 articles selected for more detailed evaluation, key concepts were extracted that enrich the theoretical framework of the research. The following is a concise summary of the main themes covered in the most relevant articles.

- *A Survey on the Role of IoT in Agriculture for the Implementation of Smart Farming:* The Internet of Things (*IoT*) is an innovative technology that offers efficient solutions to modernize various areas, including agriculture. The article covers the main aspects of *IoT technologies* applied to agriculture, explaining their components and discussing the network technologies used, such as architecture, layers, topologies, and protocols. In addition, it explores the integration of *agricultural IoT* systems with cloud computing, storage, and big data analytics. The text also highlights safety issues and presents *smartphone* and sensor applications for agricultural management. International regulations and success stories are also addressed, along with research challenges in the field of *IoT agriculture*.
- *Applications of remote sensing in precision agriculture: A review: Agriculture* plays a crucial role in meeting basic human needs, but faces challenges due to increased demand for food, population growth, and environmental impacts. Emerging technologies such as *IoT*, *Big Data* analytics , and artificial intelligence are being utilized to make more informed decisions and increase agricultural production sustainably. Precision agriculture (PA) applies these technologies to optimize the use of inputs and reduce waste. The use of remote sensing, such as satellite imagery and unmanned aerial vehicles (*UAVs*), has increased in recent decades, allowing for accurate crop monitoring and resource management. The adoption of these technologies depends on the development of efficient and easy-to-use systems, favoring their large-scale application in commercial agriculture.
- *Adoption of the Internet of Things (IoT) in agriculture and smart farming towards urban greening: A review:* This study analyzes the application of the Internet of Things (*IoT*) in the agricultural and livestock industries, highlighting how it can improve productivity and reduce human intervention through automation. The research, based on 60 scientific publications from 2016 to 2018, focuses on IoT subverticals such as water management (28.08%), crop management (14.60%) and smart agriculture (10.11%). Data collection covers measurements such as ambient temperature, moisture, and soil pH. Wi-Fi is the most used technology (30.27%), followed by mobile technology (21.10%). The results indicate that the

agricultural sector is more researched (76.1%) than the agricultural sector (23.8%). The study offers recommendations for future research, including the scalability of *IoT systems*, security and cloud platforms, with a focus on improving the efficiency of agricultural production.

- *Experience versus expectation: farmers' perceptions of smart farming technologies for cropping systems across Europe:* Technological innovations, especially so-called smart farming technologies (*SFTs*), are transforming mechanization in agriculture and promoting more sustainable agriculture in Europe. A survey of 287 farmers from seven EU countries and 22 experts revealed that 50% of farmers have adopted *SFTs*, with greater adoption on larger farms and in arable cropping systems. While farmers recognize the usefulness of *SFTs*, many have doubts about their potential in farm-specific challenges. In addition, both adopters and non-adopters have hesitations, the former are disillusioned with the technologies they use, while the latter question their availability and accessibility. The survey indicated that 60% of farmers suggest improvements to make *SFT* more relevant. Peer-to-peer communication is seen as an important source of information, and both farmers and experts highlight the need for unbiased advice. Experts generally have a more positive view on *SFT* and its long-term trends. The results suggest that in order to improve the adoption and development of *SFTs*, it is necessary to consider the differences in Europe's agricultural structures and cropping systems.
- *Precision and digital agriculture: Adoption of technologies and perception of Brazilian farmers:* Rapid population growth has increased the demand for food, fiber, energy and water, requiring the most sustainable use of natural resources. Since the 1990s, precision agriculture has promoted productive gains and greater efficiency in the use of inputs. Rural connectivity and integration with data from sensors and mobile devices have given rise to Agriculture 4.0 or digital. A survey of 504 Brazilian farmers revealed that 84% use at least one digital technology in their operations, with benefits perceived mainly in increased productivity. Challenges include the costs of acquiring technologies and connectivity. In addition, 95% of farmers showed interest in learning about new technologies to improve their properties.

Chart 4 presents the 10 selected articles that were used as a basis for the construction of the theoretical framework of this study.

Frame 5 - Articles for theoretical framework

1	A Survey on the Role of IoT in Agriculture for the Implementation of Smart Farming	Farooq, M.S., Riaz, S., Abid, A., Abid, K., Naeem, M.A.	2019	IEEE Access 7,8883163, pp. 156237-156271, 96(4), pp. 1540-1550, 293,126130	181
4	Applications of remote sensing in precision agriculture: A review	Sishodia, R.P., Ray, R.L., Singh, S.K.	2020	Remote Sensing, 12(19), 3136, pp. 1-31, 350(1),012074	66
6	Adoption of the Internet of Things (IoT) in agriculture and smart farming towards urban greening: A review	Madushanki, A.A.R., Halgamuge, M.N., Wirasagoda, W.A.H.S., Syed, A.	2019	International Journal of Advanced Computer Science and Applications, 10(4), pp. 11-28	54
9	Experience versus expectation: farmers' perceptions of smart farming technologies for cropping systems across Europe	Kernecker, M., Knierim, A., Wurbs, A., Kraus, T., Borges, F.	2020	Precision Agriculture, 21(1), pp. 34-50	43
13	Precision agriculture: A remote sensing monitoring system architecture	Triantafyllou, A., Sarigiannidis, P., Bibi, S.	2019	Information (Switzerland), 10(11),348	32
14	A survey on LoRa for IoT: Integrating edge computing	Sarker, V.K., Queralta, J.P., Gia, T.N., Tenhunen, H., Westerlund, T.	2019	2019 4th International Conference on Fog and Mobile Edge Computing, FMEC 2019, 8795313, pp. 295-300	31
22	Precision and digital agriculture: Adoption of technologies and perception of Brazilian farmers	Bolfe, É.L., Jorge, L.A.C., Sanches, I.D., (...), Ferreira, V.R., Ramirez, A.R.	2020	Agriculture (Switzerland), 10(12),653, pp. 1-16	19
25	An architecture model for smart farming	Triantafyllou, A., Tsouros, D.C., Sarigiannidis, P., Bibi, S.	2019	Proceedings - 15th Annual International Conference on Distributed Computing in Sensor Systems, DCOSS 2019 8804834, pp. 385-392	16
26	Putting agricultural equipment and digital technologies at the cutting edge of agroecology	Bellon-Maurel, V., Huyghe, C.	2017	OCL - Oilseeds and fats, Crops and Lipids, 24(3),D307	16
29	A framework of cybersecurity approaches in precision agriculture	Chi, H., Welch, S., Vasserman, E., Kalaimannan, E.	2017	Proceedings of the 12th International Conference on Cyber Warfare and Security, ICCWS 2017, pp. 90-95	15

Source: Scopus (2022)

DETAILED CASE STUDY ANALYSIS

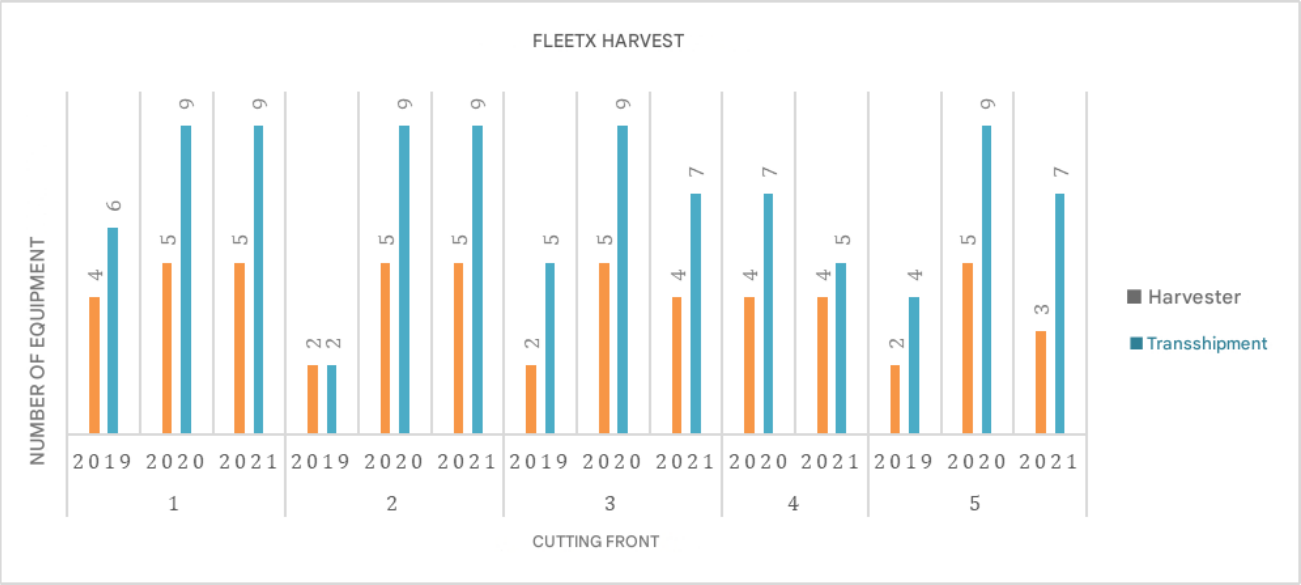
This article focuses on the analysis of the results obtained during the year of implementation of the technological solution and, subsequently, after two years of its use, with a specific monitoring of the process of cutting and loading the raw material.

The analysis focuses on the data generated by harvesters and transshipment tractors, equipment sized within the scope of the project.

The first survey carried out involved an analysis of the historical basis of the data collected by the on-board computers installed in the organization's harvesting equipment. This data served as the analytical basis for the case study.

The work fronts are illustrated in graph 4, which presents the sizing of the equipment used in the 2019, 2020 and 2021 harvests, with a specific focus on the month of October of each year.

Graph 4 - Fleet sizing with on-board computers



Source: The Authors.

The second topic analyzed refers to the occurrence rates, presented in hours, generated by the operation called "No Point". This operation is characterized by the only demand for man/machine intervention, occurring when the operator, through the on-board computer, fails to record the equipment downtime, automatically resulting in an unproductive operation "No Pointing".

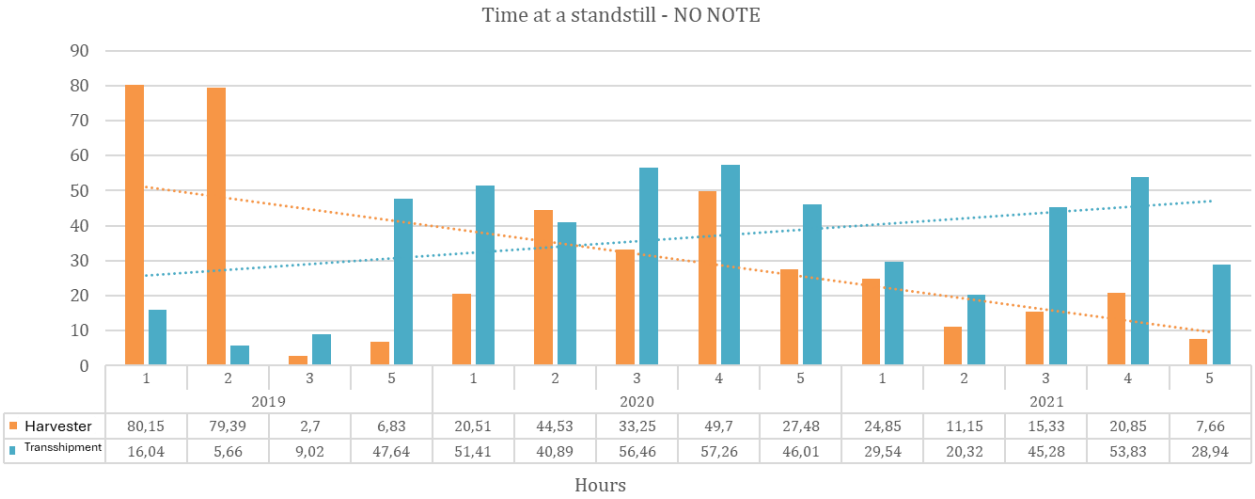
To apply the concept of COA, as presented in section 3.3.3, it is essential that the tactical team performs a continuous and assertive monitoring of operational *performance*, with a focus on improving the quality of information.

In this context, mapping production stoppages allows the registration of unproductive operations, facilitating the control and comparison between what was planned and what was accomplished, as defined by the Agricultural Operations Center.

High "No Pointing" rates make the process imprecise, generate distortions in management results and hinder continuous improvement actions, which aim to transform the opportunities identified in unproductive operations into efficiency gains in productive operations.

Graph 5 shows the total hours accumulated by the "Sem Apontamento" operation in October of each harvest.

Graph 5 - Downtime per Operation



Source: The Authors.

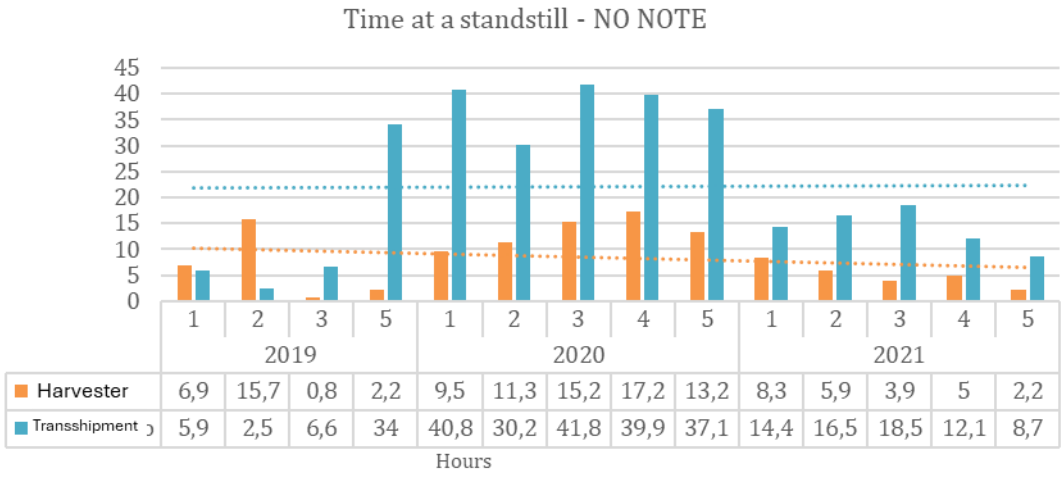
In the graph, it is observed that, in 2019, the number 4 cutting front is not referenced, due to the absence of this front in the sugarcane harvest during this period.

Another relevant point identified during the analyzed period is presented in Graph 6, where an aggravating factor is observed in the highlighted operation: the engine running rate while the equipment is in a state of stoppage.

This value is considerably significant for an operation that should follow the engine off routine.

This occurrence generates an important indicator: the diesel consumption of the equipment. It is worth mentioning that, among the costs of agricultural machinery, fuel and lubricant represent a range of 16% to 45% of the total costs of the operation.

Graph 6 - Engine hours on in "No Pointing" operation



Source: The Authors.

By analyzing the percentage of engine started during the "No Pointing" stop operation, it is possible to observe the significant impact of this occurrence in relation to the other factors that cause engine idleness, also characterized by unproductive operations that require engine shutdown. In 2019, the operation of the engine on accounted for 30.1% of the total unproductive operations, followed by 59.9% in 2020 and 38.6% in 2021. These data indicate that the Agricultural Operations Center (AOC) has not performed efficiently over the years, failing to promote continuous improvements in the control of this occurrence of high consumption.

Throughout the historical collections, it was possible to highlight the importance of effective monitoring of agricultural mechanization (carried out through the on-board computers installed in the machines), with the responsibility of the COA sector. This monitoring, when well applied, can significantly increase operational efficiency by identifying and acting on opportunities to increase productive time, in addition to enabling conscious intervention in situations that require manual notes.

Active control by the COA, combined with the preparation of action plans that identify and address the main reasons for stoppages, especially in the case of the "No Appointment" operation, are essential premises for effective and results-focused management. Chart 5 illustrates that it took three harvests to achieve an improvement in the stoppage rate of the harvesters' "No Point" operation, which still remains above the market *benchmark*, which is around 2%. This scenario is in contrast to the rates observed in the Transshipment Tractor, which showed an increasing trend compared to the year of implementation.

DISCUSSION

In this article, based on RBS, it was possible to explore the growing presence of 4.0 technologies in farms and agribusiness organizations, with a wide range of innovative *hardware* and *software* that offer essential support for strategic decisions in animal and plant production practices. The application of these technologies enables real-time monitoring, which facilitates more accurate and sustainable adjustments, promoting greater efficiency and productivity. However, the sector still faces the challenge of integrating the different socioeconomic and geographical realities, so that access to innovations and the development of technical skills are democratized. To this end, it is crucial that technical and practical knowledge is disseminated in an equitable manner, empowering users from all regions and agricultural profiles.

The analysis of the case study reveals that, even in well-structured companies specialized in offering technological solutions, it is essential to adopt a robust plan for the dissemination of knowledge to all those involved. Such a plan should include both the implementation phase and continuous post-service monitoring, monitoring changes in teams and regularly measuring the ability of users to absorb and apply innovations. This approach is key to ensuring that technological advancement is sustainable and well-adapted to the operating conditions of each organization. With continuous monitoring, it is possible to mitigate the impacts of a high *turnover* of employees and ensure that the knowledge acquired is continuously reinforced, avoiding the loss of *expertise* and promoting greater autonomy in the use of technologies.

The exploratory research also identified an important gap in the state of the art: the lack of content focused on good practices in the use of 4.0 technologies, as well as models of use and lessons learned, which could strengthen knowledge management. This type of content is essential to increase the effectiveness of technological solutions, promote knowledge sharing among users, and drive innovation collaboratively. Although the literature and the agro-industrial market are largely supplied with services and applications for agriculture 4.0, there is a lack of practical and applicable materials, which represents an opportunity to develop a robust collection of knowledge management practices that guide the effective use of innovations.

CONCLUSION

The digital transformation in Brazilian agribusiness, driven by technology 4.0, is changing the way agricultural activities are managed, bringing significant gains in productivity, sustainability, and competitiveness. However, for this revolution to be inclusive and sustainable, it is necessary to promote a more effective integration between technology and training, involving universities, research centers, companies, and *startups* in initiatives that expand access to innovations and generate practical knowledge for users.

Throughout this article, the importance of a continuous knowledge management plan, which covers both implementation and post-sales follow-up, has been highlighted in order to ensure that users have the necessary skills to deal with constant innovations. This approach allows not only the technological updating of operations, but also the strengthening of human capital, creating a collaborative environment that is adaptable to changes in the sector.

Finally, strengthening the practical knowledge base, with a focus on good practices and use models, is essential for Brazilian agribusiness to make the most of the potential of

Agriculture 4.0. In this way, it will be possible to build a more innovative, competitive, and sustainable ecosystem, which contributes significantly to the country's development and global food security.

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EMANCIPATION THROUGH ART IN JACQUES RANCIÈRE

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ABSTRACT

This article has as its scope the question of emancipation through art from the philosophy of Jacques Rancière. In his work The Ignorant Master, emancipation is seen as an affirmation of the equality of intelligences that occurs from the beginning of the formative process as opposed to the explanatory order in which there is a need for the submission of the intelligence of the apprentices to the master, who attests to their cognitive superiority through explanations. To address this problem, we developed the theme in three moments. In the first part, we discussed what an aesthetic education would be based on the definition of education and art. In the second, we approach the concept of emancipation as the starting point of a practice in which the teacher is an agent who organizes the teaching-learning process, but does not dominate intelligence because it presupposes an equality of cognitive capacity. In the last part, we dealt with what this emancipatory practice of the student would be within the universe of art. In this sense, learning and artistic practice are understood as paths of autonomy and freedom by leading the human being to the recognition of the equal capacity to feel, understand and express the poetry of the world.

Keywords: Emancipation. Education. Art. Philosophy.

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INTRODUCTION

AESTHETIC EDUCATION

Before thinking about emancipation, it is very salutary to ask ourselves about the relationship between Education and Art, because it is in the configuration that we give to the reach of these practices and their exchanges, that we find the transformative and liberating meaning expected when dealing with this issue. Let's start with education. By this term we understand, in line with the first article of the Laws of Guidelines and Bases of National Education (LDB\96), all the "formative processes" that take place in different environments, groups and even in the School. Although it does not define it peremptorily, the legal text provides the criterion for recognizing this human phenomenon, which brings within itself two core ideas (process and formative), which inform us about the dynamics and objective of this reality.

Education is a *process*. Now, our biological being brings a genetic programming that configures our physical being and our tendency towards affective life; but it is not capable of answering what we will do with what Nature has done to us. We are born ignorant of everything and fragile (the weakest among mammals); and, along with milk, we drink values and behaviors built up generations ago, through which, from males and females, we build ourselves men and women. There is no static essence of woman and man; what there are are historically circumscribed patterns and roles through which we are provoked to conform and configure our individuality. We become what we are through a teaching-learning process that, as a rule, is spontaneous, experiential and systematic. We learn to walk on two feet, to speak, to contain our desires and impulses, and we enter the world of culture, through our paternal and maternal references. Then, we are challenged to adult life, which, depending on the degree of complexity of the society in which we are inserted, may require us to study the socially constructed knowledge required for insertion in the world of work and social decisions.

Education is processual and *formative*. The word formation in recent times has been used in a pejorative way. Generally, it is used as a synonym for "form" or an *a priori framework* that the official educational system imposes and conforms to everyone, under penalty of sanctions. However, Education does not necessarily represent this reproducing machine of cultural hegemony. The word formation in its broadest sense (and without necessarily negative denotation) can be associated with the meaning given by Aristotle (2001) to *Entelechy*, or reality towards which something or someone tends dynamically. A marble stone, for example, in the vision and in the shrewd and skillful hands of an artist has the "form" of a work. If we remove the metaphysical-naturalist tendency of the reading of

the Stagirite, we can say that education is the passage of something from one state to another through an intersubjective action, known as educational practice.

For Wener Jaeger, educational practice concerns the existence, maintenance and reproduction of any society. “[...] every society, when it reaches a certain degree and development, becomes accustomed to the educational practice [which is the] principle through which human communities preserve their physical and spiritual peculiarities" (Jaeger, 1995, p. 03). Thus, we can assert that education goes through two complementary poles: the subjective, development of individual potentialities; and social, reproduction of existing models of societies. In this second case, we have the etymological root "educare", from the Latin: *ex* (of, outside) and *ducare* (to transmit, to teach).

Education would then be a way of reproducing the *status quo ante* of the moral and artistic values and standards of any human organization. In the first (subjective) case, the etymological root is "educere", from the Latin: *ex* (out); and *ducere* (to guide, lead, take). The idea embedded here is that education would be a process that would awaken an attitude that starts from the inside of the person and projects itself outwards. The example of this type of formation, presented in pedagogical reflections, is that of Socrates, because of his maieutics or art of leading the interlocutor to give birth to ideas.

If education is defined by what it does (or do) with nature, Art, originally, is also understood in opposition to what is merely natural. In its etymological sense*, téchne* (from the Greek) presents the same root as *technique* or "set of rules capable of directing any human activity" (Abbagnano, 2007, p. 92). Thus, any action on the world or on man himself aiming to bring about changes, by means of more or less solidified productive processes, could in a *broad sense* receive the qualification of artistic! This is how, throughout the Middle Ages, the distinction was made between manual (or productive) arts and liberal (or spirit) arts. Today, we speak of art [2]in a stricto sensu *way* to designate affective and concrete construction processes that materialize in pieces and representations (paintings, stagings, sculptures, music, etc.).

[2] From a contemporary point of view, art is an affective-productive process that presupposes and is constructed in its entirety through its hermeneutic fusion between the artist and the public, in the "artistic coefficient" or in what is discovered through the active participation of the public's interpretation of the artist's work: "Consequently, when I refer to the "artistic coefficient", It should be understood that I am not referring only to great art, but that I am trying to describe the subjective mechanism that produces art in its raw state – *l'état brut* – bad, good or indifferent. In the creative act, the artist passes from intention to realization, through a chain of totally subjective reactions. Their struggle for fulfillment is a series of efforts, sufferings, satisfactions, refusals, decisions that cannot and should not be fully conscious, at least on the aesthetic level. [...] consequently, in the chain of reactions that accompanies the creative act there is a missing link [...]; this difference between what he wanted to accomplish and what he actually accomplished is the personal "artistic coefficient" contained in his work of art": DUCHAMP, Marcel. "The creative act". In: BATTCOCK, Gregory. The new art. Trad. Cecília Prada and Vera de Campos. 2nd ed. São Paulo: Perspectiva, 1986, p. 73.

In this strict sense, we can understand art as a form of education. Now, since woman and man are not only, as one interpretation of Aristotle states, "a rational animal",[3] but are also constituted of emotion, sensibility and passion, education would not be integral if it left aside the aesthetic aspect of the experiences of life and of the world, so that what it would aim to form would end up deforming, reducing people to simple beings of discursive-logical reason, close to mere calculators; or to operating systems provided, throughout their years of study, with efficient applications.

However, when we talk about aesthetic education, we are not referring only to the production and enjoyment of artistic products, as if we were separating the creative subject and his inner expression from the created object and his standardized knowledge. We allude, in fact, to the aspects that we consider central in this type of experience: expression of feelings; language; and culture. In fact, art is a form of expression of the inner world and feelings, a way of talking about the world as it affects us and makes us affect others by analogies and symbols. It is language, which can learn its codes and schemes and, thus, transmit feelings, convictions and ideas. It is culture, since it concerns the most varied ways of cultivating oneself and the world, in the process of reproduction and reproduction of symbolic life, as well as contacts and hybridizations, which occur over time.[4] Thus, art is a form of knowledge that we can call aesthetics or understanding by feeling.[5]

We are used to reasoning that names things, organizes them into judgments and proceeds through argumentative stages until they reach deductive conclusions (by subtracting smaller propositions from larger propositions); or to inductive conclusions (of a larger proposition, resulting from the sum of smaller propositions). However, we perceive

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[3] Based on a naturalistic and essentialist idea of man and society, Aristotle conceives that the city is proper to the essence of man, who only needs to actualize this deeper reality through Education: "It is evident, therefore, that the city is part of the things of nature, that *man is naturally a political* animal, destined to live in society, and that he who, by instinct, and not by any circumstance inhibits him, ceases to be part of a city, is a vile being or superior to a man. Such an individual deserves, as Homer said, the cruel reproach of being a being without family, without laws, without a home. For he is greedy for combat, and, like birds of prey, unable to submit to any obedience": ARISTOTLE. Politics. Trad. Nestor Silveira Chaves. 2 ed. Bauru, São Paulo: EDIPRO, 2009, p. 16 (emphasis added).

[4] Art, throughout history, has taken on different facets in the school world. Thus, in the seventeenth and nineteenth centuries, it was treated as *technical knowledge*, in the twentieth century, as *an expression* or as an activity (in the case of the dictatorship period); and, currently, it is seen within a scope that involves all human life in society, namely: as *culture*. Within this context, art stands out as a transdisciplinary and transmethodological place, which affects the human being as a whole, as well as all its symbolic expressions: Cf. COUTINHO, Rejane; SCHLÜNZEN JUNIOR, Klaus; SCHÜLUZEN, Elisa Tomoe (Org.). Arts. São Paulo: NED, 2013. (Training Themes).

[5] The term Aesthetics was coined by BAUMGARTEN, A. G. (Aesthetics: the logic of art and poem. São Paulo: Vozes, 1993), meaning a sensorial knowledge, through which the Beautiful is accessed and art is produced. The science that would take care of this knowledge would be precisely aesthetics. However, SUASSUNA, Ariano (Iniciação à estética. 11th ed. Rio de Janeiro: José Olympio, 2011, p. 22) draws attention to the fact that in modernity, especially under the influence of Kantian philosophy, beauty no longer has exclusivity in this type of reflection and other categories and other categories began to be valued and worked on, in view of the *sublime.* And even what was completely discarded, also began to appear, such as the *ugly,* etc.

and understand the world also through sensitivity, especially when it comes to realities for which words are always lacking or surplus. How to represent the feeling of horror in the face of injustice or gratuitous violence? How to explain how you feel about a person? How to understand jealousy or hatred? Certainly, we can make psychological or sociological approaches to these phenomena, but they will never be sufficient or adequate to what we best understand when we feel, imagine or intuit.

Feeling is, therefore, the cognitive reaction that unveils structures of the world, opening it to its virtualities. The artist, when creating a work, configures a web of cognitive reactions, which represents a reality of human life. This symbolic production affects individuals who react spontaneously to affective provocation. The emotion that follows this experience comes from an understanding that was not mediated by logical reasoning, but by the feeling that elucidates what happened inside the subject marked by a psychological state of agitation. Take into account laughter, which is an emotion provoked by the feeling of the comic; or the horror-admiration coming from the sublime; in short, art, in its most varied forms, is configured as a "form of [aesthetic] knowledge that [apprehends] and organizes the world through feeling, intuition and imagination" (Aranha, 2006, p.18).

Aesthetic education thus has the power to become a short circuit in the mechanical life[6] of moral systems, which sclerose experiences and close horizons of meanings and expressions. Instead of conditioning behavior by what is socially approved or disapproved, art has the possibility of promoting dissent through a subversive attitude to the frameworks of values arising from ideologies or certain reductive worldviews. At the same time, it can empathize with other forms of culture and awaken creativity and more dynamic, joyful and lighter ways of learning and dealing with life. In this sense, there would be a greater appreciation of the individual to the detriment of traditional explanatory logic. But will any aesthetic education be able to promote this? Before answering this question, it is necessary to ask ourselves how emancipation takes place.

[6] Art breaks the doing for the sake of doing, the rigidity of ready-made formulas and the moral fossilization, which restores for us the meaning of what we do and choose, including whether to continue living or not: "One fine day the 'why' arises and everything begins to enter into a lassitude tinged with astonishment." Start", this is the important thing. Lasitude is at the end of a *mechanical life* , but at the same time it inaugurates a movement of consciousness. It awakens him and provokes his continuation. The continuation is the unconscious return to the shackles, or it is the definitive awakening": CAMUS, Albert. The myth of Sisyphus. 11th ed. Ari Roitman and Paulina Watch. Rio de Janeiro: Record, 2014, p. 27. However, the conclusion to be coherent with the life that is built as a work of art, cannot end suicide: "For the absurdist analysis, after having shown that killing is a matter of indifference, eventually, in its most important deduction, condemns killing. The final conclusion of the absurdist process is, in fact, the rejection of suicide and persistence in that hopeless encounter between human questioning and the silence of the universe. Suicide would mean the end of this encounter, and the absurdist position realizes that it could not endorse suicide without abolishing its own foundations": CAMUS, Albert. The Rebel. Translated by Anthony Bower. London: Penguin Books, 2000, p. 14.

THE EMANCIPATION AND BRUTALIZATION OF THE EXPLANATORY ORDER

Emancipation presupposes an appreciation of the individual as a capable being and also presumes equality among all. The big question that arises, however, is whether the denial of inequality does not itself become the sedimentation of an asymmetric state of affairs. The belief in the School places all the possibility of creating autonomous beings in the capacity of an educational system to present paths in which a ritual of initiation to intellectual, affective and political life could be offered. All the pedagogical emphasis would fall on the sciences and knowledge that should describe the failures in learning; to create means of better teaching; and ways to verify whether this learning was effective. In short, everything would happen through scientific knowledge and who can explain it.

The issue of education, and also of art, would be within a system called by Rancière the "explanatory order", which works like a machine (Rancière, 2002, pp. 17/138) reproducing enlightened people through master explainers, who would have the authority to distinguish knowledge from non-knowledge; and to confer *status* of understanding to those who agree with the criteria, to which they themselves were submitted. In a pedagogized society, it is necessary to submit to those enlightened in search of light, becoming a student in the restricted and pejorative sense of the word, namely, without light. Hence the School becomes the nucleus of a world that intends to save itself from barbarism and inequality through the transmission of knowledge essential to the ascension to the degree of woman/man, educated/educated, citizen/citizen.

> [...] Explanation is not necessary to help an inability to understand. It is, on the contrary, this *incapacity,* the structuring fiction of the explanatory conception of the world. It is the explainer who needs the incapable, and not the other way around, it is he who constitutes the incapable as such. To explain something to someone is, first of all, to demonstrate to him that he cannot understand it by himself. Before being the act of the pedagogue, the explanation is the myth of pedagogy, the parable of a world divided into wise spirits and ignorant spirits, mature and immature spirits, capable and incapable, intelligent and foolish. The explainer's own procedure consists of this double inaugural gesture: on the one hand, he decrees the absolute beginning [...]; on the other hand, it covers all the things to be apprehended from this veil of ignorance that it itself is responsible for removing (Rancière, 2002, p. 20).

Within the context of a society based on the principles of the Enlightenment, Rancière draws attention to the belief we have inherited that the world will become better, fairer and equal, through the action of the State through school education. Forming citizens is the great goal of our enlightened society. However, this means conforming people's lives to a pre-established curriculum, which rewards those who succeed in achieving the proposed stages, which will lead them to be considered enlightened. The School becomes,

within this universe, a machine for forming citizens, good men and "explained explainers" capable of also remedying the incapacity of those who have not yet learned.

Hence the epistemological assumption of our pedagogized society is that of the superiority of the intelligence of some in relation to that of others. And the evidence demonstrated for this starting point is the abyss between scientific knowledge and common sense; or adult and child knowledge. One way of learning the world (called by Rancière the "little gentleman") is through a rigorous method, starting from the simplest to the most complex; and from hypotheses and verification tests to conclusions. The other way continues as an "animal that gropes", through non-systematic experiments and attempts, which are independent of rigorous procedural methods or guidelines.

The obvious superiority of the little gentleman's knowledge (or adult scientific knowledge) is due to the fact that much of this knowledge is found under the veil of the technical explanations of its bearers, who can explain to whom to submit to their curriculum, recognizing their inability to learn alone. The institutionalization of knowledge is, at the same time, the affirmation of the incapacity of some who must submit to the capacity of others: those who already have the explanation or scientific knowledge. How can we deny this? How can we not say that in fact to the intelligence of the teacher, doctor, psychologist or philosopher, we should not submit? Who will doubt the diet and treatment prescribed by the "doctor"? Or who will not feel comfortable opening their intimacy and awareness to a scientist of the soul and human behaviors? Who will question the pedagogue/teacher's ability to describe the best path for learning? It seems that, within the beliefs of scientificity that we bring, the affirmative answer to these questions will be received as madness, foolishness or a youthful rebellion. However, if we look closely, it is these same beliefs that, by aiming at equality and emancipation, paradoxically *brutalize*.

> It is not enough for inequality to be respected: it wants to be the object of belief and love. It wants to be *explained*. Every institution is an *explanation* in action of society, a staging of inequality. Its principle is and always will be antithetical to that of the method founded on the opinion of equality and the refusal of explanations. Universal Education can only be addressed to individuals, never to societies. Societies of men [need] for their stability, some kind of order. Those who are charged with the maintenance of this necessary order must explain and cause to be explained that it is the best possible, and prevent any explanation to the contrary. This is the object of institutions and laws (Rancière, 2002, p. 111).

In the end, *emancipation* is an announcement, not an explanation, that there is no intelligence better and more apt to know the world than others. It is to place equality as a founding principle and not as the end of a process to be achieved. It is to deny the hierarchy of knowledge and its knowers. It is to discover that Universal or Natural Education is the one that does not depend on explainers. It is to be enthusiastic about the capacity of

each individual to emancipate himself and also to be a herald of the courage to be free and not to submit to his own intelligence to the intelligence of anyone. At the same time, it is refusing to be patronizing towards others, not allowing them not to submit or become his disciples. The opposite of this emancipatory attitude is the *brutalization* or affirmation of the structuring fiction of inequality, which is given by the fear of being free, of assuming by oneself the risks of making use of one's own understanding,[7] and the dangers and emotions of chance.

> Stultification is not an inveterate superstition, but fear of freedom; routine is not ignorance, but cowardice and pride of people who renounce their own power, for the simple pleasure of seeing the impotence of their neighbor. It is enough *to emancipate*. Do not ruin yourselves with publications to flood lawyers, notaries, and pharmacists of sub-prefectures with encyclopedias designed to teach the inhabitants of the countryside [...] (Rancière, 2002, p. 113).

The order of explanation is a stultifying machine, which seeks to escape the influences of chance and the unexpected. At the same time, it divides and hierarchizes knowledge between science and ignorance. Only those who were in possession of this first would be able to prescribe the truth, the best means of attaining it and verifying its understanding. The *wise master* teaches from his own science through explanations and scientific and technical knowledge. Our pedagogized society teaches us to submit to this vertical disparity of knowledge and to obey a so-called superior intelligence. Believing in the superiority of intelligence of an intellectual caste, we always refer to it to enlighten ourselves and decide on our steps and objectives. There is here in this presupposition and attitude a double submission: from the will to the will of another; and, the worst, from the intelligence of one to the intelligence of another.

The *ignorant master* is the one who teaches nothing of his knowledge and, therefore, is emancipated and emancipating. He does not need (and does not want!) to teach anything of his science, because he knows that it is vain and disrespectful to the freedom of the other. Their ignorance, far from being (as it might sound to our ears) a manifestation of harshness or arrogance, is respect for the intelligence and humanity of the other. It is not like a Socrates, because he was arrogant in saying that *he knew more* than others simply because he knew nothing. It is rather like someone who has clothed himself in the lightness

[7] Paradoxically to what Rancière defends, the idea of equality and enlightenment are themes and flags of the Enlightenment and of our entire society built on the values of this movement, but denying equality as a starting point: "Enlightenment (Aufklärung) is man's exit from his minority, of which he himself is guilty. Minority is the inability to make use of one's understanding without the direction of another individual. Man is himself guilty of this minority if the cause of it is not to be found in the lack of understanding, but in the lack of decision and courage to use himself, without the direction of others. *Sapere aude!* Have the courage to make use of your own understanding, such is the motto of enlightenment [Aufklärung]: KANT, Immanuel. Which is Enlightenment (Aufklärung). 6th ed. Raimundo Vier and Floriano Fernandes. Petrópolis, RJ: Vozes, 2010.

and simplicity of life and nature and announces to everyone that anyone is capable of learning for himself; and, also, that between any individual, lost in a corner of the world, and a mind like that of a Leonardo da Vinci, Bach, Spinoza, Kant, Freud, Einstein or a Stephen Howking, there is no qualitative or significant difference.

There is no reason to refer to geniuses or geniuses, because to affirm education as a means that aims at equality as a goal is the same as to put it to an end without end. On the contrary, emancipation occurs when it is understood that in a teaching-learning relationship, equality must be affirmed from the beginning, so that, even if there is a hierarchy of will, there is never a submission of one intelligence to another. The ignorant master is thus capable of teaching anything, including the arts, because he, first of all, provokes a fundamental experience, namely: self-emanciapation.

EMANCIPATION THROUGH ART

The question we asked ourselves about art as an emancipatory activity receives a positive answer. However, not just any aesthetic education can promote the autonomy and freedom of individuals. There is a conception of art as the exclusive work of geniuses, who master techniques and languages to dazzle and provoke emotions. A teacher who assumes such an assumption will be brutalizing the creativity of his students, in addition to sedimenting in their minds the inequality and the feeling of inferiority in relation to certain personalities endowed with privileged talents or gifts, which make them superior, genius and unequaled. Plato called this, according to Rancière's interpretation, the *golden race*, or the race whose spirits were sown with the gold of intellectual superiority.

In Plato's conception of justice, each one must occupy in society what he has been called by nature. The education of the *polis* would be the judge of the vocation of all, distinguishing spirits for crafts and manual work, and for the armed forces and for command; the latter being the ones who would have the duty of governing and educating. That is to say: there would be no founding equality, even though among the children of the artisans could come spirits from the elite, who should be led to the rightful social post: the command and education of the entire city. This, however, would only happen by pure natural determination, and not because manual workers are men as warriors and philosophers are. Here, we do not even mention the painters, poets, sculptors and playwrights, because their knowledge represented an inferior way of understanding the world, three degrees away from the truth, according to book X of the Republic.[8]

[8] "So this kind of imitation [art] concerns something that is the *third* from the truth [...]": Plato. The Republic. Trad. Edson Bini. Bauru, SP: EDIPRO, 2006, p. 430 (emphasis added).

Although rooted in Antiquity, the distinction between scientific knowledge (episteme) and opinion (doxa), presupposed in the Platonic aesthetic approach, explains many stultifying practices today. In different pedagogical conceptions, from the traditional to the New School and to the technicist and historical-critical approaches, the hierarchical difference between knowledges is established. The student is seen as a being of common sense, bearer of naïve and necessarily inferior knowledge; therefore, a method and a curriculum must be established to instill true knowledge in them (Traditional School) or so that they themselves can overcome this stage of inferior inequality and reach the maturity of scientific knowledge (New School; constructivists; interactionists, etc.).

Finally, to a greater or lesser extent, art enters this educational process as a knowledge that helps or leads to another, superior and more important in itself: scientific knowledge! In addition, it is based on the assumption that there are geniuses or talents (divinely or genetically prone) to affective and aesthetic raptures capable of producing works relevant to humanity. Poor mortals, who have not been identified as having these golden germs, can only have fun, be distracted and learn to enjoy the symbolic products. And, in the best case, to be sensitized to some topic in order to be able to subsequently get in touch with scientific knowledge; like a teacher who shows a film to the students with the intention of "facilitating" the introduction of concepts and theories that are supposedly more apt to explain reality.

Aesthetic education is emancipatory when it breaks with the vertical separation of knowledge and starts to see it as languages capable of speaking about the world.[9] When it leads the student to say "I am also a painter", this experience is liberating, because it makes the individual understand affectively and rationally that he is as human a being as anyone else; that is, equality has been verified and not postponed to the end of a process of technical training and expressions, by which he will be able to equate himself in the future with the great geniuses of painting such as Da Vinci, El Greco, Veermer or other. In the case of the work of the ignorant master, it is a matter of placing the student in the midst of exercises that lead him to understand that art (such as painting, for example) is a

[9] Society and the models of education that we have are the fruit of the Enlightenment ideal of a "redemption" of humanity through the progress of rational knowledge. The problem is that, as the Frankfurt school showed, in every conquest of reason, there is the germ of distrust and rational autophagy: "the Enlightenment – the work of reason – is the process of unmasking ideology. The Enlightenment philosopher, using reason, sets up a concept – truth – and affronts power by showing that power says things that differ from the concept. Power is, therefore, ideological and, in this sense, illegitimate; however, at this very moment of denunciation, the Enlightenment philosopher cannot prevent himself from acquiring *power* over his listener to the extent that he denounced power: GUIRALDELLI JR. Philosophy of education. Rio de Janeiro: DPeA, 2000, p. 31. In another book, this same author works on the issue of the equality of the various narratives from the pragmatic contribution of Anglo-Saxon philosophy: ___. Philosophy of education and teaching: neopragmatic perspectives. Rio Grande do Sul: UNJUÍ, 2000.

language. Make him draw, without initially caring about measurements and proportions, so that he does not feel incapable; and to show paintings to verify the "unity of feeling" or what the artist meant by that work. Now, if he used those signs and images, anyone, after careful research and in his own way, can also express his thought by means of canvas and paint. In this case, "there is no pride in saying, out loud: I am a painter! Pride consists in saying quietly: you are not painters either" (Rancière, 2002, p. 76).

The poet also demonstrates equality as a presupposition of his art. When it expresses the suffering, pleasure, fury of a jealous lover or the emotion of a mother at the death of her child, it is not translating pain and joy into a third gender (*tertius*) between the subjective experience of an individual's soul and ordinary language. What he does, in fact, is, through words, to produce a poem that needs to be deciphered, since linguistic signs are not able to accurately enunciate the internal movements of a person and the nuances of an emotion. The written verses then refer to other verses, "the poem of the world", which is the ability of each one to "guess" what was subtly insinuated, for the simple fact that we all have feelings, emotions and participate in experiences similar to that of the writer and the one who is referenced. Rancière cites the French playwright Jean Racine as an example.

> Our "equality" with Racine, we know as the fruit of Racine's labor. His genius is to have carried out his work on the basis of the principle of the equality of intelligences, not to believe himself superior to those to whom he spoke [...]. It remains for us to verify this equality, to conquer our power through our work. This does not mean making tragedies like those of Racine, but employing so much attention, so much research in art to report what we feel and give it to others to experience, through the arbitrariness of language or the resistance of all matter to the work of our hands. The emancipatory lesson of the artist, opposed term by term to the stultifying lesson of the teacher, is that each one of us is an artist, insofar as he adopts two procedures: not to be content with being a man of a trade, but to pretend to make every work a means of expression; not to be content with feeling, but to seek to share it. The artist needs equality, just as the explainer needs inequality (Rancière, 2002, p. 79).

Art, therefore, emancipates the student when it accomplishes what is peculiar to it, namely, to provide an aesthetic experience. Through this, emancipation occurs to the extent that it opens space for the person to constitute himself as an individual, aware of being endowed with an affectivity and intellectuality capable of expressing himself and understanding what is expressed by others. When he understands that the artistic work is not of geniuses, but of souls equally capable of feeling pain and suffering, anger or indignation... and to share that with the world. He discovers that we can understand, because we are reasonable, but that in order to enunciate well it is necessary to learn the appropriate language for the intended narrative. “[...] he must learn the language proper to each of the things he wants to do: shoe, machine or poem" (Rancière, 2002, p. 77). The

aesthetic experience is, therefore, intrinsically emancipatory because it provides an understanding of the equality of individual geniuses in their ability to understand the common soul of the world: the pains, sufferings, joys, commotions, enjoyment, exaltation, in short, everything that moves us and transforms us infinitely into what we always are.

FINAL CONSIDERATIONS

The lessons of Rancière's ignorant master lead us to realize that art needs equality to exist. In fact, all those considered great artists worked assuming that they translated joys or pains for others similar to them, capable of understanding reality that was reduced to the characters and meanings of language, to canvases and paints, to sounds, to worked stones; in short, to any matter whose relevance is to be a symbolic product, which continues to be under constant construction by those who come into contact with it. The student, more than knowing artistic works, is encouraged to research, in the sense of reading, repeating, decomposing and composing in his own way the various exemplary artistic works, to understand that he can learn the language of production of any artistic artifact; in order to discover and translate the unity of feeling of the researched work and, at the same time, also to know that he can express his feelings and emotions in a meaningful way. When this type of aesthetic experience is made, emancipation has been effected and individuality preserved.

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HUMANIZATION AND ART: THE IMPORTANCE OF PLAYFULNESS FOR INSTITUTIONALIZED CHILDREN

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ABSTRACT

Institutionalized children are those removed from their family environments, for some reason, and are inserted in institutions, popularly known as "homes/shelters", to experience the process of family reintegration, or for the adoption process, carrying with them marks and complex experiences since childhood, due to the fact that they are removed from their homes due to situations of abandonment, mistreatment, negligence, exploitation, among many other possible causes. Thus, playful activities and art can and should be considered indispensable for the reception, development and learning inherent and healthy, aiming at awakening the possibility of creating and recreating through perception, imagination, feelings and the very fantasy built by the child who communicates with himself and with the world, starting to accept the existence of others, the establishment of rules in their social relations, building knowledge and developing integrally. Thus, this extension project aimed to carry out humanization and care actions intertwined with art, divided into four fronts of action (clowning, storytelling, music and handicrafts), and to promote playful care practices through art with these four fronts. In this sense, the actions carried out through play provide these children with the ability to develop their individuality and integrality through activities that, intertwined with art, encompass cognitive development, affectivity, communication, interaction and socialization, thus creating the establishment of moral and value judgment, as they will be able to explore the environment around them, their imagination, their feelings, their creativity and their ability to interact and socialize. Thus, it was evidenced that there are numerous strategies that can be combined with care and assistance and welcoming, in order to move away from the trend of dehumanized care strongly associated with "shelters".

Keywords: Institutionalized Embracement. Art. Child. Humanization. Playfulness.

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INTRODUCTION

Institutionalized children are those who are in institutional care, after being removed from their family environments, for some reason, and are inserted in these entities to experience the process of family reintegration or to be referred to the adoption process, being decided by the judiciary.

The responsibility attributed to shelters, nursing homes, schools, or orphanages, as they are popularly known, is to care for both the physical and emotional integrity of children and adolescents who have had their rights denied or violated, which may be due to a situation of social abandonment or exposure to risks triggered by negligence by their guardians (Silva; Aquino, 2005).

The Statute of the Child and Adolescent (ECA) defines the "shelter" as a "provisional and exceptional" measure in its article 101, sole paragraph, and should be appealed to as a last resort, even though it is often seen as the best initial measure and the easiest to be instituted (Brasil, 1990). However, the term "shelter", used in 1990, in the Statute of the Child/Adolescent, was replaced by Law 12.010 of 2009, and was renamed institutional shelter (Brasil, 2009).

The cases that should be approached in such a way are those considered extreme cases, in which there is a need for family separation until the conditions of coexistence are (re)established and adequate, thus having in the shelter institutions, a space that provides care and protection, and should be as similar as possible to the family routine.

It is necessary to emphasize that the measure of institutional care, in addition to being exceptional, must be provisional, therefore, it aims for the child/adolescent to be reintegrated into his or her family of origin in the shortest possible time. When these aspects are experienced for long periods, they represent, in addition to the violation of rights, irreversible signs and marks in the lives of these children and adolescents, making it difficult for them to acquire a sense of belonging, facing difficulties in adapting to family and community life (Silva; Aquino, 2005).

According to psychoanalyst and pediatrician Donald Winnicott (2002), these institutions are often seen as factors that hinder the physical, cognitive and psychological development of children/adolescents, but they can become a favorable environment for improvement, since the environment is the crucial factor for the child's development, based on the good care provided.

Thus, if the institution ensures that, during the period of institutional care, the children/adolescents who live there have their rights established by the ECA and the environment closer to a healthy family routine and life, their development process will not be

impaired in the physical and cognitive spheres, and emotional and psychological support should also be provided during the confrontation of this turbulent phase (Silva; Aquino, 2005).

On the other hand, the ECA (Brasil, 1990) advocates in its guidelines that the child/adolescent is the holder of rights, which are the right to life, health, food, sports, leisure, professionalization, culture, dignity, respect, freedom, family and community life. In this way, the articulation of the two policies, applied in the reality of children/adolescents in institutional care, contributes to a differentiated and humanized look at the planning and implementation of the care provided.

For Piaget and Inhelder (2002), cognitive development is intertwined with affectivity, communication, interaction and socialization to establish moral and value judgment, and through play the child/adolescent is able to explore the environment around him/her, their imagination, their feelings, creativity and capacity for interaction and social communication, and not seen as a miniature adult, Therefore, your role is to be a child/adolescent.

In this sense, the actions carried out through play provide these children/adolescents with the ability to improve their individuality and integrality through the development of activities that, intertwined with art, encompass the improvement of cognition, affectivity, communication, interaction and socialization, thus creating the establishment of moral and value judgment, because they will be able to explore the environment around them, their imagination, their feelings, their creativity and their ability to interact and socialize.

JUSTIFICATION

In this sense, the National Curriculum Guidelines (DCN) aim to guide the curricula of Higher Education Institutions (HEIs) by encouraging the offer and adherence of academics to participate in research and extension projects, with the intention of enriching the training and construction of the professional being. With regard to the health area, undergraduate nursing courses (Brasil, 2001) presuppose that it is necessary for health professionals to be properly trained to meet the needs presented by society (Coura *et. al*.; 2015).

However, subjects considered key, especially in the area of health, can be addressed during graduation in a superficial and shallow way, as is the case with the National Humanization Policy (PNH) (Medeiros *et al.*, 2015), in which it addresses the importance of having a humanized look that contemplates the individuality and integrality of the human being, also favoring the stimulus to the production of new ways of managing, caring, welcoming and organizing work, leveraging the change in the perspective of implementing

care according to the needs of each individual, distancing itself from technicist and biomedical care (Brasil, 2013).

The PNH, established in 2003, reinforces the importance of training health professionals, especially nurses, in order to promote more humanized care, focused on the integrality and dignity of the individual. Nurses, as protagonists on the front line of health care, play a crucial role in this process, because, in addition to their technical knowledge, their work involves the establishment of bonds and the perception of patients' subjectivity. The PNH encourages care practices that integrate emotional, social and cultural aspects, which requires trained professionals to implement humanization effectively, whether in the hospital environment or in primary care services (Brasil, 2013).

This interaction between university and society through extension projects, consolidates an alliance between them, from the perspective that the individual is capable of transforming society, through the implementation of theoretical-practical actions beyond the walls of the classrooms. Thus, academic extension activities should be understood not only as a practice, in which students have contact with social demands, but also as a way to develop critical-reflective thinking (Silva; Aquino, 2005).

The insertion of these extension activities in the institutions also contributes to the promotion of the right to community life, allowing the establishment of new bonds and relationships. For nurses, this is essential, as extension practices provide a real experience of humanized care, helping to develop essential skills to meet the complexities of health care, in line with the principles of the PNH (2013), providing that the training of these professionals is aligned with the demands of contemporary society, ensuring a more humanized and effective practice. as pointed out by Altoe, Silva and Pinheiro (2011).

It is essential that in addition to the child/adolescent feeling welcomed, understood and with their individualities respected, there is also the establishment of solid affective bonds, as the feeling of protection and belonging is crucial for them to better adapt to the environment in which they are inserted, with playfulness as an important tool to assist in this process. Through the intertwining between humanization and art, especially in its playful forms, it can be inserted as a strategy in the care, attention and well-being of the child/adolescent, distancing itself from the model of "deposits" of individuals and making the environment enriching for their development, since the environment influences their formation process and can become a means of living, learning and developing (Piaget, 1976).

Since nursing as a care profession, little is said about the need to implement humanization, the practice of empathy and the maintenance and monitoring of the

development of institutionalized children/adolescents. It is foreseen that nurses must develop technical-scientific, ethical-political and socio-educational skills according to the social needs they encounter, with the objective of prevention, promotion and recovery of health in the context in which they are inserted. However, the curricula present a gap in relation to the teaching of humanization, together with the scarcity of research production on this theme, contributing to the formation of a professional whose fragmented view is focused only on educational practices in the health area (Medeiros *et al.*, 2015).

OBJECTIVE

The objective of this article was to analyze how scientific research deals with the development of innovative strategies for humanized care with children/adolescents in institutional care, using playfulness and play as tools to face dehumanization and isolation. In addition, it was sought to highlight how university extension contributes to the academic training of future health professionals, sensitizing them to the importance of acquiring knowledge about humanized care and the various strategies that can be applied.

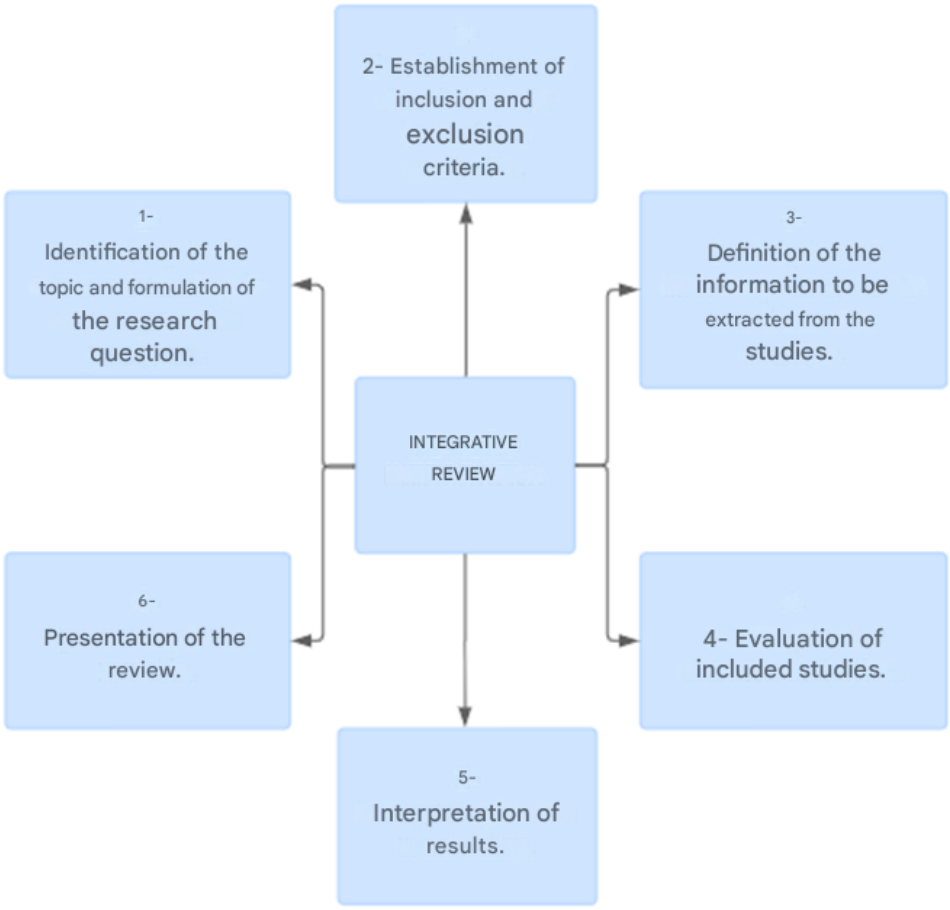
METHODOLOGY

The construction of this article was carried out through an Integrative Review, which is based on an essential instrument in Evidence-Based Practice (EBP) in Nursing, as it is a method that groups the results of primary research on the same subject with the objective of synthesizing and analyzing these data to develop a more comprehensive explanation of a specific phenomenon (Cooper, 1989).

Thus, in the light of the authors Souza et al. (2010) and considering the fundamentals conceptualized by Ganong (1987), the present survey used as a data source the CAPES Thesis and Dissertation Catalog portal, the Virtual Health Library of the Ministry of Health, Google Scholar and Scielo. Gray literature, theses and dissertations, and books were used as exclusion criteria.

According to Agnon (1987, n.p.), the integrative review process is divided into six phases: Identification of the theme and selection of hypotheses or questions to be answered, combined with the methodology of the acronym PiCo to outline the research in a specific way; Composition of the sample of studies to be reviewed (inclusion and exclusion criteria), description of the characteristics of the studies and their main findings; Categorization and analysis of these results; Interpretation of the results and Presentation of the synthesis of knowledge, as shown in figure 1.

Figure 1: Flowchart according to Ganong for carrying out the integrative review



Source: Authors, 2024

When searching for descriptors, it was identified that there is no adequate standardization to refer to "institutional shelter", as defined by the ECA (Brasil, 2009), a term that was replaced by the previous "shelter". The term institutional care was updated in 2009. It was expected that, because the update occurred before the 2013 period, the searched articles would be up to date.

According to the Descriptors in Science and Health (DeCS), the term closest to the one searched for with the exception of "child" and "adolescent", together with the combinations of the Boolean operators "*and" and "not*". The descriptor "shelter" was selected for standardization, excluding the descriptor "orphanage" that addressed the situation of children who would not go through the process of family reintegration, disorienting the focus of this research.

After defining the main descriptors used, each database showed its particularities in relation to the appropriate search format, then other descriptors were added for better filtering of materials, and these are presented later for better understanding.

The searches carried out in the databases had their results organized in an *Excel table*, subdivided into the following columns: Article Title; Subject Addressed; Year of

Publication; *Link* to access the material. This format allowed categorizing the information according to the use of different colors, with green articles according to the theme by title, abstract or year, red articles excluded by analysis of title, abstract or year, and yellow, articles that by title or abstract it was not possible to identify if they were consistent with the objective of the research, requiring full reading.

Articles published in the period from 2013 to 2024 were used as inclusion criteria, and this period was established due to the last update of the PNH to the present day. The articles were selected by two researchers so that the selection could occur in a safer way, following the analysis of title and abstract, first, after reading in full.

As an exclusion criterion, all articles published before 2013, as well as titles that addressed other themes with children/adolescents who were not institutionalized.

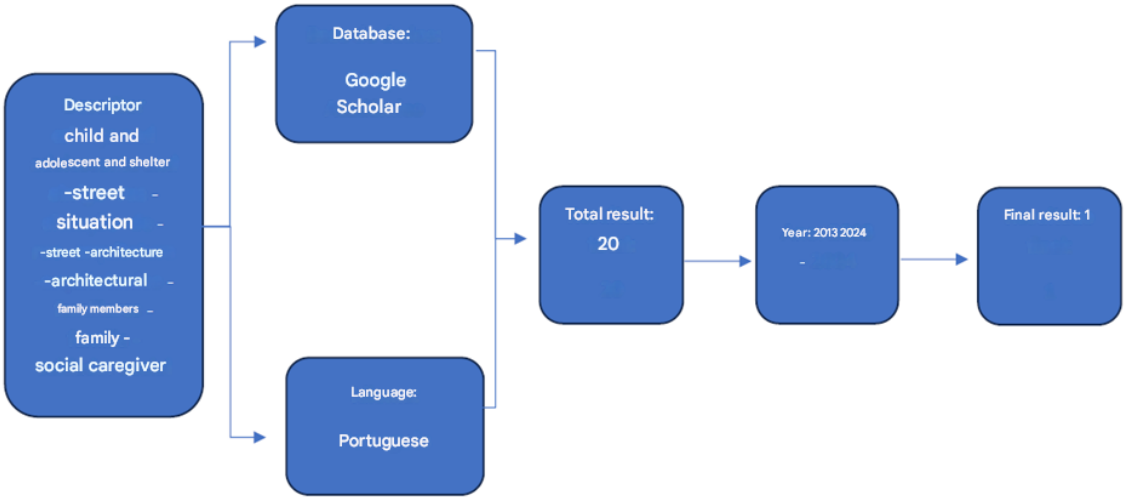
To elaborate the central question of the research, the PICo strategy was used, which is an acronym for Population or Problem, Intervention and Context of the study (Nishikawa-Pacher, 2022), as shown in the table below.

COMPONENT	DEFINITION	DECS DESCRIPTORS	SYNONYMOUS
POPULATION (P)	CHILDREN AND ADOLESCENTS	CHILD; ADOLESCENT	
INTERVENTION (1)	HUMANIZATION	HUMANIZATION OF ASSISTANCE	HUMANIZATION OF CARE
CONTEXT (CO)	INSTITUTIONAL WELCOME	SHELTER; SOCIAL VULNERABILITY	HOME HOUSES

Source: Authors, 2024

Figure 2 represents the search carried out in the period from 2013 to September 2024 using the Health Science Descriptor (DeCS) "google scholar - *child and adolescent and shelter -street -situation -street -architecture -architectural -family members -family -caregiver -caregivers -caregivers -elderly -institution -hospital -hospital -person -elderly".*

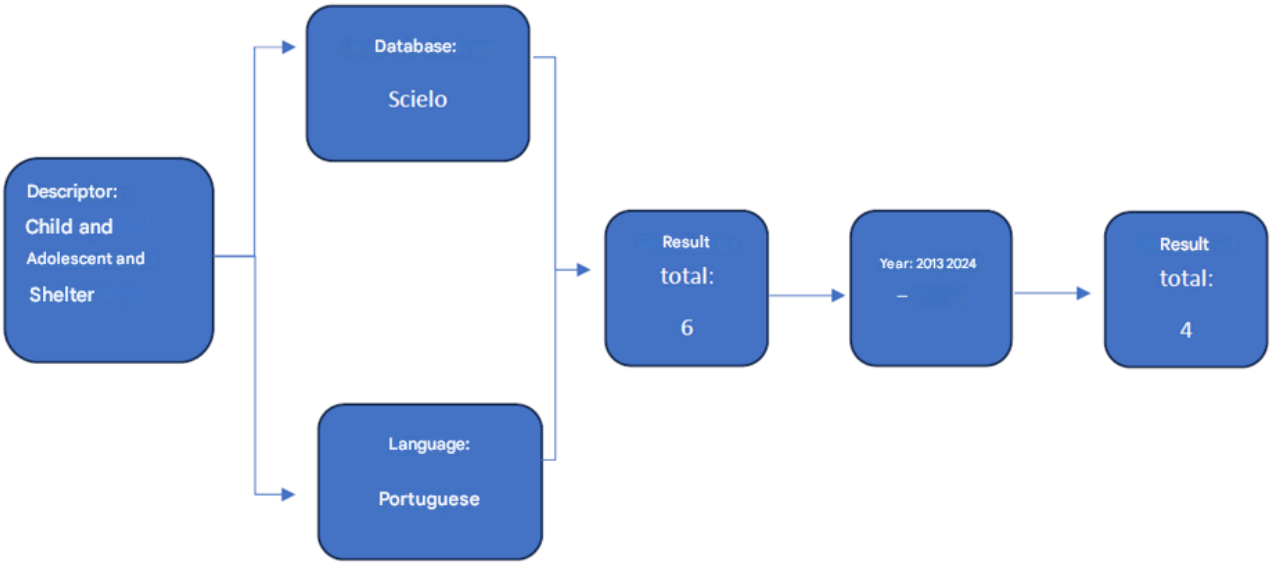
Figure 2: Google Scholar Data Source



Source: Authors, 2024

Figure 3 represents the search carried out from 2013 to September 2024 using the Health Science (DeCS) descriptor "Scielo - *child and adolescent and shelter."*

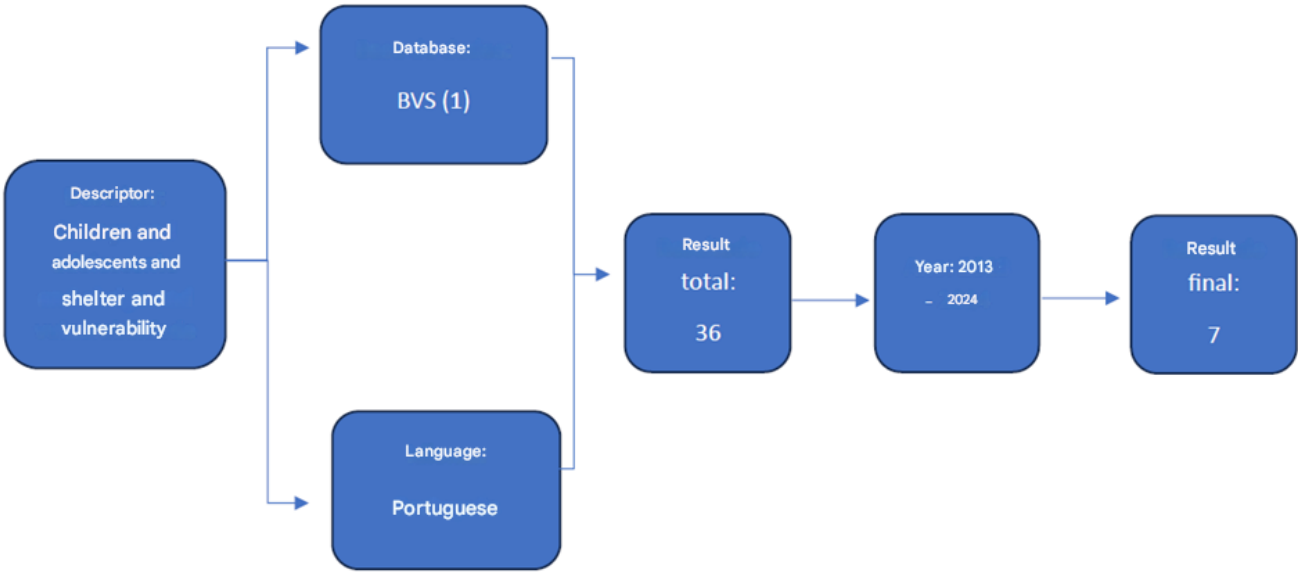
Figure 3: Scielo Data Source



Source: Authors, 2024

Figure 4 represents the data search carried out from 2013 to September 2024 using the descriptor in Health Science (DeCS) Virtual Health Library of the Ministry of Health "*Child and adolescent and shelter and social vulnerability".*

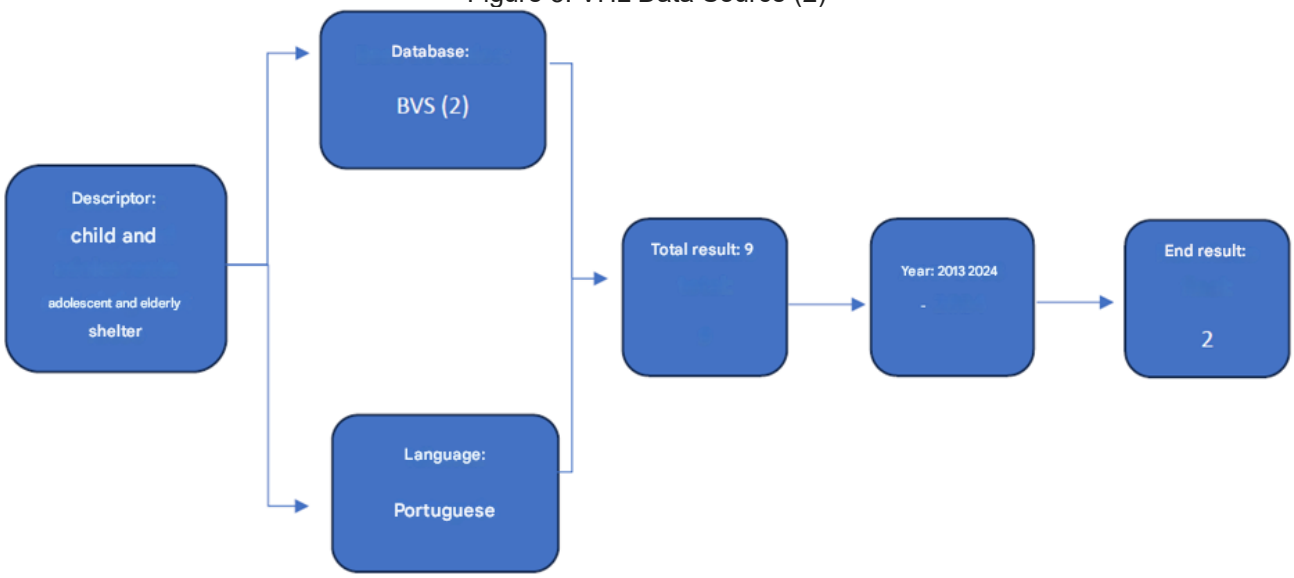
Figure 4: VHL Data Source (1)



Source: Authors, 2024

Figure 5 represents the data search carried out from 2013 to September 2024 using the Health Science descriptor (DeCS) Virtual Health Library of the Ministry of Health *"child and adolescent and shelter not elderly".*

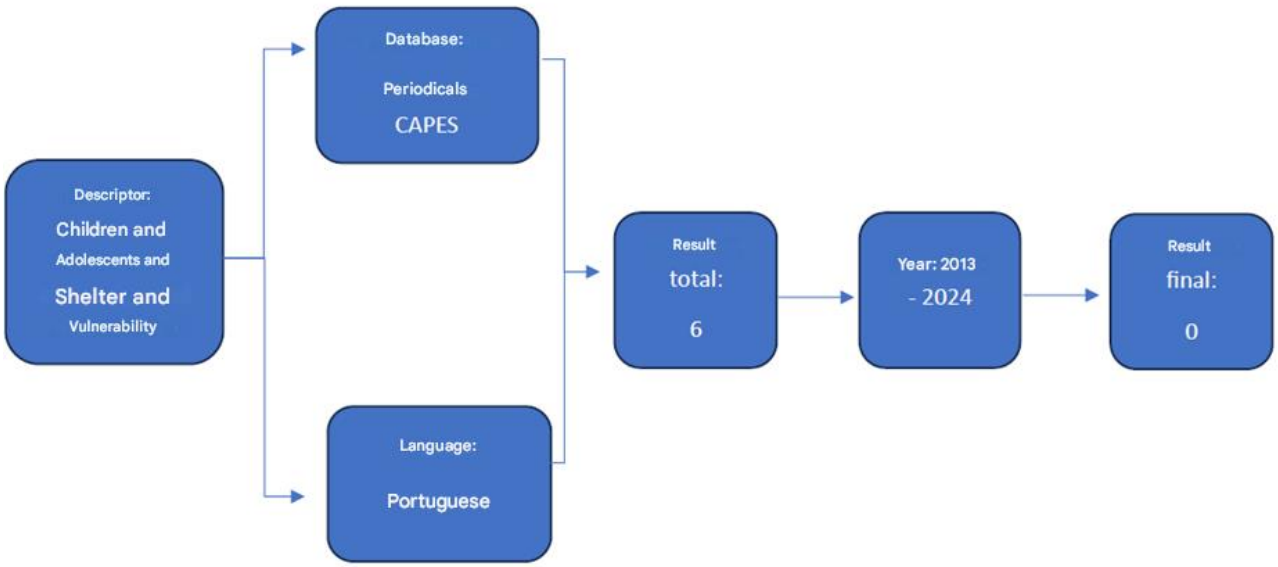
Figure 5: VHL Data Source (2)



Source: Authors, 2024

Figure 6 represents the data search carried out in the period from 2013 to September 2024 using the descriptor in Health Sciences (DeCS) in CAPES Journals *"child and adolescent and shelter and social vulnerability".*

Figure 6: CAPES Periodical Data Source



Source: Authors, 2024

RESULTS AND DISCUSSION

The Integrative Review allowed us to visualize and analyze how the Humanization theme has been addressed in the last ten years in relation to institutionalized children and how its implementation becomes crucial for the full development of these children/adolescents in institutional care.

Based on the criteria established for the survey by descriptors, the search carried out in the "Google Scholar" database, obtained 20 titles of works, 9 of them according to the theme according to title and abstract, and after applying the inclusion and exclusion criteria, resulted in only one selected article. In the "Scielo" database, six articles were found according to the theme, after applying the criteria per year, a total of four articles were found.

In the first search carried out in the "Virtual Health Library", with the descriptors and booleans "child and adolescent and shelter and social vulnerability", a total of 36 articles were found, 13 of which were according to the theme, and seven were excluded after applying the criteria listed per year, obtaining only five articles. The second search carried out in the "Virtual Health Library", the descriptors were used together with the Boolean operators *"child and adolescent and shelter not elderly",* after it was identified that many articles carried out in the first search had to be excluded because they were related to the institutionalization of the elderly, a total of nine articles were obtained, however, only two of them according to the exclusion and inclusion criteria.

The search carried out in the CAPES journal database used the descriptors *"child and adolescent and shelter and social vulnerability"* and a total of six articles were found,

two of them according to the theme by title and analysis of the abstract, but none of them were published between the years 2013 and 2024.

The titles excluded by year covered the year 2003 to 2012, and for a better analysis of the period in which there was exclusion by period, where: in the years 2003, 2004, 2005, 2006 and 2012, one article from each year mentioned above was excluded. In 2007 there were three articles excluded, in 2008 four articles were excluded, in 2009, two articles were excluded, in 2010 there were 5 articles and in 2011 three articles were excluded.

In view of this analysis, we were able to verify that the largest number of publications, even in a period of no interest to the study, was in 2010, the period prior to the publication of the PNH update that occurred in 2013, while in 2004, 2005 and 2006, a period of three years after the 2003 publication of the PNH, It was a period that found lower production on the subject, with only one in each year surveyed.

After the analysis by title and abstract of the selected articles, they were read in full and separated according to the title, journal and year of the study carried out, objective, main results and final considerations, in order to observe the main issues addressed in relation to children/adolescents in institutional care.

Table 1: analysis of search data performed on Google Scholar

GOOGLE SCHOLAR				
Title	Periodical and year	Objective	Main results	Final Thoughts
Shelter, poverty and neglect: paths of judicialization	Psychology & Society – 2015	Discuss negligence as a categorization that justifies state intervention in poor families	The generalization of negligence is applied in an incoherent way, analyzed by a cut of situations. The negligent family is the one that is not the way society expects it to be and do.	In judicial situations, the most immediate scenario is to punish, punish, without taking into account other possibilities and reduce the practice of sheltering to solve problems.

The data search carried out on the Google Scholar platform (table 1) brought only one related article in the year of publication researched. It is a form of search in which it encompasses a wide variety of studies, from different places, and different types of research, encompassing books, theses, laws, syllabus, etc. It is worth mentioning that during the search, several materials considered "gray literature" appeared, however, none of them fit the proposed production period.

The article found highlighted the immediacy of the Judiciary to solve possible problems that could be solved more quickly. It was inferred that many times, there is no more assertive investigation, and what legal possibilities can help and solve the problem in question, other than the initial referral of the child/adolescent to institutional care, removing them early from their homes in several cases, resulting in an intensely stressful period, unnecessarily. (Nascimento, 2012)

Table 2: analysis of search data carried out in Scielo

SCIELO				
Title	Periodical and year	Objective	Main results	Final Thoughts
Evaluation of institutional care services and adolescents in Recife	Ciência & Saúde Coletiva – 2018	To evaluate the structure and process of institutional shelters for the protection of children and adolescents who are victims of abandonment and/or violence in Recife	It was highlighted that one of the main problems is related to human resources, since educators/caregivers establish an affective bond and become a fundamental part of the development of children and adolescents. The on-call regime undermines the continuity of this bond, linked to turnover.	The obstacles to the implementation of the measures by the ECA stem from the use of drugs by adolescents and their families, geographical distance from the family of origin, integration with other institutions and the community and, mainly, the high turnover of professionals
Motor Learning in children and adolescents institutionalized in shelters	Physiotherapy and movement	To analyze the motor learning of children and adolescents institutionalized in shelters and compare them with individuals in a family context.	Children tend to seek affection from others they are living with, creating a family environment where stimuli that favor development occur; individuals live in a stable family environment they have significant differences in development when compared to institutionalized individuals	Individuals living in shelters showed motor learning deficits, evidenced by longer task execution time
Identity politics in the childcare system: the life story of a post-sheltered woman	Social Psychology - 2017	Understand what the experience of having been welcomed in childhood or adolescence is like and what identity politics are attributed; and the possibilities of overcoming after this scenario	The marks of abandonment become part of the identity of the sheltered child; there is a lack of preparation and lack of training to deal with the children in their non-material needs; ambiguity related to the child is divided into gratitude and docility and the prescription of marginality	It is necessary to have public policies that meet the needs of children and guarantee their autonomy and the necessary support for the transition between the age of majority and assuming a role in society after deinstitutionalization by adulthood.
Institutional care for children and adolescents in Aracaju	Clinical Psychology - 2015	Present and discuss research carried out on the execution of institutional care	Dismemberment of a group of siblings at the time of foster care, institutions restricted to the care of children of a certain age group, disarticulation of the child and adolescent protection network,	It is necessary to offer modalities of protection to children and young people that value the family and reduce the application of the foster care measure

			significant number of children and adolescents from the interior sheltered in the capital, absence of work with the family and difficulties in realizing the right to family and community life	

The data search carried out on the Scielo platform (Table 2) brought Piaget's theory to the fore in a clearer and more objective way, since it establishes the importance of creating a bond with the individuals who make up the child/adolescent's life, in an attempt to keep their routines as close to their realities, to minimize the impacts of family separation. The relationship between the search for institutionalizing the children/adolescents and not providing subsidies that can help the family to structure itself was once again evidenced, seeing institutionalization as the only solution, highlighting the delay in processing the case, further prolonging the waiting time and the suffering experienced by the family. The second article highlights how the appropriate stimulus in institutional care goes unnoticed, and the high demand of children/adolescents and their different needs leads to delays and difficulties in their development. (Santos, *et* al 2017)

It is one of the openings that the university has through extension projects, in which they can promote playful ways that provide humanization, lightness and playfulness in actions in an attempt to alleviate the suffering experienced by children/adolescents and the opportunity for adequate development, allied so that the environment becomes favorable, as recommended by Winnicott (2002).

Table 3: analysis of search data performed in the Virtual Health Library in the first approach

VHL 1				
Title	Periodical and year	Objective	Main results	Final Thoughts
Implication of professional practice in the institutional care of children: caregivers' perspective	Psychology: Science and Profession – 2023	to characterize the implications of professional practice in the reception of children in a shelter, from the perspective of caregivers	The entry of children into the shelter results in a change in the position and role to be occupied; the establishment of a relationship begins from the initial reception; the child feels without prior warning or explanation of what is happening (does not confer autonomy); there are welcoming practices linked to caregivers;	It is necessary to work on the importance of the Bioecological Theory of Human Development so that there is a process of development of the child from the interaction with the others involved in this process. Reflect the reception process according to the implications of human development and existing public policies.
Adoption delivery and demand for reunion: mother's motivation	Psychology: Science and	Discuss the specificities of the voluntary	There is no explanation from the Court of Justice regarding the	It is important that you record in the report information that can

	Profession - 2023	surrender of a child for adoption, in the context of Justice, and the motivations for the mother's subsequent demand for the feasibility of a reunion	explanation of the separation from his mother; reports that their son will never be forgotten, and they worry about the fate of their children;	help in relation to the integration of your life story
Risk, vulnerability and confinement of poor childhood	Psychology & Society	Analysis of the criteria considered for erroneous attribution of the institutional foster care process.	Poor families are directly pointed out as incapable of raising their children properly for historical reasons, and not for analysis itself (criminalization of poverty). Poverty is a situation of vulnerability, and not necessarily a risk. Many believe that institutionalizing is the solution.	Institutional care, when used wrongly, as a magical solution to problems, becomes a confinement of childhood, instead of a reasonable solution. Confinement encompasses the restriction of bodies (sheltered) in terms of the subjectivity that exerts its power and moves life; it limits them to an undesirable future, when limited in "risk" and "vulnerability"
Empowerment of sheltered female adolescents: sexual health from the perspective of Nola Pender's theoretical model	UERJ nursing journal	To describe the sexual attitudes and behaviors of adolescents in foster care and to analyze the repercussions of these attitudes on sexual health, considering the Nola Pender Theoretical Model.	Adolescents are more likely to commit to the behavior that best benefits them; report future concerns about their sexual and reproductive health (pregnancy and STIs); the exercise of sexuality is an important right for the promotion of sexual health; Dialogue between partners contributes to the reduction of risks and gender inequalities and the ability to decide their own future.	The sexual empowerment of adolescents presents duality between sexual practices; Education strategies should be thought of together with adolescents in foster care, where there is a dialogue of care, valuing their personal and social particularities of gender and ethnicity.

In the first search carried out in the Virtual Health Library, there was the presence of an article published in a nursing journal, which was the only one found in this search, while the others are prevalent in journals focused on psychology. The presence of the nursing professional is highlighted as essential for the monitoring of the child/adolescent in their development, establishing a bond with the foster care institution. The importance of monitoring the child/adolescent in an individualized and integral way was also addressed, carrying out health education actions that contribute to a better understanding and

autonomy of each one, since their needs, rights and autonomy are often neglected, with their individualities trivialized. (Penna, *et al.* 2016)

The second article also recommends that there be more information about the child/adolescent, so that they have access to their history and origin, so that they recognize themselves as individual beings with different experiences and knowledge about themselves. (Pinho; Machado, 2023)

Table 4: analysis of search data performed in the Virtual Health Library in the second approach

VHL 2				
Title	Periodical and year	Objective	Main results	Final Thoughts
Perception of professionals from foster care units about the sexual and reproductive health of institutionalized adolescents	Care is key - 2020	To characterize the sociodemographic profile of professionals who work in foster care units for adolescents and to analyze the perception of sexual/reproductive health of institutionalized adolescents from the perspective of professionals in the foster care unit	The professionals do not have training aimed at sexual and reproductive health; the adolescents arrive without having had family guidance; professional difficulty in dealing with abuse and abandonment;	The professional nurse must contemplate in his specialized care the promotion of sexual and reproductive health in this environment that is forgotten by the population, providing support to the health demands of young adolescents, acting in the process of rehabilitation and social insertion of these adolescents.

Finally, the second search carried out in the Virtual Health Library brought an article that highlights the importance of contemplating the individualized care of each individual, since it is the competence of the nursing professional to carry out health promotion, taking into account sexual and reproductive health within the reception environment, since doubts about the subject need to be resolved. (Felix *et al,* 2020)

It is crucial that there is a follow-up by someone trained to adequately instruct these children/adolescents, facilitating the process of their social reintegration in a safe and appropriate way. After analysis, it was evidenced that there is no scientific production that addresses humanization through playfulness for children/adolescents in institutional care, mostly being restricted to health education focused on more emergent care of the child/adolescent, and not in an integral way, contemplating their biopsychosocial and spiritual needs.

CONCLUSION

Despite the implementation of the National Humanization Policy (NHP) in 2013, health professionals have limitations in relation to the applicability of the humanization of care in practice, as there is not a significant amount of work that includes health care for children/adolescents in institutional care, mainly by health professionals beyond psychology.

The predominance of publications related to children/adolescents is directed to areas related to the judiciary, addressing the rights and duties for children/adolescents in institutional care and the ills present within the institutions in relation to professional preparation for the care of this age group, and the lack of public policies that leverage families who had their children removed from their homes, in order to provide the opportunity for the (re)establishment of the family nucleus to be able to hold custody again.

In this sense, the National Extension Policy (FORPROEX, 2012), university extension strengthens the technical-professional training of students and encourages social changes, promoting an exchange of knowledge between academics that reveals the uniqueness of each one, shaped by community experiences. Through university extension practices, students are able to strengthen ties with the target audience, promoting the humanization of care, as recommended by the PNH (2013). Individuals in situations of structural vulnerability need to be welcomed in a humanized way by other human beings.

Nursing, in particular, stands out for its proximity to users and for the establishment of bonds, especially in primary care. By meeting the needs of foster care institutions, nursing plays a crucial role in the implementation of humanization, ensuring adequate reception and the healthy development of children/adolescents.

According to Lima and Chahini (2021), humanization intertwined with art and health contribute to the promotion of well-being in moments of pain and anguish in individuals of different age groups, taking into account the individuality of the being and the subjectivity of each one. The activities contribute to the development of the child/adolescent, being able to provide cognitive development intertwined with affectivity, communication, interaction with the environment and socialization among individuals.

Through play, the child/adolescent is able to explore the world around him, his imagination, express his feelings and explore creativity, providing moments of relaxation and integration of all the individuals involved, from the planning to the execution of each activity, making art the health promoter capable of promoting well-being, self-esteem and care for others, with the aim of improving health conditions.

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BASIC EDUCATION MUSIC TEACHER AND PRIVATE MUSIC TEACHER: A REFLECTION ON THEIR ATTRIBUTIONS AND REMUNERATION IN BRAZIL IN 2024

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ABSTRACT

The present research was based on the methodology of research via the internet. As an objective, it aimed to expose a small analysis of the remuneration and attributions of Music teachers, comparing the Music teacher of Basic Education with the autonomous/extra-class Music teacher, giving more emphasis to the scenario of the latter. Thus, the following questions were prepared to be answered by this author who has in his curriculum as a teacher in Music the school curriculum of Basic Education, and also, has experience in teaching practice as an autonomous Music through MEI (Individual Microentrepreneur): Which teacher has more attributions in his work as a music teacher? Which of these earns the most per hour of work? As a result, the investigation brought that clearly, the Music teacher of Basic Education is the one who has the most attributions, given the number of students per class that he attends at once, in addition to having to deal with the lack of work material and adequate space for Music classes. And in response to the second question, the survey pointed out that it is the private music teacher who has the best remuneration per hour of work, disregarding, of course, the benefits guaranteed by law to Basic Education teachers, such as planning hours.

Keywords: Private music education. Music in Basic Education. Remuneration.

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INTRODUCTION

First, the author of this article would like to inform the reader that, in 2024, this text was disregarded for presentation and subsequent publication in the annals of the XXXIV Congress of the National Association for Research and Graduate Studies in Music (ANPPOM), as this event considered that the present writing did not meet its standards. Thus, the text is presented.

In Brazil, in the year 2024, the remuneration of Basic Education teachers is still an issue out of line. This is said because the study and work time of a teacher in this range of education is disconnected from his remuneration, especially when talking about public education. When it comes to the teaching of Music, the scenario is no different.

Despite this, the present reflective investigation aims to bring a small analysis of the remuneration and attributions of Music teachers, comparing the Music teacher of Basic Education with the autonomous/extra-class Music teacher, giving more emphasis to the scenario of the latter. Thus, the following questions were elaborated to be answered by this author who has both experiences: Which teacher has more attributions in his work as a music teacher? Which of these earns the most per hour of work?

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

It is known that not all people who take Music classes in non-formal courses in this sub-area of the great area of Art – which in turn is a sub-area of the mother area that is the area of Linguistics, Letters and Arts – go on to a formal education in Music, such as technical courses, undergraduate and post-graduate courses, because they do not aspire to pursue a career in this area. At the same time, there are also cases in which people graduate from formal courses in the area of Music, but do not pursue a career in this area. Many people use Music as leisure, a robe or just attend the mandatory classes in the mandatory school curriculum of Basic Education, when there is Music in this curriculum, just to fulfill a legal obligation.

However, we cannot forget that people are not required to formalize and certify their training in Music, as well as in any other area of knowledge, such as Mathematics, Letters, History, Geography, Philosophy, Chemistry, Physics, Biology, Physical Education, Sociology, the area of Religious Education, etc. that is, the areas and subareas of knowledge that are taught to us in the Basic Education school. We are the ones who decide what direction we will take for our life. There is no legislation in Brazil that requires us to take a technical course or undergraduate degree, especially in some area that does not interest us.

At the same time, as the present work talks about the teaching of Music, it is important to report to the reader that this teaching of Music is not available in all places in Brazil, free of charge or not. In some places where there is no free music education, there is it available for a fee. However, not everyone can pay the amount or the entire amount of tuition and/or single classes of this Art.

Thus, even though there is no legal obligation in Brazil that obliges private music teachers to offer music lessons at more affordable prices, it would be important for them to have the common sense to at least start thinking, for example, of offering for every ten students who pay the full tuition, one who pays only half (partial scholarship) and one who pays nothing (full scholarship).

It is important to think about this, not only for marketing reasons, but also for reasons of humanity and Human Rights. Thus, for the present theoretical framework, the present investigation relied on the following declaration and legislation: Universal Declaration of Human Rights of the United Nations (UN, 1948) which in its Article 24 says that every human being has the right to rest and leisure. Thus, Brazil ratified this and other articles of this Declaration (UN, 1948) in its Federative Constitution of the Republic of Brazil of 1988 (Brasil, 1988) by guaranteeing, in its Article 227, the right to leisure for Brazilian citizens.

In this context of having access or not to music education in a paid way, let us bring Pierre Bourdieu's Three States of Cultural Capital (1978), the Incorporated, the Objectified and the Institutionalized. Making a direct analogy to the teaching of Music, these Three States are explained.

In the first, the Incorporated State, the individual learns to play a musical instrument by himself, that is, in a self-taught way. He could even, through his self-teaching, learn to make his own musical instruments.

In the second, the Objectified State, the purchasing power through the financial power of the individual makes the difference. Thus, in private music education, the individual can only use it if he has a financial reserve to be able to pay for this education. In a place where there is no free music education, such as through social inclusion programs, the Objective State will make all the difference in the life of the individual who is not self-taught, but who has a good financial condition.

Finally, the Institutionalized State refers to the formal study of Music, for example, college. It is when the individual seeks to certify his knowledge in Music. It is worth mentioning that in Brazil, until a few years ago, there were Brazilian states (federative units) that did not have the Faculty of Music. Thus, if the individual residing in one of these states was interested in certifying his knowledge in Music at the university level (undergraduate),

he would have to travel to another federative unit of the country to fulfill his interest and desire.

METHODOLOGY

The short and present investigative reflection focused on the methodology of research via the internet (Netnography) (Soares; Stengel, 2021), as sources contained in internet pages were sought; the qualitative approach (Mynaio, 2002), as we sought to work with the meanings of the data found and not with the quantity of these. For the present investigation in relation to the average income per hour of class of a music teacher who teaches private lessons, it was randomly chosen to choose the www.superprof.com.br website that covered, in May 2024, the entire national territory.

On this website, the descriptor "Musical Initiation" (on any musical instrument) was used up to the maximum value per hour, which is R$230.00 made available on the www.superprof.com.br website, regardless of the training of each teacher (whether or not they had academic training in the area of Music), their evaluations made by students and whether the class modality was online and/or face-to-face. It is worth mentioning that in the interior of each Brazilian federative unit, there are several other music teachers who charge different amounts from those charged in their respective capitals. Therefore, this research focused only on Brazilian capitals. Although the site allows you to choose the maximum amount as R$230.00, there have been cases in which teachers have appeared who charge more than this amount per hour of class. Once this was done, only the name of the capital and the state to which each one belonged were changed in the descriptors.

For the research on the base salary (salary floor) for a Brazilian Basic Education teacher, regardless of the area of training, the Federal Government website https://www.gov.br/mec/pt-br/assuntos/noticias/2024/fevereiro/divulgado-novo-valor-do-piso-salarial-dos-professores was used, which published on February 1, 2024 the new salary floor for Basic Education teachers, through the Ministry of Education (MEC).

RESULTS AND CONSIDERATIONS

As results and considerations, this reflective article brought the following table (Figure 1) on the values of class hours charged by private music teachers in Brazil, as well as the 2024 salary adjustment imposed on Brazilian Basic Education teachers.

Figure 1 – Table of values per hour of class given by private music teachers in the capitals of Brazil

Região	Unidade Federativa	Capital	População (IBGE, 2022)	Número de professores cadastrados no site	Valor mínimo p/hora	Valor máximo p/hora	Média de preço por hora de aula
SUL	Rio Grande do Sul (RS)	Porto Alegre	1.332.845	54	R$30,00	R$175,00	R$117,50
	Santa Catarina (SC)	Florianópolis	537.211	65	R$20,00	R$150,00	R$95,00
	Paraná (PR)	Curitiba	1.773.718	87	R$20,00	R$150,00	R$95,00
	Média da Região Sul com base em suas capitais apenas						R$102,50
SUDESTE	São Paulo (SP)	São Paulo	11.451.999	356	R$1,00	R$150,50	R$76,00
	Minas Gerais (MG)	Belo Horizonte	2.315.560	71	R$30,00	R$180,00	R$120,00
	Rio de Janeiro (RJ)	Rio de Janeiro	6.211.223	159	R$18,00	R$250,00	R$134,00
	Espírito Santo (ES)	Vitória	322.869	30	R$25,00	R$280,00	R$152,50
	Média da Região Sudeste com base em suas capitais apenas						R$120,62
CENTRO OESTE	Mato Grosso do Sul (MS)	Campo Grande	898.100	2	R$75,00	R$100,00	R$87,50
	Mato Grosso (MT)	Cuiabá	650.877	1	R$50,00	R$50,00	R$50,00
	Goiás (GO)	Goiânia	1.437.366	49	R$20,00	R$300,00	R$160,00
	Distrito Federal (DF)	Brasília	2.917.381	44	R$20,00	R$300,00	R$160,00
	Média da Região Centro Oeste com base em suas capitais apenas						R$114,37
NORDESTE	Bahia (BA)	Salvador	2.417.678	34	R$15,00	R$175,00	R$95,00
	Sergipe (SE)	Aracaju	602.757	41	R$15,00	R$150,00	R$82,50
	Alagoas (AL)	Maceió	957.915	44	R$13,00	R$150,00	R$81,50
	Pernambuco (PE)	Recife	1.488.920	42	R$13,00	R$100,00	R$56,50
	Rio Grande do Norte (RN)	Natal	751.300	34	R$13,00	R$100,00	R$56,50
	Ceará (CE)	Fortaleza	2.428.708	17	R$25,00	R$150,00	R$87,50
	Piauí (PI)	Teresina	866.300	6	R$30,00	R$247,00	R$138,50
	Maranhão (MA)	São Luís	1.037.775	4	R$20,00	R$250,00	R$135,00
	Paraíba (PB)	João Pessoa	833.932	41	R$13,00	R$100,00	R$56,50
	Média da Região Nordeste com base em suas capitais apenas						R$87,72
NORTE	Acre (AC)	Rio Branco	364.756	0	R$0,00	R$0,00	R$0,00
	Rondônia (RO)	Porto Velho	460.434	0	R$0,00	R$0,00	R$0,00
	Amazonas (AM)	Manaus	2.063.689	4	R$25,00	R$50,00	R$37,50
	Roraima (RR)	Boa Vista	413.486	0	R$0,00	R$0,00	R$0,00
	Pará (PA)	Belém	1.303.403	13	R$30,00	R$150,00	R$90,00
	Tocantins (TO)	Palmas	302.692	1	R$50,00	R$50,00	R$50,00
	Amapá (AP)	Macapá	442.933	2	R$40,00	R$80,00	R$60,00
	Média da Região Norte com base em suas capitais apenas						R$33,92
Média brasileira da hora aula de música (iniciação musical em qualquer instrumento musical) com base em suas cinco regiões							R$91,82

Source: *Website* www.superprof.com.br (19/05/2024) e (20/05/2024) e site https://cidades.ibge.gov.br/ (20/05/2024)

For a better understanding of the previous table (Figure 1), it is important to keep in mind that in certain places in Brazil, there are more music teachers than in others. Thus, the rule often follows the logic of the market, which is: the more teachers, the lower the price of the class hour. The fewer teachers, the higher the price per hour of class. Thus, São Paulo/SP has a very large number of musical initiation teachers in relation to the city of Porto Alegre/RS, which in addition to being drastically smaller in territory and mainly, in population, has a smaller number of musical initiation teachers than São Paulo/SP.

It is also important to take into account that the capital of each state is not always the most populous city in it, as is the case of the states of Santa Catarina and Espírito Santo, where the capitals of these states are not the most populous cities of these federative units. Thus, it is possible that the value of musical initiation class hours can vary even more in these states. It was also observed during the research on the www.superprof.com.br

website, that in some cases, the same teacher worked in more than one Brazilian capital. It is also worth mentioning that many of the teachers found on this site also taught online classes, in addition to face-to-face.

Regarding the amount paid to the Basic Education teacher, according to the following direct quote from the article entitled "New value of the teachers' salary floor released", the base salary for a teacher who works 40 hours a week is R$4,580.57 (Four thousand, five hundred and eighty reais and fifty-seven cents). Namely

> New value of the teachers' salary floor released
>
> The National Professional Salary Floor for public basic education teachers for the year 2024 will be adjusted by 3.6%. New minimum value is R$ 4,580.57
> The Ministry of Education (MEC) published, on Wednesday, January 31, in an extra edition of the Official Gazette of the Union, Ordinance No. 61/2024, which defines the new salary floor for basic education teachers. The expected increase is 3.62%, and the minimum amount defined by the government for 2024 was R$ 4,580.57. This salary is valid for the public network throughout the country, with a working day of at least 40 hours per week.
> The minimum wage is the minimum amount that the professional category must earn throughout Brazil. The annual readjustment of the national salary floor for public teaching professionals in basic education was defined by Law No. 11,738/2008. Every year, it is up to the MEC to calculate the readjustment index and publish the ordinance with the new values, as provided for by law. The value update is calculated using the same percentage of growth as the minimum annual value per student, referring to the initial years of urban elementary education, defined nationally in Law No. 11,494/2007.
> The value of the floor is defined by the federal government, but, as salaries are paid by the education networks, each state and municipality needs to make the new value official through its own rule. Therefore, the readjustment is not automatic. Basic education salaries are paid by municipalities and states, from resources from the Fund for the Maintenance and Development of Basic Education and the Valorization of Education Professionals (Fundeb) transferred by the Union, in addition to tax collection.
> Source: MEC Social Communication Office (2024), website https://www.gov.br/mec/pt-br/assuntos/noticias/2024/fevereiro/divulgado-novo-valor-do-piso-salarial-dos-professores

Based on this report, the formula contained in the website of the Union of Teachers of Itajaí and Region (https://sinproitajai.org.br/calcule-seu-salario/#:~:text=O%20sal%C3%A1rio%20base%20%C3%A9%20calculado,par%C3%A1grafo%201%C2%BA%2C%20da%20CLT) was used as a formula to calculate the value of the class hour of a Basic Education teacher, which deduces, as well as other entities of equal similarity and relevance in Brazil, that the salary of the Basic Education teacher should be calculated in the same way as the following form (example): 20 (weekly class hours) X 5.25 (4 weeks plus 1.25 of paid rest) X 10 (value of the class hour) = R$ 1,050.00 (monthly salary with paid rest and without discounts) (Sinpro Itajaì, 2024).

Thus, bringing to the example of the base salary of Basic Education teachers in 2024 who work 40 hours a week, we have the following mathematical formula: 40 (weekly class

hours) X 5.25 (4 weeks plus 1.25 of paid rest) X x (value of the class hour we want to find out) = R$ 4,580.57 (monthly salary with paid rest and without discounts). Apart from the words, the equation and its resolution look like this:

40 X 5.25 X x = 4,580.57 ⇨ 210 X x = 4,580.57 ⇨ 210x = 4,580.57 ⇨ x = 4,540.57 / 210 ⇨ x = R$21.81

Therefore, the remuneration of a Basic Education Music teacher per hour worked is R$21.81 in contrast to the average R$91.82 that a private music teacher who teaches private music lessons earns in Brazil in 2024, regardless of their training, that is, whether or not they attended college (licentiate/bachelor's degree) in Music. In regular Basic Education, it is mandatory for the teacher of Music, as well as other areas, to have a degree in Music to teach in the mandatory school curriculum of this academic range. To teach music on account and/or in a music school of their own, there is no legal obligation for the teacher to have a university course to teach classes. This is not even talking about the discounts that the teacher's salary, both hired and competitive in Basic Education, suffers.

When it comes to assignments, a private music teacher, if it is of interest to you, can choose to plan, teach and evaluate your classes for only one student at a time (per hour) or in small groups. The Music teacher in Basic Education, on the other hand, has to deal, on average, for example, with about 15 to 40 students per hour of class and per class, depending on the school and school year of Basic Education (Early Childhood Education, Elementary School, High School), not counting Technical Education at the high school level where the teacher, if of musical instrument, you can give individual lessons, with the exception of more comprehensive classes, such as choral singing, musical theory and perception, etc., where the class is usually composed of more students.

If we take as an example the Brazilian average of the price of the hour of private music lessons found in this research, disregarding rest, and we make the same calculation that we used to calculate the price of the hour of class of a Basic Education teacher, to calculate how much a private music teacher earns per hour of class taught, considering that he also works 40 hours a week, we will have the following: 40 x 91.82 = R$3,672.80. All this, without the great responsibility and work demand that exists in Basic Education.

Remembering that the www.superprof.com.br site is just one of several existing sites to find music teachers in Brazil. Thus, in figure 1, in the Brazilian capitals where there were no registered music teachers or few of these registered professionals, it does not mean that there are no professionals who teach music classes in these locations, since the music teachers in these places should and may be using other means of disseminating their work as music teachers other than the www.superprof.com.br website.

CONCLUSION

Answering the research questions: Which teacher has the most assignments in your job as a music teacher? Clearly, the Music teacher of Basic Education is the one who has the greatest attributions, given the number of students per class that he attends at once, in addition to having to deal with the lack of work material and adequate space for Music classes. Also, of course, because their employers often pay their salary below the minimum wage, since many times, teachers of Basic Education in general, especially public education, have to unite to protest in various ways for better working conditions, including salary, benefits that are often too shallow for the amount of work that these teachers perform, as well as, they almost always have to fight against mental exhaustion due to their hard work. This is all added to the fact that many develop disorders due to the stress generated by the high workload and demand on it.

Which of these earns the most per hour of work? Clearly, the private music teacher is the one who has the best remuneration per hour of work. The disparity between the amount charged per hour of class between a private music teacher who wears out less than a music teacher in Basic Education who has a more exhausting workload and responsibilities is notorious. At the same time, in the vast majority of times, the stress of a Basic Education teacher goes beyond issues of dealing in the classroom, such as when the teacher does not have adequate materials for the work and also does not have the appropriate physical environment to work in.

This teacher often comes into conflict with the management of the schools where he works and with the public power to get the minimum. It almost always becomes disliked for its actions of claims that are necessary to ensure the best possible learning of its students. On many occasions, the Basic Education Music teacher must take his own work materials to the schools where he teaches, to be able to do the best possible and the most appropriate class possible with his students. Not to mention, of course, when this teacher spends his own salary to buy a piece (part) of a musical instrument that the school has, but which is defective, among many other shortages that the Basic Education teacher finds in his workplace, especially in the municipal and state public school networks.

Obviously, it is important to highlight that the Music teacher of Basic Education does not develop his students to the point of becoming instrumentalists, at least not as fast as a private Music teacher can due to his time dedicated individually to each of his Music students.

The present author, who in addition to being a music teacher, having worked in the curriculum of Basic Education, and who also worked in the private teaching of Music, does

not want to detract from his own area. But rather, to alert to the common sense of their fellow private music teachers that even if there is, in certain cases, a quota to be paid to the school where they teach, this is certainly not so high that the value of the class hour is so abruptly higher than the amount paid to their fellow Basic Education teachers who have at least, a college (in relation to private teachers who do not have a degree in the area) and infinite more responsibility.

Pay attention and remember the social part of Music that is also based on Human Rights, which certainly involves Article 24 of the Universal Declaration of Human Rights (UN, 1948) and Article 227 ratified by Brazil in its 1988 Constitution (Brazil, 1988). Thus, it is worth remembering that the Objectified State (Bourdieu, 1978), points out that it is evident that not all individuals who are interested in music classes in places where there is no free offer of it or that there are, but that there are no more vacancies available and/or that the place where these are offered is a long distance from the residence of those who are interested in these and/or who do not have a car to travel to free and/or private music classes, have and/or will have access to music education.

This author considers shameful a country that does not imprison more for Basic Education than for private music education. Proof of this is his experience as a teacher in Basic Education, where he witnessed his fellow teachers who had passed the exam and graduated in other areas of knowledge accepting invitations to teach classes in the Art curricular component, due to the lack of teachers in this area, since the municipality either did not want to call teachers from the competition that had already been held or that did not want to make a new public exam for this area or worse, that there were in fact no licensed music teachers to occupy their space in Brazilian Basic Education. Thus, the area of Music is even more devalued in Basic Education in Brazil since there are not and/or will not be professionals in this area defending it and carrying out its respective maintenance in all regions of Brazil.

Basic Education is the basis of an entire society. The teaching of Music in Basic Education is an important door for its users (students) to become even more consumers (paraphrasing a teacher of the visual arts of Basic Education who supervised the author of this article while he participated in the PIBID – Institutional Program of Scholarship for Initiation to Teaching) of musical art and even to be interested in taking Music classes in an extra-class (private) way.

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DIAGNOSIS OF TRAINING NEEDS IN RURAL TOURISM COMPANIES IN THE CANTON OF COTACACHI

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ABSTRACT

The tourism industry in Ecuador needs to have a scientific basis, according to its development and economic growth. According to the Plan for the Creation of Opportunities 2021 - 2025, the government has structured a policy aimed at strengthening the tourism system, therefore, the inquiry carried out with local business representatives will allow us to understand where to direct administrative tools and concrete actions with management models in tourism services. which will seek to promote a culture of quality and good service.

The purpose of this scientific article is to make a diagnosis of training needs of technical and administrative skills for the management of the tourist service of the parish of San Francisco and the Sagrario of the Cotacachi Canton of the province of Imbabura. To this end, it is proposed to develop a situational diagnosis, which evidences the reality of tourism service provider companies; and that allows this research to become a significant contribution to the canton.

Keywords: Diagnosis. Technical skills. Training. Rural tourism.

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INTRODUCTION

Currently, the social and economic context that Ecuador is going through translates into slow economic growth in addition to a strong inequality of access to goods and services that negatively impact all corners of the country in a transversal way, from the national and local levels but also urban and rural. The challenge is to outline elements that consider cultural, natural, historical, heritage resources, etc., as a source of development for tourism through the use of the externalities offered by these material and intangible resources of the "province of the lakes" as it is known; and recently (May 2019) distinguished as a Global Geopark by the United Nations Educational, Scientific and Cultural Organization (UNESCO). (Dávalos, Pinargote, & Brusil, 2019)

THEORETICAL FRAMEWORK

The tourism industry in Ecuador needs to have a scientific basis, according to its development and economic growth. According to the Plan for the Creation of Opportunities 2021 - 2025, the government has structured a policy aimed at strengthening the tourism system, therefore, the inquiry carried out on local business representatives will allow us to understand where to direct administrative tools and concrete actions with quality management models in tourism services. which will seek to promote a culture of quality and good service.

Tourism is a booming economic and social activity, which contributes directly or indirectly to a developing area, generating significant monetary movements, allowing national and foreign investment (Santamaría, 2019). Currently, tourism is the key driver in the socioeconomic process of a destination, that is, the greater the transit of people in the destinations, the greater the economic flow and social development (Silva, 2018).

According to the World Tourism Organization (UNWTO), in the current economic scenario, tourism is emerging as one of the most dynamic activities of global capitalism. (World Tourism Organization, 2012). Its importance can be seen in the contribution to the generation of wealth, *tourism represents one of the support services for the production of the labor force, for the progressive growth of industrial, commercial and financial relations in the different markets, tourism services serve to support the mobility of labor, which serves as a strategy for the production of capital (Bravo, 2018).*

The tourism sector is a sector with significant growth both globally and nationally, so according to (UNWTO, 2021) tourism contributes 4.6% of global GDP and more than 8.3% of employment. In this sense, the importance of adequate, accurate, up-to-date and

constant training should be highlighted, it is essential since all work carried out in this activity is aimed at a single objective: full customer satisfaction (Mesa, 2018).

During the last decades, countries have included the country brand as one of their competitive advantages in their strategies, which helps them to strengthen their international image in order to favor both tourism and their exports. Ecuador has sought to align itself with the global trend and this is how it consolidates a process of creation and dissemination of its brand "Ecuador loves life"; and in this way it ensures that the imaginary it communicates favors presenting to the world a country with both cultural and natural wealth (Chicaiza, Lastra, & Yánez, 2014).

The province of Imbabura is in a process of economic and social growth, the declaration of a geopark has allowed the local population to set their sights on tourism as a strategy to strengthen the process of economic and social growth (Gómez, González, & Villalonga, 2019). A reference in this regard is made by (Kliksberg, 2006, p.12), when he states that the degree of trust between social actors, their norms of behavior and the level of associativity that characterizes them; they indicate the richness and strength of the internal social fabric of a society and therefore fundamental elements to achieve a sustainable and sustainable development of tourism.

On the other hand, Cotacachi seeks to make tourism a productive, friendly, economic, and socio-cultural alternative, in such a way that it allows the canton to become an important tourist destination in the local market (Quinga, 2013).

The diversity of the Cotacachi canton promotes development as a tourist alternative, given the advantages it has for its inhabitants, entrepreneurs and urban and rural businessmen, by generating new jobs, promoting family income, and valuing tangible and intangible heritage (Bravo D., 2017)

Currently Cotacachi is made up of 2 urban parishes that make up the canton itself. The urban parishes into which Cotacachi is divided are as follows: El Sagrario located north of 10 de Agosto Street and San Francisco located south of 10 de Agosto Street (Municipality of Cotacachi, 2020).

In Cotacachi, tourism activity has been managed in a disorderly and empirical way in recent years, the last tourism development plan of the canton was prepared in 2002, this fact has not allowed an orderly development of this sector in the parishes of the canton (Association of Municipalities of Ecuador, 2019).

Castelluci (2009) argues that tourism anywhere in the world should have as its primary objective to contribute to the development of peoples. This goal can be achieved through full customer satisfaction. The growing trend in tourism demands more quality in

the provision of services. This situation forces tourist destinations to analyze their current competitiveness in relation to the quality of services, this through the implementation of training programs that are focused on the strengthening of operational personnel.(Reyes J. , 2019)

In this context, Granados & Amaru (2013) must acquire up-to-date knowledge, which allows them to strengthen generic competencies and training in skills and abilities. That is why training is a crucial process for those who develop a tourism activity (Torres, 2016). It is through training that human capital receives the appropriate and necessary technical and theoretical knowledge to correctly develop their function within the tourism company (Valle, Barca, González, & Núñez, 1999). Therefore, if adequate and accurate training is not available, the results could be jeopardized, training can be tedious in many cases, but the benefits obtained are so important that it must be considered as a necessity, since otherwise it becomes a serious problem of competitiveness (Aguilera, 2017). In other words, training is generated by a need, every need is the product of a lack, the lack can be identified if you compare what you have with what you should have; therefore, training needs are those shortcomings of knowledge, skills, and attitudes that personnel have in relation to what the position demands (Díaz Y., 2018).

In agreement, Díaz, Gómez, & De la Osa (2008) present a theory that allows the identification of individual training needs, based on the definition of the competencies that are required for the performance of the same. (Polo, 2003) mentions that, in a shared process, there is a shift from a detection of training needs to one of improvement; It starts from the trainer's previous experience to discover what they need to know, and then develops the content they need to acquire to perform better.

On the other hand, (Guamán, 2018) mentions that there are two groups of identified training needs: Manifest needs and hidden needs.

Manifest needs: These are those arising from a change in the organizational structure due to the mobility of personnel or as a response to the technological progress of tourism companies, becoming quite unquestionable needs of the staff, who will occupy a newly created position, working methods and procedures.

Hidden needs: They are aimed at identifying the deficiencies in the knowledge, skills and abilities of the owners of tourism companies, which do not allow them to perform optimally in each of their tasks within their job (p.41).

That is why training is a crucial process for those who develop a tourism activity. It is through training that human capital receives the appropriate and necessary technical and

theoretical knowledge to correctly develop its function within the tourism company (González, 1993).(Torres, 2016)

In this sense, the execution of training processes is based on the ethics of service based on principles in relation to the skills, aptitudes and knowledge that an employee can develop continuously. Process improvement is the main objective sought when implementing a training process, especially in the tourism field (Morillo, 2016).

Therefore, if we do not have the appropriate and accurate training, the results could be jeopardized. Training can be tedious in many cases, but the benefits obtained are so important that it must be considered a necessity, since otherwise it becomes a serious problem of competitiveness (Aguilera, 2017).

METHODOLOGY

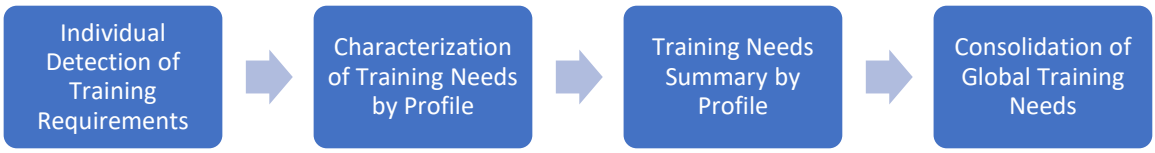
With this research work, the training needs of several companies in the Cotacachi canton were identified, for this a methodology with a qualitative approach was applied. Qualitative research is based on the correlation of variables, this type of research allows the collection of data, description of phenomena, contexts, facts and circumstances, in addition to identifying independent and joint features in order to detail how they are and how they are represented within a population (Sampieri et al., 2014).

Under this description, several research methods were used that allowed a process of detection of real training needs to be carried out (Pastaz & Ruiz, 2020). Other authors propose a methodology based on descriptive, documentary and field research, through the use of research tools such as: the observation sheet that allows demonstrating the current situation of companies, interviews and direct observation, in order to detect the problems arising in situ (Gómez, 2012).

For this reason, the Training Need Detection Process (DNC) aims to discover, integrate and prioritize training needs based on the analysis of the skills that are required of people to adequately perform the different activities and job roles.

For the development of this research, the methodology applied by (Carrión, 2005) is presented, which mentions the steps to be followed to carry out an effective diagnosis of training needs:

Stage 1: Situation Analysis (Training Needs Study)



A first step in this process will be the search and detection of training needs of each of the tourism companies in the parishes of San Francisco and El Sagrario, as well as the knowledge and skills necessary for work performance.

This process comprises four phases:

1. Individual Detection of Training Requirements
2. Characterization of Training Needs by company
3. Synthesis of Training Needs by company
4. Consolidation of Global Training Needs

First Phase:

For the individual detection of training requirements, a tool was designed and applied to collect information (interview) to all the officials involved. This interview was not anonymous since the needs or skills gaps are specific to each person.

Second Phase:

As a second step, the Characterization of Training Needs was carried out, this was done once, the instrument (interview) was applied to each of the people who are part of the rural tourism companies. The characterization of needs is proposed according to the criteria issued by a team of certified trainers, who raised the competency gaps that were found and that are likely to be solved through training actions.

Third Phase:

As a third step, a Synthesis of Training Needs by company was carried out, this by recording the findings on a matrix that allows to organize in a simple way the training needs present in each of the companies.

Once the results were consolidated, they were analyzed and training priorities were established according to different gaps detected, it should be noted that these were worked on according to their level of priority and importance.

Fourth Phase:

For the development of this phase, a Consolidated Global Training Needs was prepared and presented, which corresponds to the last phase of the process. In this document, the training needs must be grouped according to the demand found in each of the rural tourism companies in the parishes of El Sagrario and San Francisco in the Cotacachi canton.

DISCUSSION, ANALYSIS

Nowadays, jobs and professions in the tourism sector require constant updating of content, so that a task or function can be carried out correctly, which means that tourism actors must receive specific training in the face of these incessant advances (Peñaloza et al, 2011). In this sense, human capital is constituted as a strategic factor for the achievement of competitiveness objectives in the tourism organizations of the parish of El Sagrario and San Francisco of the Cotacachi canton. The economic growth of the tourism sector is largely determined by the development of its human resources (Lillo, 2012).

For the development of this research, several investigations were determined, of which the most important are presented. The data collected from these scientific articles correspond to the way in which the results are interpreted by the researcher, and as other authors say or have found on the subject.

In this sense, it is a question of elucidating what the results mean and why things happened that way.

Board 1: Analyzed Articles

Item Name	Author	Central theme
Diagnosis of training needs for the UBPC of Pinar del Río	Mabel Caridad Prieto Olivera Raida Alicia Pérez-Marimón[2]	In the achievement of a good DNC, both the immediate superiors and the personnel involved with the position must participate and both provide accurate, truthful and relevant data regarding the information requested, for this it is recommended that the personnel who participate, both on one side and the other, have knowledge of the information that is handled, understand it and contribute to the expansion of it.
Diagnosing Training Needs is a Local Issue	Efrén Méndez Morales	The object of study is the training and/or education needs of the officials who work in the CCSS programmatic units. In this type of research, the object is limited to this area, however, in the diagnostic designs it must be described. It should be noted that, in this type of study, an important set of training desires emerge that must be isolated and discarded because they do not constitute the essence of the object under investigation. A real need for training results from the performance gap that an official presents according to what he knows and what he should know in relation to institutional policies, the type of product or service provided by the programmatic unit and the functions he performs in his job.

		The desire for training results from the spirit of self-improvement, which is normal in most people but should not be included in the table of needs, given its reduced impact on the organization.

Source: The author

Item Name	Author	Central theme
Diagnosis of Training Needs in Public Officials	Díaz de Casanova, PeggyHernández, MaydelisPérez, Yamilet	The business environment is an agent of constant change and every day it becomes more and more globalized. That is why only organizations that ride at the forefront of these innovations are the most capable of adapting to the environment. Vocational training according to Hill (2007, p12) "constitutes the first stage of development of an individual or group of individuals that is characterized by a curricular program in some discipline and that allows those who obtain it to reach increasingly higher educational levels. In general, they are medium and long-term programs."
Diagnosis of Training Needs for the Animation and Entertainment Staff at the Marival Resort Nuevo Vallarta Hotel	Carlos A. Navarrete Cueto, Maira Rosalía Flores Peña, Mónica Guzmán Pérez, Omar de la Rosa Martínez	Usually those who work in the area of animation and tourist recreation have technical studies in English, they do not have a technical career in tourism and very few have a degree in tourism or related career, in some cases they have nothing to do with tourism and by chance of fate they are in that place doing their best around animation and tourist recreation.

Source: The author

The analysis of the scientific literature made it possible to determine the most relevant aspects of each of the investigations in relation to the topic of study. For Prieto & Pérez (2011), training is generally accepted as one of the best solutions to increase the productivity of organizations by improving the skills and knowledge of employees. On the other hand, (Méndez, 2004) emphasizes the meaning of training planning and the development of human talent as a key to determining the destiny of organizations, which beyond taking a reactive stance in the face of the changing environment of the tourism market, focuses on training as a specific solution to daily problems and contingencies.

Consequently, Casanova, Hernández, & Yamilet, (2018) state that for training to have a strategic sense, it is vital that it is adjusted to the needs of the organization. For this purpose, the Training Needs Diagnosis (DNC) approaches the needs of the business, the characteristics of the current position and the people who occupy the position, presenting a three-dimensional vision of the training process, and finally (Navarrete, Flores, Guzmán, & de la Rosa, 2019) they argue that training can be effective, only if it solves a problem that is

caused by a lack of knowledge, competencies and skills. It is for this reason that the Assessment of Training Needs is particularly necessary in today's changing environment. Consequently, the objective of the training needs diagnosis is to ensure that the training addresses existing problems, is adapted to the current and future objectives of the organization and is also carried out in an effective and cost-effective manner.

In accordance with the research carried out, the difficulties and deficiencies presented by the owners and collaborators of the tourist companies of the parishes of El Sagrario and San Francisco of the Cotacachi canton are exposed, through the structuring of a SWOT matrix with the purpose of identifying and diagnosing the environment in which tourism companies operate.

Bryant, (2002) defines this matrix as the "general state of interpretation of the data in light of the totality of the available evidence, including sources of bias and imprecision (internal validity) and discussion of external validity, as detailed in Table 2.

Board 2: Matriz Foda

STRENGTHS	**OPPORTUNITIES**
- Spaces with a quiet environment for training. - Evidence of training activities for the benefit of employees. - Personal motivations when planning a training. - Information is evidenced in ancestral customs and traditions of the locality for the study and development of a training plan. - Communities organized to carry out training. - Complex knowledge in tourism training.	- Coexistence of interaction between tourism collaborators. - Activities in the communities and the parish for economic benefits. - Training with more skills and values. - Quality customer service services.
WEAKNESSES	**THREATS**
- Insufficient trainers suitable for changing the vision of employees in charge of the tourism field. - Little help from the highest authorities. - Lack of attention to giving information to tourists who are interested in these topics. - Problems in providing a correct tourist service.	-Lack of investment by competent authorities. -Lack of information on rural tourism. -Lack of support with other tourism companies in providing training. -Hiring of trainers in tourism areas, but without adaptation in the processes. - Failures on the part of public authorities in detailing information on rural and urban tourism of tourist sites and establishments.

Source: The author

The SWOT matrix allowed us to observe positive and negative aspects presented by the tourism organizations of the parishes of El Sagrario and San Francisco del Canton Cotacachi.

Of the findings of the SWOT matrix, the most relevant strength refers to companies with spaces and a quiet environment for training, however, in contrast the most notorious weakness refers to the lack of planning on the part of public and private organizations.

Within the opportunities aspect, the diversity of tourist activities that can be developed in communities and parishes as a means to obtain an economic benefit that allows maintaining sustainable and sustainable tourism is highlighted. Finally, it is considered that the greatest threat corresponds to the insufficiency of trainers in tourism issues, which allow substantially improving the daily performance of companies, especially when training in tourism companies in the canton of Cotacachi and its parishes, must be conceived precisely as models of education and training of technical skills, through which it is necessary first, To form a culture of corporate identity, based on the social values of productivity and quality in operational tasks. (Reyes & Óscar, 2011)

Based on the above, it was possible to obtain a real vision of the current state of tourism workers regarding the type of knowledge they have, what skills they have and what level of education they have, thus evidencing the importance of having a diagnosis on the need for training presented by companies in the tourism sector of the Cotacachi canton. It is worth mentioning as an important fact that the people who are dedicated to tourism in the Cotacachi canton, over the years have been developing empirical knowledge, most of them based on years of experience serving the tourist and overcoming the difficulties that arise in the operational part day by day, becoming this the factor responsible for the poor quality in the provision of the service. causing dissatisfaction in the tourist for the services received.

RESULTS

According to the research carried out and the data exposed, the difficulties and deficiencies presented by the owners and collaborators of tourist establishments in the fields of: technology management, administrative processes, assertive communication, customer service, sales and tourist information are shown, the data show that all these establishments present serious difficulties, this is largely due to the lack of commitment and accompaniment on the part of the of local governments, through the execution of training programs, which causes tourism servers to have less knowledge of the processes within tourism activities.

Below is a matrix with the training needs presented by tourism companies in the parishes of El Sagrario and San Francisco de Cotacachi.

Board 3: Training Needs Matrix

Training Needs Matrix			
Problems	**Requirement**	**Proposal**	**Solution**
Language management.	Workers who know how to speak different languages in special English.	Provide English courses by the owners to the reception staff.	Invest in language trainings for front desk staff.
Registration in office programs.	Contracted staff must have knowledge of the use of office programs for reception.	Knowledge in the use of office programs such as Excel and Word.	Manage training workshops for the management of office programs.
Document system management.	Staff who manage matrices for the registration of activities carried out by guests.	Establishments should use different documents for the registration of activities.	Create different matrices for activity logging.
Booking management.	Establishments must have several forms of reservation to facilitate the customer's accommodation.	Have applications that help the receptionist to keep a good control of the reservations.	Research the different applications that exist for bookings.
Payment methods.	Establishments must have several means for the customer to make their payment.	Provide training to personnel through different financial institutions.	Hire a finance specialist to guide staff on payment methods.
Technology management.	Always be informed about the evolution of technology.	Acquire new technological equipment.	Train personnel in the use of new technological equipment.
Assertive communication.	Interest on the part of the owners in maintaining communication in an efficient way.	Have training processes in oral and written communication.	Train staff in effective communication.

Fountain. The author.

Once the difficulties were identified and with the sample obtained from the analysis of the interviews, the findings of the research were reviewed. Thus, the results show five points of interest for those who propose to implement a training program. These points are: assertive communication, the use of technology, languages, administrative processes, sales and customer service, the latter being the most relevant that must be prioritized and covered in relation to the demand for tourism services.

In this sense, training in customer service is the first priority of establishments dedicated to tourism, this need becomes a fundamental aspect for the development of tourism in this sector, under this perception it becomes necessary and important that employees improve their knowledge, skills and abilities, so that they can offer a quality service to each of the customers. in addition to generating added value to the business, in a way that allows customer loyalty, these being the key engine for the tourism development of organizations.

The second point of interest or priority for training is in the administrative processes, although the owners of the tourist establishments develop an empirical administration, it is considered that it is necessary to reinforce this knowledge, this in order to measure compliance with the processes through indicators and results.

The use of technology as a third important point or training priority. When starting a business, it is necessary to have the necessary knowledge in technology and handling of state-of-the-art equipment, since they become vital actions to be able to promote, sell and to relate to the customer and society.

Assertive communication is the next point of interest, the owners of these establishments are mostly elderly people. Under this appreciation, it should be mentioned that the importance of proper communication management and basic learning of the English language should be considered, a primary point within the service to tourists.

Finally, the need for sales training. In tourism it is necessary to know how to sell. Sales training serves as a business development engine since it provides tools that are focused on facilitating sales in a better way and with a higher volume.

However, it is important to mention that state entities must pay special attention to these training points in order to solve them and provide a greater experience within the tourism activity. Tourism workers must be willing to receive training that allows them to successfully acquire a good relationship with the tourist. In addition to this, companies must take the initiative and develop programs with expert trainers in each of the aforementioned topics in order to improve the tourist experience within the Parishes.

Finally, it should be mentioned that despite the fact that most of the rural tourism companies in the parish of El Sagrario and San Francisco intend to give the necessary support to customers and propose the non-need for training, these begin to be relevant until companies begin to face problems in these aspects. Only then will companies understand the need to implement training programs on service quality strategies.

It is worth mentioning that companies that do not listen to or respond to the needs of their customers can experience serious difficulties during loyalty. For this reason, it is necessary for these companies to ensure that each of the services provided to customers is carried out in a way that makes them feel unique and special, which is why a series of competencies that can only be achieved through training are presented below.

Board 4: Skills to be acquired through training

Skills to be acquired through training				
Facility Management	**Languages**	**Customer Care and Service**	**Hospitality**	**Quality culture**
Budget control	Technical English Management	Customer service	Providing quality service	Tourist organization
Technology know-how	Basic French skills	Care for children	Managing Good Habits	Social behaviour
Advertising	Kichwua	Care for the disabled	Handling with each of the types of customers.	Learning in tourism areas
Marketing and promotion	Spanish	Attention to foreigners and locals	Skills specific to the position of managing informant.	Goals and objectives
Communication	Communication	Customer Experience	Knowledge of the client's needs.	Knowledge of local products
Business management	Linguistics	Tourist excitement	Knowledge and correct use of protocol rules	Knowledge of the territories
Business and Commercial Management	Grammar	Problem Management	Use of the client's language orally and in writing.	Consumer Safety and Protection
Analyst and planner in training programs	Phonetics	Customer Support	Cultural and entertainment services.	Principles of continuous improvement

Fountain. The author

CONCLUSIONS

Tourism has been going through great changes, the needs and demands of tourists are becoming stronger, this means that companies must promote and implement a culture of constant learning, which allows employees to perfect their professional skills and abilities. It is important for every company to carry out periodic diagnoses that allow the generation of planned processes of continuous training based on the needs of customers.

The Tourism Sector Plan 2021-2025 proposed by the executive aims to reactivate tourism and turn it into a sustainable economic activity whose contribution to the well-being and wealth of the country is recognized and valued (MINTUR, 2021) this proposal is associated with the development of labor capacities of the tourism actors of the Cotacachi canton. In this sense, the generation of knowledge is achieved through the implementation of strategies aimed at promoting reflection and the systematization of knowledge through daily practice that allow them to face significant situations linked to the environment.

The application of a DNC should always be directed towards the preparation of personnel, it is better to have professionals specialized in tourism who have the ability to adapt the methodology to the different target groups during the teaching-learning process. As a result, the establishments must monitor variables such as knowledge, skills, abilities,

experience and attitudes in the personnel under their charge, in addition to establishing the characterization of the profile corresponding to the position they perform.

It is necessary that the owners of each tourism company allocate a percentage of the budget generated annually for the implementation of a training plan that allows strengthening the individual and collective capacities of the service providers of the Cotacachi canton. From the above, it is evident that tourism is one of the economic activities that present sustained and sustainable growth, with a growing demand, which demands a greater generation of personalized and quality experiences, so there is an express and fundamental need for continuous improvement in sectoral labor skills.

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ASSOCIATION BETWEEN IL-1, IL-6, TGF-β AND IFN-γ SINGLE NUCLEOTIDE POLYMORPHISMS AND AUTISM SPECTRUM DISORDER: SYSTEMATIC REVIEW AND METANALYSIS

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ABSTRACT

Autism spectrum disorders (ASDs) constitute a group of neurodevelopmental disorders with increasing incidence. Cytokine changes may affect the integrity of the central nervous system, contributing to neuroinflammation and behavioral symptoms in patients with ASD. Single nucleotide polymorphisms (SNPs) can lead to immune disorders such as this. Therefore, the aim of the present study was to perform a systematic review and meta-analysis to determine whether cytokine SNPs are more common in individuals with ASD. A systematic search of seven databases was conducted on September 19, 2023. Odds ratios (ORs) were used in the meta-analysis to test the association between each SNP and ASD. Six studies were included. Four cytokines were investigated: interleukin-1 (IL-1), IL-6, transforming growth factor beta (TGF-β) and interferon-γ (IFN-γ). Although some studies alone have associated genotypic and allelic variants with ASD, the pooled results of the studies were not statistically significant in the meta-analysis. Our systematic review highlights important gaps and inspires new studies to investigate significant associations between genetic variations in different cytokines and the development of ASD.

Keywords: Autistic disorder. Single nucleotide polymorphisms. Behavioral symptoms. IL-1. IL-6. TGF. IFN-γ.

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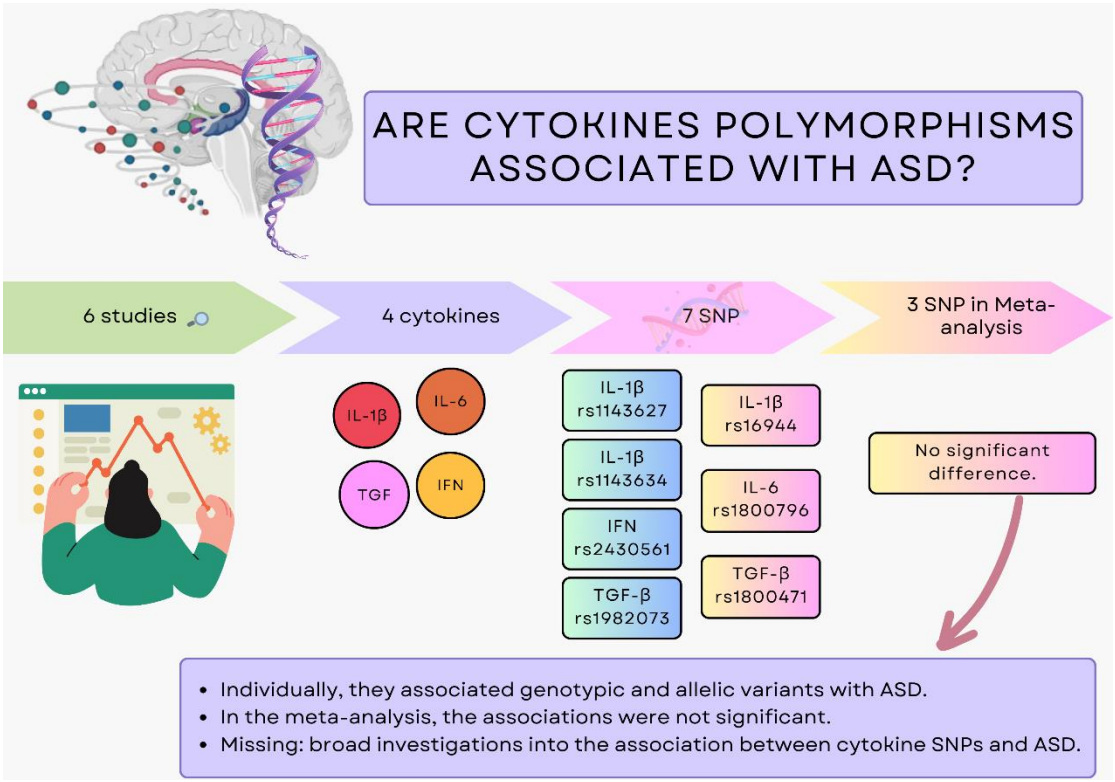
GRAPHICAL ABSTRACT



INTRODUCTION

Autism spectrum disorder (ASD) is a group of neurodevelopmental disorders characterized by impairments in social interaction, communication, and stereotypical patterns of behavior and interests[1]. The incidence has increased significantly in recent years[2]. At least one in every hundred children worldwide has autism[3].

It is a multifactorial disorder with an etiology associated with genetic, epigenetic, and environmental factors, such as parental conditions and intrauterine and perinatal factors. Hundreds of genes are involved in ASD, resulting in a spectrum with different phenotypes, including language and social deficits, along with several associated subphenotypes[4].

Immune disorders, especially neurological development deficits, seem to be prominent in the pathogenesis of ASD, especially in neurological development deficits[5]. Cytokines can alter the functional and structural integrity of the central nervous system (CNS), contributing to neuroinflammation and influencing behavior[6]. Altered levels of cytokines, such as interleukin-1 (IL-1), IL-2, IL-6, tumor necrosis factor-α (TNF-α), TNF-β and interferon-γ (IFN-γ), have been found in individuals with autism[7].

IL-1β, an important proinflammatory cytokine, is expressed during crucial early stages of development. However, increased IL-6 levels in autistic children are positively correlated with autism severity, behavioral abnormalities, and increased IL-6 production[8]. IL-6 and IFN-γ are related to neurodevelopment. Reduced levels contribute to normal physiological development, whereas elevated levels are associated with neuroinflammatory processes that can cause neural abnormalities[9]. Transforming growth factor beta (TGF-β) is considered a crucial regulator of CNS development. However, studies suggest that there is a decrease in TGF-β1 levels in the serum of patients with autism[10,11]. Lower levels are associated with worse behavioral symptoms[11].

Understanding the factors that increase susceptibility to ASD and its development can improve patients' quality of life and treatment[2]. Therefore, single nucleotide polymorphisms (SNPs) in cytokine genes can modify genetic transcription and cytokine secretion[12], thus influencing the behavioral symptoms of patients with ASD. Studies that evaluate genetic changes in patients with ASD analyze SNPs. However, the relationship between cytokine gene SNPs and autism is unclear[13]. Therefore, the objective of the present study was to carry out a systematic review and meta-analysis to determine whether cytokine SNPs are more common in individuals with ASD.

MATERIAL AND METHODS

The present study consists of a systematic review and meta-analysis performed and reported following the Meta-analysis Of Observational Studies in Epidemiology (MOOSE)[14] statement and the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines[15].

SURVEY QUESTION AND ELIGIBILITY CRITERIA

The guiding question of the research was “Are inflammatory cytokine polymorphisms more frequent in children with ASD?” To answer this question, case–control studies that evaluated the presence of polymorphisms in neurotypical individuals (control group) and in individuals with ASD (group) were selected. Family-based studies, editorials, comments and opinions, reflection articles, projects, technical reports, reviews, and articles that did not answer the question were excluded from this review.

DATA SEARCH STRATEGY

A systematic search of the Embase, PubMed, Web of Science, Scopus, Science Direct, and Google Scholar databases was carried out to identify all relevant publications without language restrictions. The search strategy was structured with the following terms: (Interleukin OR Chemokines) AND ("Autistic Disorder" OR Autism OR TEA) AND (“Single Nucleotide Polymorphism” OR Polymorphism OR variant OR gene).

STUDY SELECTION

Two reviewers (MAO and RRS) independently examined the search results and identified potentially relevant studies on the basis of the article titles and abstracts. The selected articles were read in full, and only the relevant ones, consistent with the eligibility criteria, were included in our study. Any disagreements were resolved after discussion with a third reviewer (PLS). Reference lists of the retrieved studies were consulted to identify additional relevant studies.

DATA EXTRACTION

Data extraction from the manuscripts was carried out in accordance with the eligibility criteria, and the extracted data were recorded in a spreadsheet. The following information was extracted from each article: name of the author(s), year of publication, total number of subjects (cases/controls), country where the research was carried out, and

cytokines and SNPs. Genotype and allele counts for cases/controls, along with p values, are listed.

QUALITY ASSESSMENT

The Newcastle–Ottawa Scale (NOS)[16] was used to evaluate the methodological quality of the selected studies. Two independent reviewers (MAO and the RSS) carried out the validity assessment. All discrepancies were resolved by discussion between the two reviewers. The NOS scale is based on three perspectives: selection of study groups (maximum of one star for each column), comparability of groups (maximum of two stars) and exposure (maximum of one star for each column). Studies that received a score equal to or greater than 6 were considered high quality and included in the review.

STATISTICAL ANALYSIS

Data were extracted from full-text articles into structured tables containing all the descriptive variables and relevant outcomes. Information such as author, country and year of study; number of cases, controls, and polymorphisms studied; and the OR and p value of each group was collected.

Odds ratios (ORs) were used in the meta-analysis to test the association between each SNP and autism spectrum disorder in case–control studies; 95% confidence intervals were included, and p values < 0.05 were considered statistically significant. Five genetic models for each SNP corresponding to dominant, recessive, homozygote, heterozygote, and allelic modes of inheritance were investigated. Heterogeneity was evaluated via the chi-square-based Cochran's Q statistic and the I2 index. When high heterogeneity ($p < 0.1$ for the Q test or $I2 > 50\%$) was detected, the random-effects model was employed for meta-analysis; otherwise, a fixed-effects model was applied.

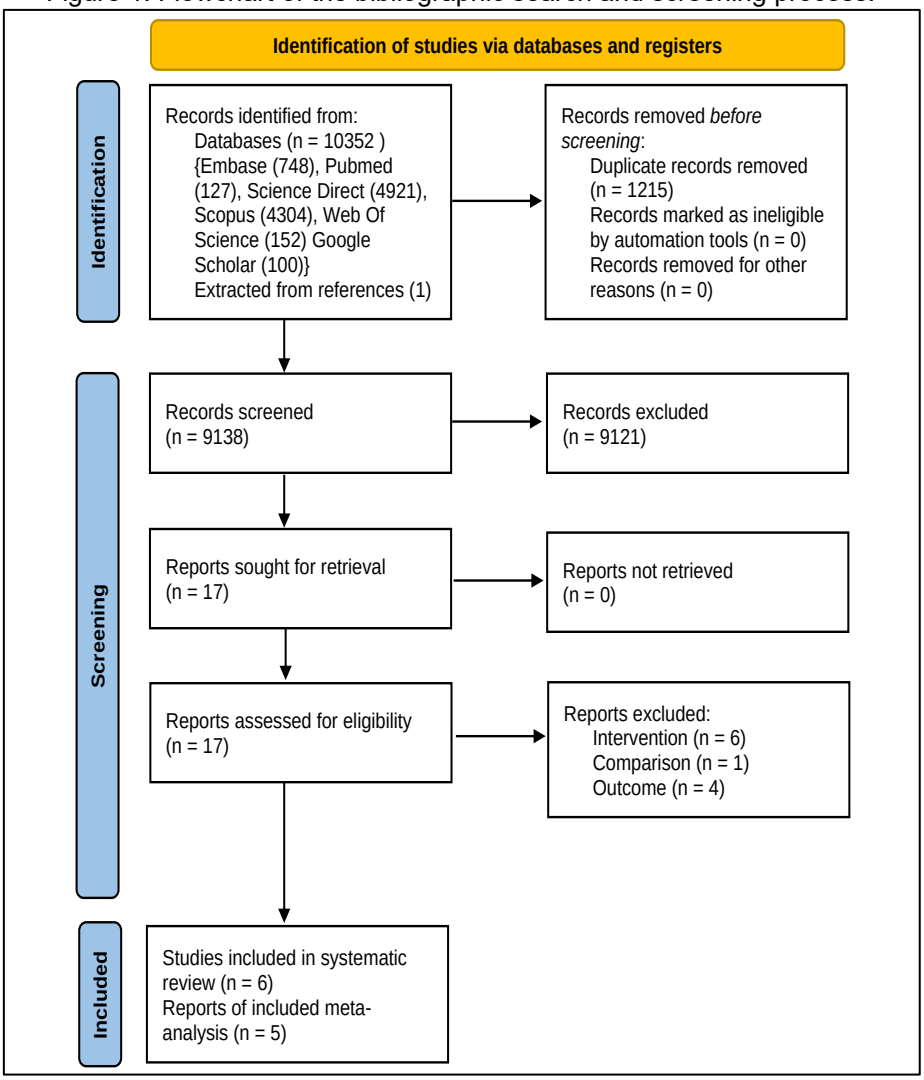
Sensitivity analysis was performed by excluding individual studies from the pooled ORs and recalculating the statistical significance to assess the stability of findings and to ascertain whether final pooled effect sizes were affected by a single publication. Pearson's chi-square test was applied to examine Hardy–Weinberg equilibrium (HWE) in the healthy control group. HWE was reached if $p > 0.05$. For all the analyses, Review Manager Version 5.3 software (Cochrane Collaboration, Copenhagen) was used.

RESULTS

STUDY SELECTION

The search yielded 10,352 potentially relevant records. Of these, 748 were retrieved from Embase, 127 from PubMed, 4,921 from Science Direct, 4,304 from Scopus, 152 from Web of Science and the top 100 from Google Scholar. Additionally, one article was retrieved from a reference. After the titles and abstracts were analyzed, 17 full texts were assessed for eligibility, and 6 (six)[2,8,17–20] were included in the review. The flowchart of the study selection process and the specific reasons for exclusion are detailed in Figure 1.

Figure 1: Flowchart of the bibliographic search and screening process.



The selected studies were published between 2015 and 2022. Two studies were carried out in Iraq[18,20], one in China[2], Egypt[8], Iran[19] and one in Turkey[17]. The study populations ranged between 74[19] and 350[2] participants. Studies have evaluated polymorphisms in IL-1β[2,8,17], IL-6[2,17], IFN-γ[20] and TGF-β1[18,19]. Table 1 summarizes the

characteristics of the studies included in the systematic review. Table 2 shows their genotypic and allele frequencies.

Table 1. Characteristics of the included studies.

Study (Year)	Country	Cases	Control	Cytokine	Polymorphisms studied
Han et al (2021)	China	98	252	IL-1β	16944
Han et al (2021)	China	98	252	IL-6	1800796
Kaleel et al (2020)	Iraq	94	100	IFN-γ	2430561
Khakzad et al (2015)	Iran	39	35	TGF-β1	1982073
Khakzad et al (2015)	Iran	39	35	TGF-β1	1800471
Saad et al (2020)	Egypt	80	60	IL-1β	16944
Saad et al (2020)	Egypt	80	60	IL-1β	1143627
Smail et al (2020)	Iraq	40	40	TGF-β1	1982073
Smail et al (2020)	Iraq	40	40	TGF-β1	1800471
Uyanik et al (2022)	Turkey	65	62	IL-1β	1143634
Uyanik et al (2022)	Turkey	95	84	IL-6	1800796

Table 2. Genotypic and allelic frequencies present in the studies.

Study	Cases					Control					HWE p value
16944											
Han et al	AA	AG	GG	A	G	AA	AG	GG	A	G	
	28	51	19	107	89	67	140	45	274	230	0.0575
Saad et al	TT	TC	CC	T	C	TT	TC	CC	T	C	
	4	45	31	56	104	11	31	18	88	32	0.7124
1982073	TT	TC	CC	T	C	TT	TC	CC	T	C	
Khakzad et al	20	13	6	53	25	11	17	7	39	31	0.9259
Smail et al	11	25	4	47	33	13	21	6	47	33	0.5989
1800796											
Han et al	CC	CG	GG	C	G	CC	CG	GG	C	G	
	48	43	7	139	57	116	118	18	350	154	0.1008
	CC	CG	GG	C	G	CC	CG	GG	C	G	
Uyanik et al	56	36	3	148	42	61	21	2	143	25	0.941
1800471	GG	GC	CC	G	C	GG	GC	CC	G	C	
Khakzad et al	27	11	1	65	13	30	4	1	64	6	0.1091
Smail et al	32	6	2	70	10	16	18	6	50	30	0.8003
2430561											
Kaleel et al	TT	TA	AA	T	A	TT	TA	AA	T	A	
	19	3	72	22	75	15	52	33	67	85	0.4543
1143627	CC	CT	TT	C	T	CC	CT	TT	C	T	
Saad et al	20	35	25	84	76	14	27	19	66	54	0.4679
1143634	CC	CT	TT	C	T	CC	CT	TT	C	T	
Uyanik et al	30	34	1	94	36	37	18	7	92	32	0.0569

IL-1β

Polymorphisms in IL-1β were investigated at the SNPs rs16944, rs1143627 and rs1143634. Saad et al. analyzed the rs16944 SNP for IL-1β-511 and detected significantly higher frequencies of homozygous (CC), heterozygous (TC) and allele (C) genotypic variants in the ASD group than in the control group (OR: 2.36, 95% CI: 1.06–5.18; OR:

2.04, 95% CI: 1.06–38; p = .039, respectively)[8]. In contrast, Han et al. reported no significant differences in the genotypic and allelic frequencies of polymorphisms between the ASD and control groups (p > 0.05)[2].

In the case of the rs1143634 polymorphism investigated by Uyanik et al., the TT variant genotype and the T allele were not associated with ASD (p > 0.05), but CT carriers were associated with an increased risk of developing ASD (OR: 2.330, 95% CI: 1.104–4.918; p = 0.02)[17]. On the other hand, when rs1143627 was analyzed for IL-1β-31C/T, Saad et al. reported no significant difference between the groups, neither for alleles nor for genotypes (p > 0.05)[8].

IL-6

The IL-6 polymorphism was investigated at SNP rs1800796 in two studies[2,17]. The first study revealed no significant differences in the genotypic and allelic frequencies of the IL-6-572C/G polymorphism between the ASD and TD groups[2]. In contrast, another study associated GC carriers with an increased risk of developing ASD (OR: 1.867, 95% CI: 0.976–3.573; p = 0.05). However, the authors also reported no significant difference between the case and control groups for the alleles and other genotypes[17].

TGF-β

Two studies[18,19] investigated two TGF-β polymorphisms, the SNPs rs1982073 and rs1800471. Both studies did not detect a significant association between genotypes or alleles and ASD (p >0.05) when rs1982073 was analyzed. However, when rs1800471 was analyzed, the studies presented different results. While one[19] did not significantly differ, another[18] highlighted a significantly greater G allele frequency in the patient group than in the control group (OR: 4.200, 95% CI: 1.882–9.372; p = 0.0003) and a significant association in the recessive model (GG vs. GC/CC: OR: 6.00, 95% CI: 2.206–16.32; p = 0.0003).

IFN-ɣ

rs2430561 of IFN-ɣ +874A/T was analyzed in only one study[20]. The authors reported a greater number of T alleles (p = 0.00) in the control group and a greater number of AA genotypes in the ASD group. However, the work did not present statistical analyses of the genotype, making it difficult to infer significance.

QUALITY OF THE STUDIES

As depicted in Table 3, all studies included in this systematic review had good overall methodological quality, with NOS scores ranging from 6 to 7.

Table 3: Risk of bias of the included studies in the systematic review using the Newcastle–Ottawa (NOS) quality assessment scale for case–control studies.

Study	Selection				Comparability	Exposure		
	1	2	3	4	1	1	2	3
Han et al	☆	-	☆	☆	☆☆	☆	☆	
Kaleel et al	☆	-	☆	☆	☆☆	☆	-	-
Khakzad et al	☆	-	-	☆	☆☆	☆	☆	-
Saad et al	☆	☆	-	☆	☆☆	☆	☆	-
Smail et al	☆	-	-	☆	☆☆	☆	☆	
Uyanik et al	☆	☆	☆	☆	☆	☆	☆	-

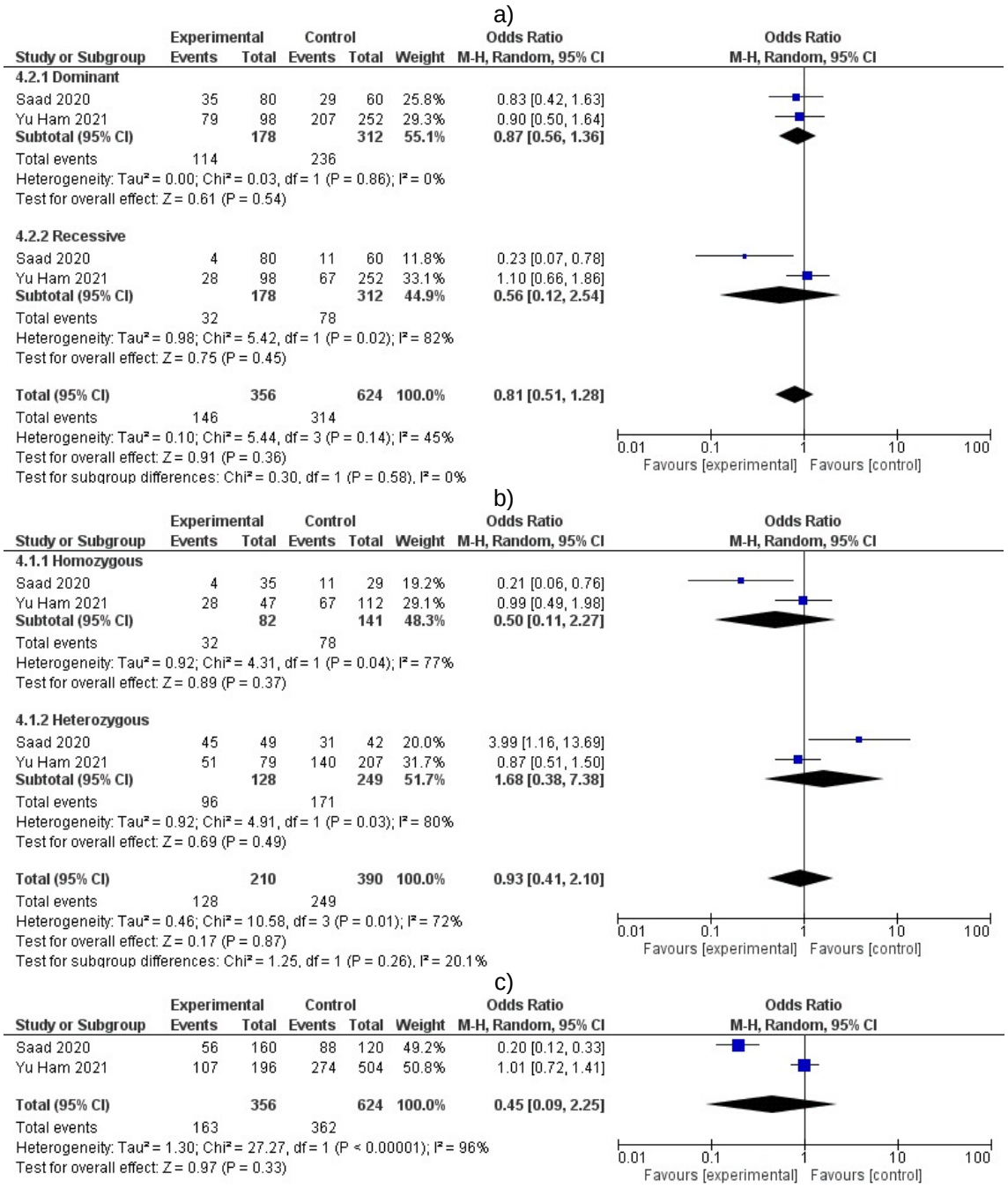
Selection: 1. Adequate case definition; 2. Representativeness of the cases; 3. Selection of controls; 4. Definition of controls. Comparability: 1. Comparability of cases and controls on the basis of the design or analysis. Exposure: 1. Ascertainment of exposure; 2. The same method of ascertainment for cases and controls; 3; Nonresponse rate.

METANALYSIS

rs16944 polymorphism

Overall, two studies[2,8] involving 178 cases and 312 healthy controls were found to be eligible for inclusion in the quantitative analysis of the association between the rs16944 SNP and autism spectrum disorder. The pooled OR revealed no significant associations between the rs16944 SNP and autism spectrum disorders across all the genotype models, including the dominant model (OR 0.87, 95% CI 0.56–1.36, P = 0.86), recessive model (OR 0.56, 95% CI 0.12–2.54, P = 0.02), allelic model (OR 0.45, 95% CI 0.09–2.25, P = <00001), homozygote model (OR 0.5, 95% CI 0.11–2.27, P = 0.04), and heterozygote model (OR 1.68, 95% CI 0.38–7.38, P = 0.03). The analyses of the recessive and heterozygous genotype groups revealed a moderate degree of heterogeneity (I^2 82%; I^2 80%, respectively) (Figure 2).

Figure 2: Pooled odds ratios and 95% confidence intervals for the association between the rs16944 and the development of ASD.



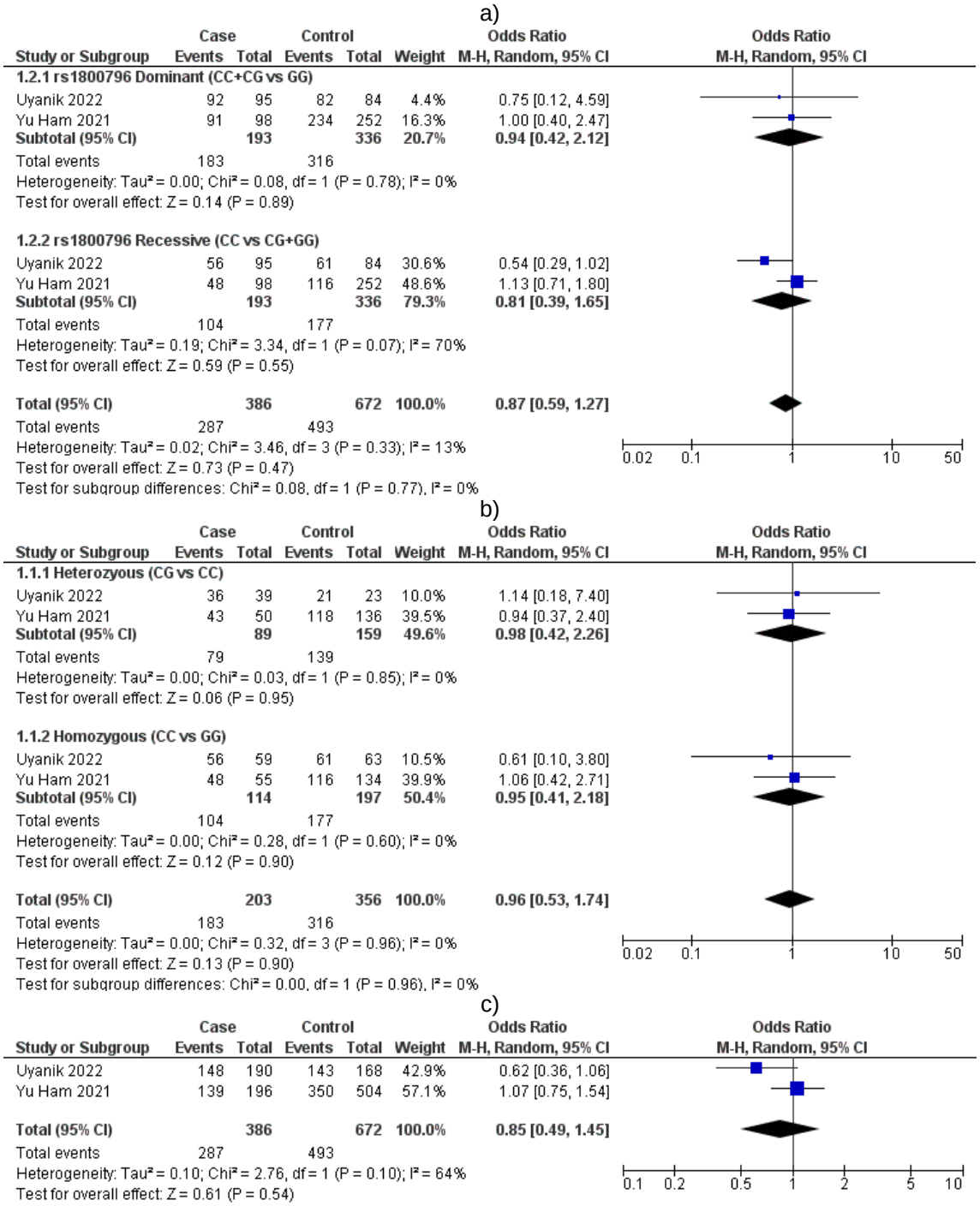
(a) Dominant and recessive models. (b) Homozygous and heterozygous models. (c) Allelic model.

rs1800796 polymorphism

Two studies[2,17] involving 193 cases and 336 healthy controls were considered eligible and included for quantitative analysis of the association between the IL-6 SNP rs1800796 and ASD. The pooled OR revealed no significant association between the rs1800796 SNP and the risk of developing ASD in any of the genotype models, including the dominant model (OR 0.94, 95% CI 0.42–2.12; P = 0. 78), recessive (OR 0.39–1.65, P = 0.07), allelic (OR 0.85, 95% CI 0.49–1.45, P = 0.10), homozygous (OR 0.95, 95% CI 0.41–2.18, P = 0.60) and heterozygous (OR 0.98, 95% CI 0.42– 2.26, P = 0.85). The analyses of

the recessive genotype and allele groups revealed a moderate degree of heterogeneity (I^2 70%; I^2 64%, respectively) (Figure 3).

Figure 3: Pooled odds ratios and 95% confidence intervals for the association between the rs1800796 and the development of ASD.



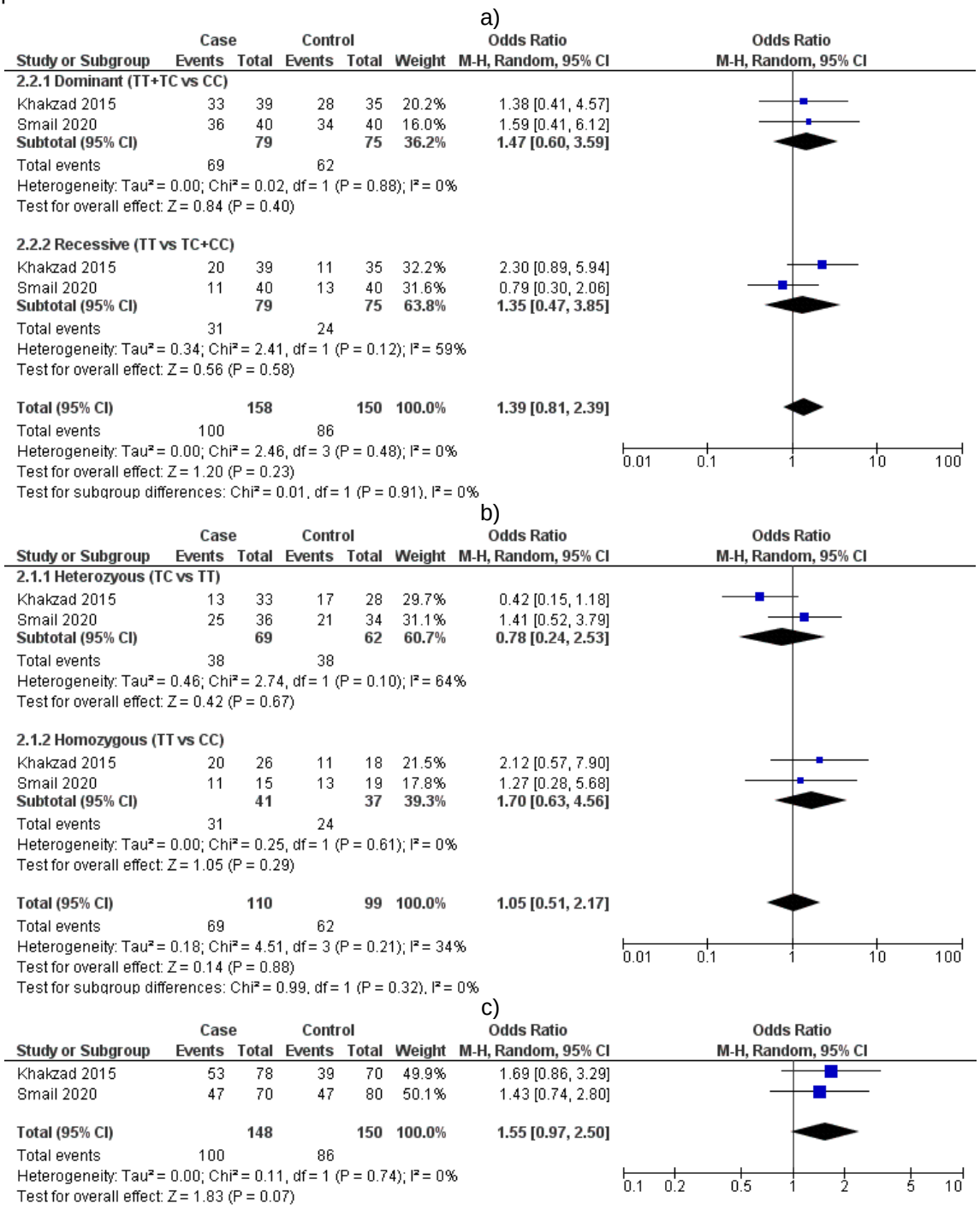
(a) Dominant and recessive models. (b) Homozygous and heterozygous models. (c) Allelic model.

rs1982073 and rs1800471 polymorphisms

Two studies[18,19] involving 79 cases and 75 healthy controls were considered eligible and included for quantitative analysis of the association between TGF-β1 polymorphisms and ASD. There was no significant association between the rs1982073 SNP and ASD

patients in any of the analyzed models, including the dominant model (OR 1.47, 95% CI 0.60–3.59, P = 0.88), recessive model (OR 1.35, 95% CI 0.47–3.85, P = 0.12), allelic model (OR 1.55, 95% CI 0.97–2.50, P = 0.74), homozygous model (OR 1.70, 95% CI 0.63–4.56, P = 0.61) and heterozygous model (OR 0.78, 95% CI 0.24–2, 53, P = 0.10). The analyses of the recessive and heterozygous genotype groups revealed a moderate degree of heterogeneity (I^2 59%; I^2 64%, respectively) (Figure 4).

Figure 4: Pooled odds ratios and 95% confidence intervals for the association between the rs1982073 and the development of ASD.

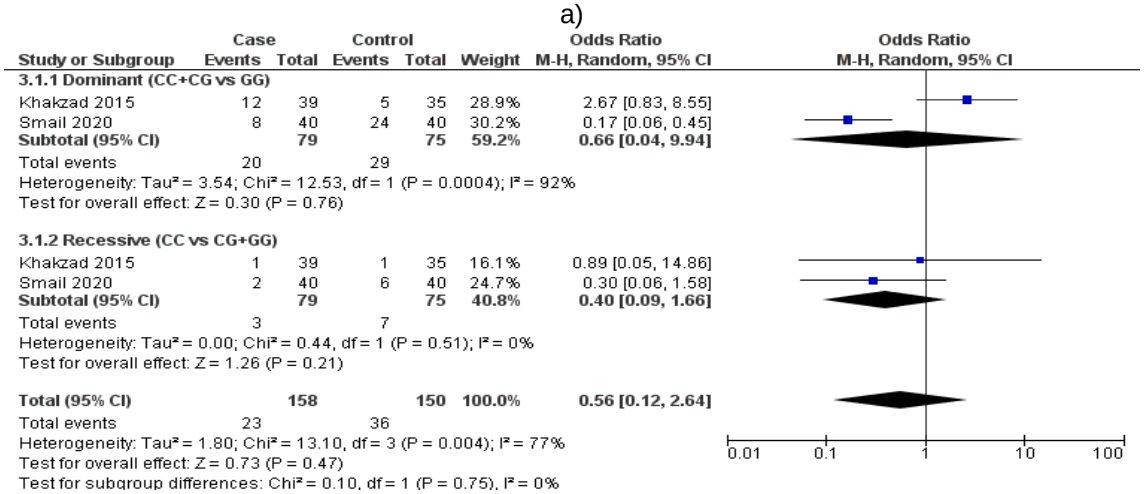


(a) Dominant and recessive models. (b) Homozygous and heterozygous models. (c) Allelic model.

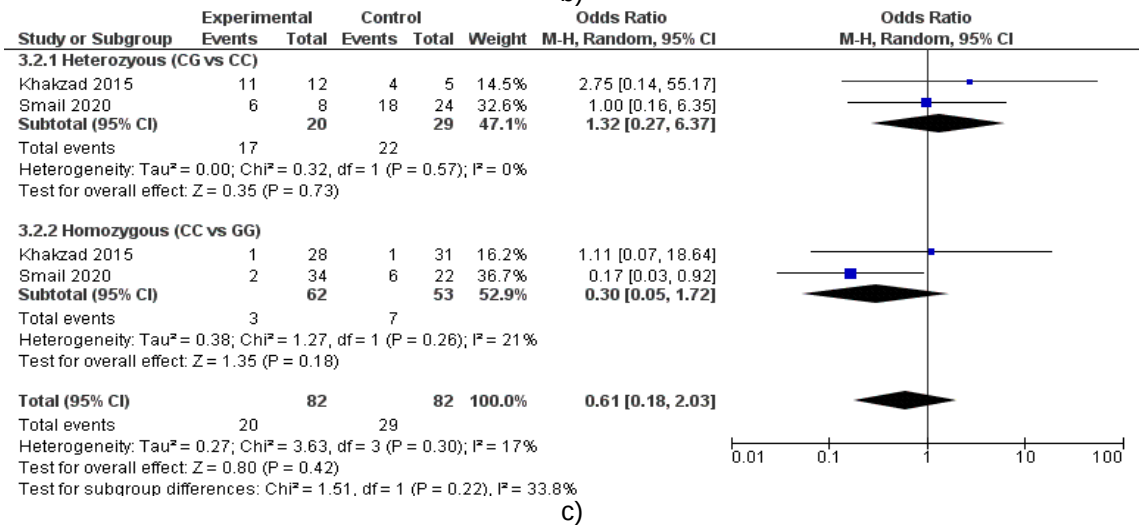
Our results also revealed no significant associations between the rs1800471 SNP and ASD risk in any of the genotypic models, including the dominant model (OR 0.66, 95% CI 0.04–9.94, P = 0.0004), recessive model (OR 0.40, 95% CI 0.09–1.66, P = 0.51), allelic model (OR 0.70, 95% CI 0.08–5.96, P = 0.001), homozygous model (OR 0.30, 95% CI 0.05–1.72, P = 0.26) and heterozygous model (OR 1.32, 95% CI 0.27–6, 37, P = 0.57). The analyses of the dominant genotype and allele groups revealed a high degree of heterogeneity (I^2 92%; I^2 91%, respectively) (Figure 5).

Figure 5: Pooled odds ratios and 95% confidence intervals for the association between the rs1800471 and the development of ASD.

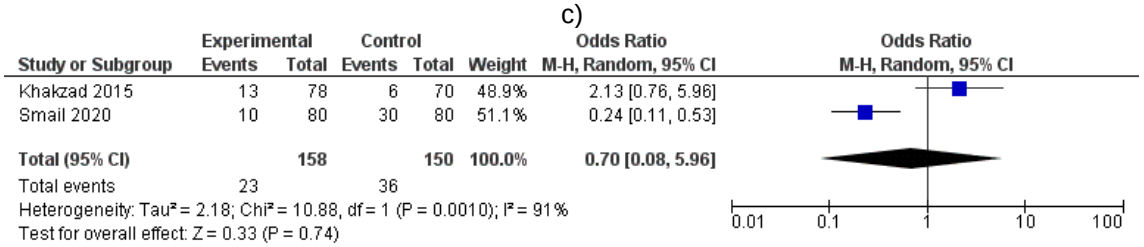
a)



b)



c)



(a) Dominant and recessive models. (b) Homozygous and heterozygous models. (c) Allelic model.

DISCUSSION

To our knowledge, this is the first systematic review and meta-analysis to examine whether inflammatory cytokine polymorphisms are more common in individuals with ASD. Our results indicate that although some studies have associated genotypic and allelic variants with ASD in isolation, the pooled results of the studies were not statistically significant in the meta-analysis. Therefore, it is not possible to infer whether there is an association between the investigated SNPs and ASD. Studies investigating this issue are scarce, and the polymorphisms of many inflammatory cytokines have not yet been investigated. Consequently, this review highlights major gaps and important points that need to be explored in future research.

Cytokines regulate the type and magnitude of immune function, influencing neurodevelopment[21–23]. These molecules require adequate regulation to maintain a balance between pro- and anti-inflammatory responses. Recent systematic reviews involving 17[24] and 38[25] studies have shown that the levels of the proinflammatory cytokines IL-1β, IL-6, and IFN-γ are increased in individuals with ASD, providing evidence of innate activation and dysregulation. On the other hand, other studies have detected a decrease in the level of TGF-β1, which has anti-inflammatory activity, in patients with autism[10,11,26–28].

Increased levels of the cytokines IL-1β and IL-6 are associated with worse behavioral scores[29]. Similarly, lower levels of TGF-β1 have been associated with worse behavioral symptoms[11] and the severity of autism[10,27,28]. These findings suggest that there is a continuous proinflammatory state in patients with ASD, where disturbances in immune responses affect central behaviors. One of the factors that can influence these immunological disorders is the presence of polymorphisms[23,30].

SNPs are the most common form of genetic variation in the human genome and are becoming important markers in clinical diagnosis and genetic research[31,32]. Among the polymorphisms identified in this review, rs1800796 of IL-6 can alter the circulating levels of this cytokine through complex interactions according to the haplotype[33]. Conversely, the rs2430561 polymorphism of IFN-γ is associated with a decrease in the concentration of IFN-γ[20]. The IL-1β polymorphisms rs16944, rs1143634 and rs1143627 that were identified in the review are associated with increased expression of cytokines[34,35]. While rs16944 is related to increased transcriptional activity[36], rs1143627 is associated with reduced promoter activity, and the rs1143627 polymorphism increases transcription factor binding[37].

Thus, functional polymorphisms of cytokine genes are considered risk factors for Alzheimer's disease (IL-10 rs1800871)[38], Parkinson's disease (IL-6 rs1800795)[39], gastric cancer (TNF-α rs1799724, IL-8 rs2227532 and IL-10 rs1800872)[40] and bipolar disorder (IL-

1 rs1143627, rs16944, rs1143623, and rs12621220)[41]. Despite their importance, SNPs involve only a single type of genetic and environmental interaction, especially in complex disorders such as ASD. However, studies that explore this association with autism are still scarce, and new research could contribute to understanding the development of this disorder.

The present review revealed six studies that evaluated seven SNPs of four different cytokines. Although some of these studies revealed an association between genotypic variants and autism, this review is not able to prove such an association. The scarcity of studies and low number of participants contributed to a moderate to high degree of heterogeneity between studies, making it impossible to obtain conclusive results on this hypothesis. Therefore, considering that cytokines are important modulators of behavior and that polymorphisms can influence their expression, further studies investigating these associations must be carried out.

CONCLUSION

Although some studies have associated genotypic and allelic variants with ASD alone, the pooled results of these studies were not statistically significant in the meta-analysis. Furthermore, few studies have carried out these investigations; therefore, more studies are needed to validate the results presented herein. Our systematic review highlights important gaps and inspires new studies involving larger populations and different ethnic groups to investigate significant associations between genetic variations in different cytokines and the development of ASD.

CONFLICTS OF INTEREST

All the authors have read and approved the contents and manuscript.

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EVALUATION OF THE CENTRAL REGION OF MARICÁ FROM THE PERSPECTIVE OF DEVELOPMENT ORIENTED TO PUBLIC TRANSPORT – DOT

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ABSTRACT

This article aims to evaluate the central region of the municipality of Maricá - RJ, from the perspective of Public Transport-Oriented Development - DOT (ITDP, 2024). A territorial cut in the Municipality of Maricá will be presented from the perspective of the five characteristics of the DOT (VTPI, 2019). It is expected to survey the advances in urban mobility, which this city can offer as an example to other Brazilian cities, as well as identify the weak points to be mitigated. The article concludes that the five characteristics of the DOT are partially met in Maricá. It is recommended that future studies evaluate the contrast present in the central region with the other neighborhoods, which have lower population density and less urban attractions. It is expected that this research will encourage the application of the DOT concept in cities, increasing traffic quality and sustainability.

Keywords: Land Use and Transport. Urban Planning.

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INTRODUCTION

In urban environments, the proper functioning of road infrastructures is essential to promote connectivity, accessibility and quality of life for the population. In the Brazilian context, road axes, such as railways and highways, were major inducers of accelerated occupation and development of urban centers, given the possibility of facilitating commuting between housing and work (ABREU, 2022; VILLAÇA, 2001). Later, according to Borsagli (2016), the strengthening of the modern movement during the 1920s made the automobile the "symbol of progress, of *status* and of social distinction" of Brazilian metropolises, generating reflections on the planning and sectorization of cities, and sometimes neglecting the human scale. As a response to the fragilities that are reproduced at the global level, the United Nations Sustainable Development Goal 11, which deals with the adaptation of cities and communities to become more inclusive, safe, and resilient, suggests that, by 2030, increased access to transport systems should be provided, while also increasing sustainable urbanization (UN, 2023). In view of the relevance of the theme, concepts related to the sustainability of urban mobility and the favoring of pedestrian scale have gained worldwide recognition, which includes the strengthening of measures and projects that address such issues (GILLIS; SEMANJSKI; LAUWERS, 2016).

Among the concepts of sustainable urban mobility, DOT - Public Transport-Oriented Development, is an approach that uses the principles of compact and sustainable city planning, promoting more "walkable" neighborhoods and their integration with public transport (FANG et al., 2023; REDZUAN et al., 2022; VTPI, 2019). The understanding of ODT is also directly related to the favoring of high population densities and mixed land use, that is, regions that offer wide availability of housing, shops, jobs and services located short distances, encouraging populations to reduce their dependence on automobiles or to prioritize the use of public transport (FANG *et al*., 2023; Papagiannakis; Yiannakku, 2022). Thus, it is necessary that the transit stations are located in centralities that allow walking distance, with radii from 400m to 800m, which represent 5 to 10 minutes of walking (REDZUAN *et al*., 2022). From the improvements in the infrastructures that support non-motorized transport, a greater contingent of trips can be made through walking or cycling, allowing the reduction of the total number of trips made by cars (VTPI, 2019). In addition, by creating friendlier and more attractive environments for pedestrians and cyclists, urban safety is consequently improved, due to the greater vitality of the streets; and community life, due to increased social interaction (Papagiannacis; Yiannakku, 2022).

According to (VTPI, 2019), the concept of DOT can be described through five main characteristics, namely: (1) the neighborhood is designed for cycling and walking, with

adequate facilities and attractive street conditions; (2) the streets have good connectivity and speed reducing features (*traffic calming*) to control vehicular traffic; (3) mixed-use development includes shops, schools, and other public services, as well as a variety of housing types and prices in each neighborhood; (4) parking lot management should encourage a reduction in the amount of land destined for this use, associating cost savings with reduced car use; and (5) transit stops and stations must be convenient, comfortable, and safe, with features such as comfortable waiting areas, merchants, public restrooms, signage, and multimodal navigation tools. Thus, it is understood that the investigation of these five characteristics allows us to understand the quality of city planning from the point of view of urban mobility, or even to predict how they can be adapted to meet the principles of DOT.

According to Fang *et al.* (2023), DOT strategies have been increasingly used around the world as a response to addressing social, economic, and environmental challenges. From a social and environmental point of view, Redzuan *et al*. (2022) studied the possibilities of integrating the DOT with the seafronts, demonstrating that aspects such as "legibility" and "connectivity" are fundamental concepts to improve access and the relationship of pedestrians with the water landscape. On the other hand, considering economic aspects, ODT can also be considered a tool for social equity, since it is capable of improving travel options and accessibility for low-income families, through public or non-motorized transport (VTPI, 2019). In this context, it is noteworthy that the Zero Fare is a national policy that aims to implement free public transport, facilitating the population's access to goods and services. In Brazil, at least 67 cities adopt the Zero Fare policy throughout their transport system (CARRANÇA, 2023), among them, the Municipality of Maricá, located in the State of Rio de Janeiro, Brazil. Based on the contextualization presented, it is necessary to study urban mobility strategies that can be integrated into the sustainable planning of cities, aiming at the valorization of natural resources, accessibility and improvement of quality of life.

OBJECTIVE

Among the municipalities located in the State of Rio de Janeiro, Maricá stands out as a positive example of sustainable urban mobility due to the offer of buses and bicycles that have been traveling with Zero Fare since 2014, benefiting approximately 170 thousand inhabitants. Thus, it is understood that its central neighborhoods of the municipality, which have greater consolidation of the road network and greater availability of public services and equipment, were adequate to improve the integration of mobility with the urban space,

which indicates the relevance of the study of the area. Therefore, the objective is to evaluate a territorial area in the Municipality of Maricá from the perspective of the five main characteristics of the DOT described by (VTPI, 2019). From this evaluation, it is expected to raise the lessons of urban mobility that the territory can offer to other Brazilian cities, as well as to raise the weaknesses that must be mitigated, helping in their sustainable development.

METHOD

The method of this study is classified into four stages. In the first, we sought to understand the five main characteristics of the DOT concept, based on the definition found in the Online Encyclopedia of Transportation Demand Management (TDM), one of the most comprehensive information resources in the world about mobility management strategies, and maintained by the *Victoria Transport Policy Institute*, or Victoria's Transport Policy Institute, in Portuguese (VTPI, 2019). After understanding the five characteristics, stage two consisted of choosing a territorial area located in the municipality of Maricá, Rio de Janeiro, as well as its characterization. To this end, historical, demographic and socioeconomic information in the area was collected, which supported the diagnosis. Thus, step three deals with the diagnosis of the region with a focus on the characteristics of DOT.

For the survey of the first characteristic, "*the neighborhood is designed for cycling and walking, with adequate facilities and attractive street conditions*", the Geographic Information Systems (GIS) and the analysis through satellite images were used as a tool to understand the current design of bike lanes and bicycle stations, as well as the assets that support the attractiveness of the streets. On the other hand, for the survey of the second characteristic "*the streets have good connectivity and traffic calming resources to control vehicle traffic*", the strategy used was the analysis of the road network and its hierarchy, in order to understand the local speed patterns. For feature three, "*mixed-use development includes shops, schools, and other public services, as well as a variety of housing types and prices in each neighborhood*," the strategy consisted of surveying various facilities, such as health clinics, schools, and squares, in order to assess their attendance within a radius of 500m (comfortable walking distance). For feature four "*parking lot management should encourage a reduction in the amount of land allocated to this use, associating cost savings with reduced car use*", the analysis considered the survey of the total number of local private parking lots. Finally, in feature five "*stops and transit stations must be convenient, comfortable and safe, with features such as comfortable waiting areas, merchants, public restrooms, signage and multimodal navigation tools*", the transit stations and their quality in

meeting the listed aspects were surveyed, considering their service within a radius of 400 meters.

Finally, in the fourth stage, located in the final considerations, the lessons that the case study can offer to Brazilian cities that seek to implement policies such as the Zero Tariff are listed, as well as the guidelines that can mitigate local weaknesses and guide the sustainable development of the region.

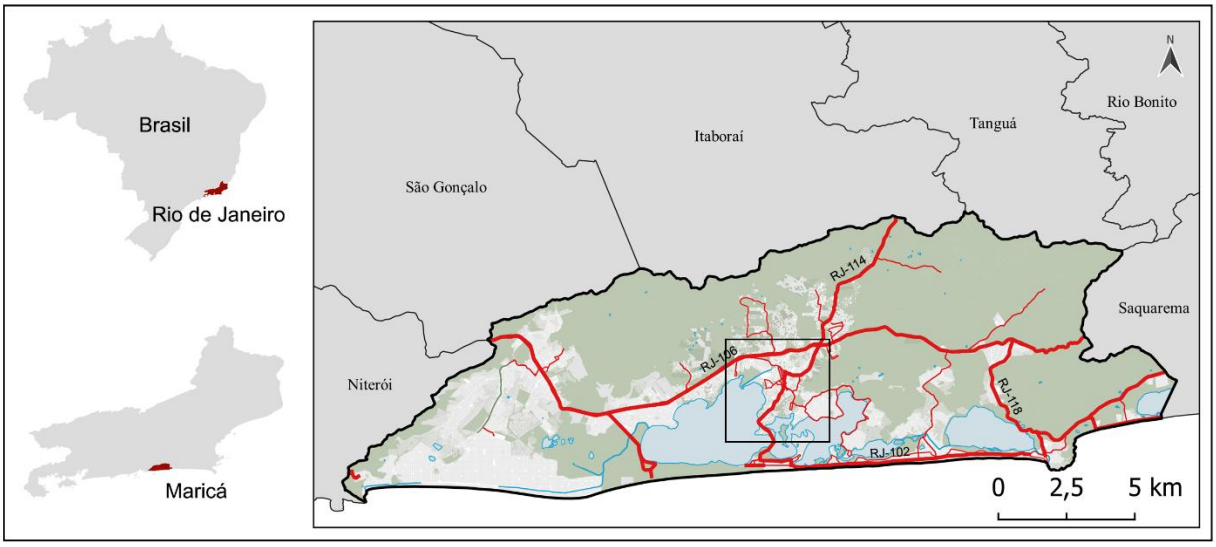
CASE STUDY

Maricá is a municipality of approximately 362 km², located on the coastal strip of the Metropolitan Region of Rio de Janeiro, Brazil (Figure 1). It is noteworthy that factors such as geomorphology, hydrography and proximity to road axes can be considered as the main inducers of its urban development. In this sense, one of the first settlements established in the area took place after the inauguration of the first stretch of the Maricá Railroad, in 1888, connecting the territory to the Rio do Ouro to enable local accessibility and food exports (SOCHACZEWSKI, 2004). Later, after processes of expansion of the Road, it allowed the migration of residents of Niterói and Rio de Janeiro, interested in the agricultural activity performed in Maricá (COYUNJI, 2009). The commercial importance of the Railroad elevated Maricá to the category of city in 1889 (SOCHACZEWSKI, 2004), transforming it into a Municipality in 1911. Later, the road is transformed into the RJ-106, the Amaral Peixoto Highway. After its doubling between the years 1990 and 2000, it was possible to establish greater accessibility in relation to the other adjacent municipalities, such as Niterói, São Gonçalo, Itaboraí and Saquarema, which also marked the beginning of a real estate boom, characterized mainly by the construction of summer houses (SOCHACZEWSKI, 2004).

Currently, only 19.85% of the region is classified as an urban area, where a medium-density occupation can be observed, mainly along the highways and the lagoon complex. In addition to the Amaral Peixoto Highway (RJ-106), which crosses the entire length of the municipality, its road system is also composed of other structuring axes, such as the Governador Paulo Torres Road (RJ-102), the Prefeito Alcebíades Mendes Avenue (RJ-110), the Vereador Oldemar Guedes Figueiredo Highway (RJ-114) and the Sampaio Corrêa-Jaconé Road (RJ-118). According to IDR (2022), the total number of registered vehicles has increased significantly over the last decade, from 35,223 in July 2010 to 76,001 in October 2021. According to the Maricá Urban Mobility Plan (MARICÁ, 2022), the urban public transport system has been operated, since 2014, by the Public Transport Company (ETP), the municipality's state-owned company. The public transport lines under ETP's responsibility have Zero Fare, that is, the user is exempt from paying for the provision of

services. Later, the same company was responsible for the implementation of a municipal bicycle sharing system, popularly known as "Vermelhinhas" (MARICÁ, 2022), which also have free service. The system has 20 bicycle stations located in the most populous neighborhoods of the region, such as Parque Nanci, Centro, São José do Imbassaí, Itaipuaçu and Ponta Negra.

Figure 1. Case study location. Source: Authorial elaboration, 2023.



Based on the historical character of the central region of Maricá, which has a greater number of tourist attractions, a wide variety of public facilities and a greater concentration of bicycle stations compared to the other neighborhoods (11 stations out of a total of 20), this was selected as a case study for the evaluation of the five main characteristics of DOT (VTPI, 2019). The territorial cut includes the neighborhoods of Parque Nanci, Mumbuca, Itapeba, Centro, Flamengo and Araçatiba, in the vicinity of the RJ-106 and RJ-114 highways.

RESULTS

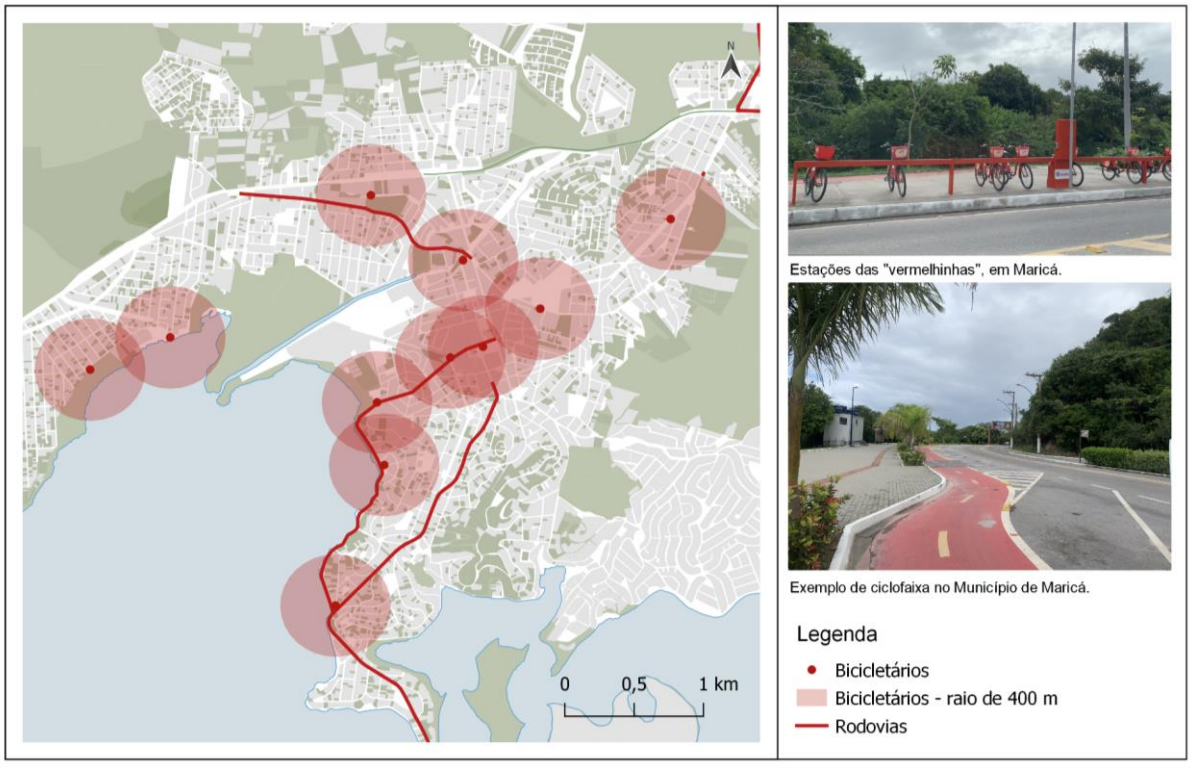
The following items aim to discuss the five items that characterize a city adequately developed for traffic; using the central region of Maricá as a case study.

THE NEIGHBORHOOD IS DESIGNED FOR CYCLING AND WALKING, WITH ADEQUATE FACILITIES AND ATTRACTIVE STREET CONDITIONS

To evaluate this characteristic, three main aspects were considered with the support of the GIS: the location of the shared bicycle stations; the availability of bike lanes or bike lanes; and the location of tourist assets that represent important destinations for the resident population, justifying their locomotion on foot (Figure 2). As explained, the territorial cut has

11 of the 20 bicycle stations available in the Municipality, serving most of the resident population, when considering a radius of 400 m. Although the bike lanes connect a significant portion of the stations, it is noteworthy that some of them have low or no connectivity between the system, which prevents greater opportunities for safe travel through the territory. This situation is highlighted mainly in the neighborhoods of Parque Nanci and Itapeba, which have, respectively, two waterfronts that could be integrated into the system; in the neighborhood of Flamengo, where the lack of integration with the bike lanes located on the RJ-106 and RJ-114 highways is observed; and in the entire western portion of the Maricá Lagoon, which does not have any access element for pedestrians and cyclists. On the other hand, the layout of the stations is observed as positive points, since they are located in the vicinity of historical and cultural elements, configuring the attractiveness of the routes.

Figure 2. Bike lanes and shared stations in the central region of Maricá. Source: Authorial elaboration and authorial photographs, 2023.



STREETS HAVE GOOD CONNECTIVITY AND TRAFFIC CALMING FEATURES TO MODERATE VEHICULAR TRAFFIC

The evaluation of this characteristic took into account the analysis of the road design, as well as its hierarchy, in order to understand the connectivity between the roads and the speed patterns. Considering that the central region was one of the first to suffer from urbanization processes, resulting from the proximity to the Railroad and the lagoon system,

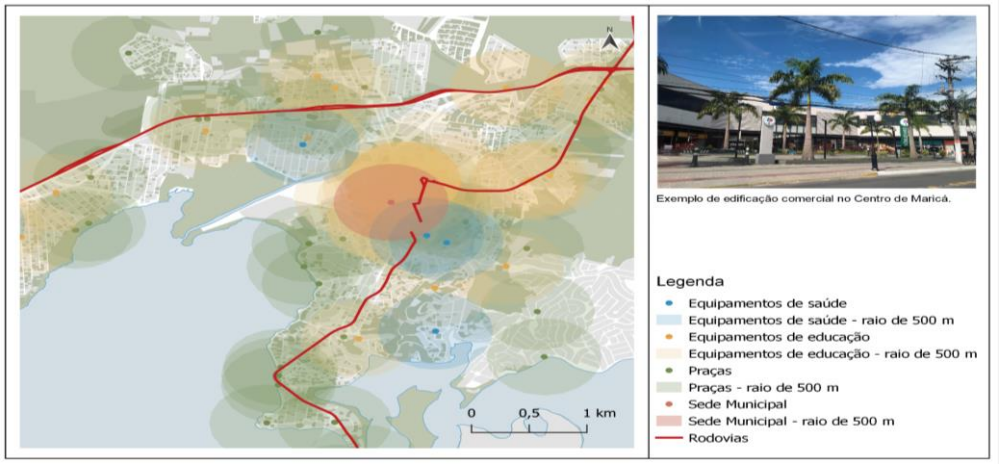
the road system presents a mixed network, predominantly organic in old regions, and orthogonal in recently subdivided blocks. Consequently, there is a system of low connectivity between roads, which impacts the fluidity of vehicles and the lower possibilities of access to neighborhoods. In addition, when evaluating the hierarchy of the road system, it is noted that the territory is mostly composed of local roads, that is, those that allow a maximum speed of 30 km/h. A smaller portion of roads is characterized as arterial, which allows a speed of 60km/h; in addition to the RJ-106 and RJ-114 highways, which allow speeds of up to 110km/h.

When evaluating the speed reducing elements (*traffic calming*), especially on roads that have a sudden transition between slow and fast traffic, it is noted that only a few adopt such resources, through the use of crosswalks or the indication of intersections and mandatory stops, for example. Thus, the adoption of strategies that increase pedestrian safety is identified as an opportunity.

MIXED-USE DEVELOPMENT INCLUDES SHOPS, SCHOOLS, AND OTHER PUBLIC SERVICES, AS WELL AS A VARIETY OF HOUSING TYPES AND PRICES IN EACH NEIGHBORHOOD

The evaluation of mixed uses in the central region of Maricá consisted of a survey of various equipment, such as schools, squares, health centers and administrative buildings, in order to evaluate their service within a radius of 500 meters for the surrounding population. The results of this analysis indicated a wide availability of equipment located at short distances, especially squares, schools and shops, demonstrating the possibilities of carrying out activities that do not depend on automobiles. In turn, when analyzing the housing typologies, it is noted that the central region also has good diversity, which includes the presence of single-family and multi-family buildings, located on public roads or private condominiums. Mixed buildings (with commercial ground floor and other residential floors) are also found with greater predominance in the Centro neighborhood, contributing to the creation of living facades and public safety (JACOBS, 1961). Figure 3 shows the equipment lifted for the area. It is noteworthy that only a sample of the total equipment was highlighted in this analysis, so other essential services, such as banks, markets and various shops were not illustrated, although they also contribute to the vitality of the roads.

Figure 3. Public facilities that configure the mixed use of the central region of Maricá. Source: Authorial elaboration and authorial photographs, 2023.



PARKING LOT MANAGEMENT SHOULD ENCOURAGE A REDUCTION IN THE AMOUNT OF LAND ALLOCATED TO THIS USE, ASSOCIATING COST SAVINGS WITH REDUCED CAR USE

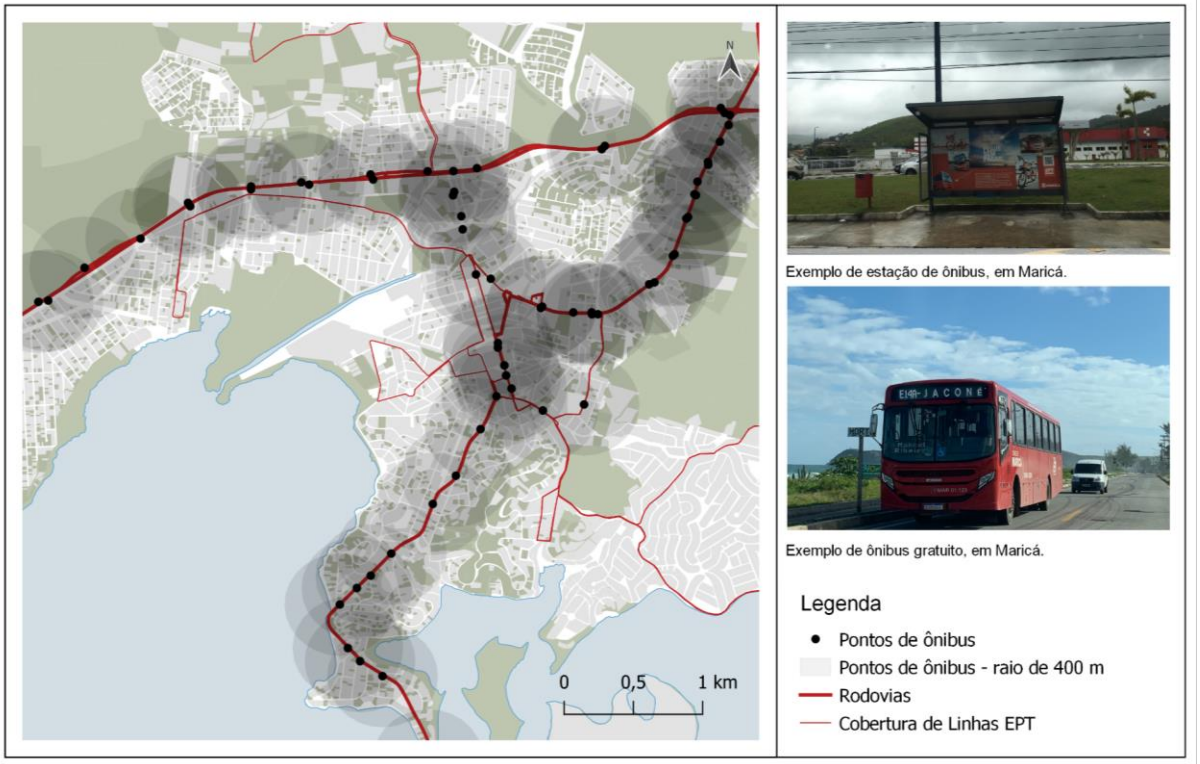
The evaluation of this criterion consisted of a survey of local private parking lots, in order to understand if the number of spaces made available is capable of impacting the use of the land, through the reduction of the contingent of vehicles parked on the roads. As a result, only four parking lots were identified in the territorial cut, all located in the Center, within a maximum radius of 1km. Although little information was found about these services, it was observed that these are small parking lots that charge, on average, R$ 8.00 per day. Considering that the case study is a region of medium population density, with high quality in terms of public transport, it is inferred that private parking lots are a strategy to accommodate the volume of vehicles present throughout the week in shopping centers, since the practice of parking on the road is uncommon in the region. Thus, although the total number of parking lots is considered sufficient for the demand, it is understood that they could be arranged in a dispersed way throughout the territory.

TRANSIT STOPS AND STATIONS SHOULD BE CONVENIENT, COMFORTABLE, AND SAFE, WITH FEATURES SUCH AS COMFORTABLE WAITING AREAS, MERCHANTS, PUBLIC RESTROOMS, SIGNAGE, AND MULTIMODAL NAVIGATION TOOLS

Finally, the evaluation of the last TOD characteristic consisted of the survey and evaluation of the current situation of the bus stations. In all, 64 stops were identified along the cut, demonstrating that the current distribution of lines serves all the neighborhoods analyzed. When considering a radius of 400m, it is noted that the access of the inhabitants is also facilitated due to the short distances. When the stations were evaluated, adopting as a parameter the furniture and the safety of the user, it was noted that most have waiting

benches, covering elements, trash cans, and information elements about the local public transport. However, it is not possible to say that all of them offer safety to the user, since the stations located on highways, for example, do not have local businesses or ample pedestrian movement. Figure 4 shows the bus stations, the lines covered by the ETP and the radius of 400m that allows the evaluation of accessibility to public transport.

Figure 4. Bus stations in the central region of Maricá. Source: Authorial elaboration and authorial photographs, 2023.



FINAL CONSIDERATIONS

In general terms, the study carried out in the central region of Maricá allowed us to verify that, among the five characteristics of DOT, only two are completely met, while three are partially met. It is considered that aspect one *"the neighborhood is designed for cycling and walking, with adequate facilities and attractive street conditions"* and aspect three "*mixed-use development includes shops, schools and other public services, as well as a variety of housing types and prices in each neighborhood*" are suitable for the case study, since the great diversity of activities developed in the region, on the pedestrian scale, are capable of activating the public space and generating greater opportunities for leisure and social interaction outdoors. On the other hand, when considering aspect two "*the streets have good connectivity and traffic calming resources to control vehicle traffic*", it is understood that the failures related to this aspect may be related not only to the organic layout, which results in low articulation between blocks, but also to the configuration of

private condominiums that hinder the creation of active routes along the edges of lagoons. In this sense, it is suggested that a study be carried out on the continuity of the bike paths and bike lanes along the lagoon, allowing the formation of a continuous system that improves the relationship of the inhabitants with the territory and with the water landscape. Additionally, the use of speed reducing elements, such as elevated roads and sound effects, is also suggested in regions that present abrupt speed transition between roads (such as places and highways), favoring pedestrian safety.

Characteristics four and five: "*Parking lot management should encourage a reduction in the amount of land allocated to this use, associating cost savings with reduced car use*", and *"Transit stops and stations must be convenient, comfortable, and safe, with features such as comfortable waiting areas, merchants, public restrooms, signage, and multimodal navigation tools"* obtained less prominence in the evaluation of the case study, due to the absence of complementary information for understanding. In the case of characteristic four, for example, the survey carried out on private parking lots was not able to inform the total number of vehicles that frequent the environment, making it difficult to understand the demand for necessary spaces. In aspect five, although the bus stations have elements compatible with those described by VTPI (2019), security is not guaranteed in remote regions, such as RJ-106. In this sense, the incentive to create small businesses and equipment for collective use would be able to improve the vitality of the streets, increasing safety.

Finally, it should be noted that the Center of Maricá presents a great incentive to the use of public and non-motorized transport, contributing to the sustainability and vitality of the region. From the point of view of DOT, the evaluation carried out allowed the observation of the efforts that have been made in one of the most important regions of Maricá, in order to adapt it and connect it to the free modes implemented from 2014 onwards. Thus, it is recommended that future studies evaluate the contrast present in the central region with the other neighborhoods present in the Headquarters District, since the neighborhoods north of the RJ-106 have lower population density and less urban attractions, resulting, consequently, in reduced accessibility. In addition, future studies could evaluate the quality of mixed streets through various aspects, such as: sidewalk width, existing afforestation or vegetation cover, safety, presence of active facades, among others. It is expected that the evaluation presented will allow the increase of discussions about the adaptation of the DOT concept in consolidated metropolitan regions, improving the quality of traffic and the sustainability of the areas involved.

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CHALLENGES OF *SMART CONTRACTS* IN THE AGE OF QUANTUM COMPUTING: AN ANALYSIS OF BLOCKCHAIN SECURITY

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ABSTRACT

This study explores the interaction between smart contracts and quantum computing, mapping the main advantages, risks and vulnerabilities involved, in addition to analyzing the benefits of *blockchain* technology and its insertion in the Brazilian legal world. Smart contracts are contracts programmed in a *blockchain* structure, which do not depend on human actions to be fulfilled. The use of *blockchain* in Law makes it possible to store encrypted data, making it difficult to violate and alter information. However, Brazilian legislation has not yet regulated the use of these techniques. The article addresses the main advantages of *smart contracts*, such as business autonomy, private data security, elimination of data manipulation, reliability, and agility. It proposes measures to ensure the robustness of smart contracts and *blockchain* in the face of the imminent advancement of quantum computing. The methodology used was a critical analysis, in which it is aimed at proposing measures that ensure the robustness of smart contracts and *blockchain in the face of the imminent reality of quantum computing, through a literature review. The relevance of this work lies in the need to anticipate and mitigate potential threats, ensuring that these technological innovations deliver on their promise of security and reliability in an increasingly digitized society.* It is understood that *smart contracts* represent an evolution in the automation of contracts, with the potential to change the way contractual relationships occur in the legal system, bringing new parameters to the law.

Keywords: Smart Contracts. Blockchain. Technology. Quantum Computing. Legal System.

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INTRODUCTION

Contemporaneity is characterized by a deep technological immersion, where digital advances permeate and redefine multiple spheres of our existence. Among these advances, smart contracts and *blockchain* technology stand out, promising significant transformations in several sectors, given their ability to provide unparalleled efficiency, transparency, and security (BARON, Guilherme; HOPPE, Aurélio, 2018). However, the evolution of quantum computing presents a potential challenge to the integrity of these technologies.

Recent literature has highlighted the promising synergy between smart contracts and blockchain, highlighting their ability to automate and validate agreements in a decentralized manner. However, the emerging quantum computing, with its superior computational power, calls into question the security of these innovations (MACÁRIO, L. M. A., MORAIS, M. M. S. de, SILVA, M. A. X. da., 2022). Given this scenario, the present research emerges as an attempt to understand and anticipate the challenges inherent to this intersection.

The central purpose of this study is to explore the interaction between smart contracts and quantum computing, mapping the inherent risks and vulnerabilities, in addition to analyzing *Blockchain* technology and how it is and can be inserted in the legal world in Brazil. Initially, the technology is conceptualized and explained in a way that facilitates the understanding of the entire study around it. Blockchain is a powerful tool that has been gaining more and more visibility, it consists of a practically unalterable chain of blocks, where various information is recorded, stored in each of these blocks and by all the computers that access it.

Smart contracts are contracts with clauses previously programmed in a blockchain structure that, once agreed, are characterized by not being independent of human actions to be fulfilled, generating practicality, transparency, and trust in the execution and execution of agreements. The work seeks to analyze the form of reception of *smart contracts* by Brazilian law, through the discussion held in the doctrine and jurisprudence about the legal nature, the applicable legislation and the casuistry, in order to present and defend potential benefits in addition to describing risks in the adoption of this model.

The topic is important and deserves to be investigated, as *blockchain* makes it possible to store encrypted data in order to hinder the possibilities of data violation and alteration. In this sense, the possibility of using the tool in Law was noted, which boosted the development of several initiatives in the area, such as *smart contracts*.

The concept of *smart contracts* was originally thought up by Nick Szabo in 1996 who devised an internet protocol that would help parties perform contracts more efficiently in

order to prevent non-compliance and make potential contractual breaches self-executing.

At the disadvantage of technology is the Brazilian legislation, which has failed to keep up with such progress and, to date, has not regulated the use of these new techniques. This, however, did not prevent them from being used. In this context, there is a need for legal operators to adapt to such technologies, as well as the regulation of smart contracts in Brazil.

Therefore, the article intends to address the main advantages of smart contract technology, using *Blockchain* technologies and, including, but not limited to, business autonomy without third-party intervention, and, consequently, security of private data and the elimination of possible data manipulation; reliability, because the documents are under a computational language that provides certainty and security; agility, due to the self-execution of *smart contracts*; economy, allowing and facilitating greater business freedom, since it minimizes legal uncertainty due to self-execution through quantum computing.

Through a critical analysis, the objective is to propose measures that ensure the robustness of smart contracts and blockchain in the face of the imminent reality of quantum computing, through a literature review. The relevance of this work lies in the imperative need to anticipate and mitigate potential threats, ensuring that such technological innovations maintain their promise of security and reliability in an increasingly digitized society (FEDOROV, A. K.; KIKTENKO, E. O.; LVOVSKY, A. I., 2018).

BLOCKCHAIN E *SMART CONTRACTS*

It is understood that *blockchain* and *Smart Contracts* have a great importance in the field of law. These technologies aim to offer a series of benefits, such as transparency, security, and process automation, which can be applied in various areas of law.

In the field of law, the use of blockchain-based smart contracts allows for the automatic and immutable execution of agreements, eliminating the need for intermediaries and reducing the risk of fraud or disputes. This brings greater legal certainty and efficiency to transactions.

It is understood that *blockchain* can also be used to record and authenticate documents, ensuring their integrity and authenticity. This is especially noticeable in areas such as intellectual property, public records, and commercial contracts.

In the field of governance and *compliance*, *blockchain* can be used to create immutable records of transactions, ensuring transparency and traceability of activities. This is particularly useful in regulated industries, such as finance and healthcare, where you need to prove compliance with rules and regulations.

Blockchain and smart contracts play a precise role in law, providing greater security, efficiency, and transparency for transactions and legal processes. Its adoption is increasingly present and promises to transform the way we deal with legal issues.

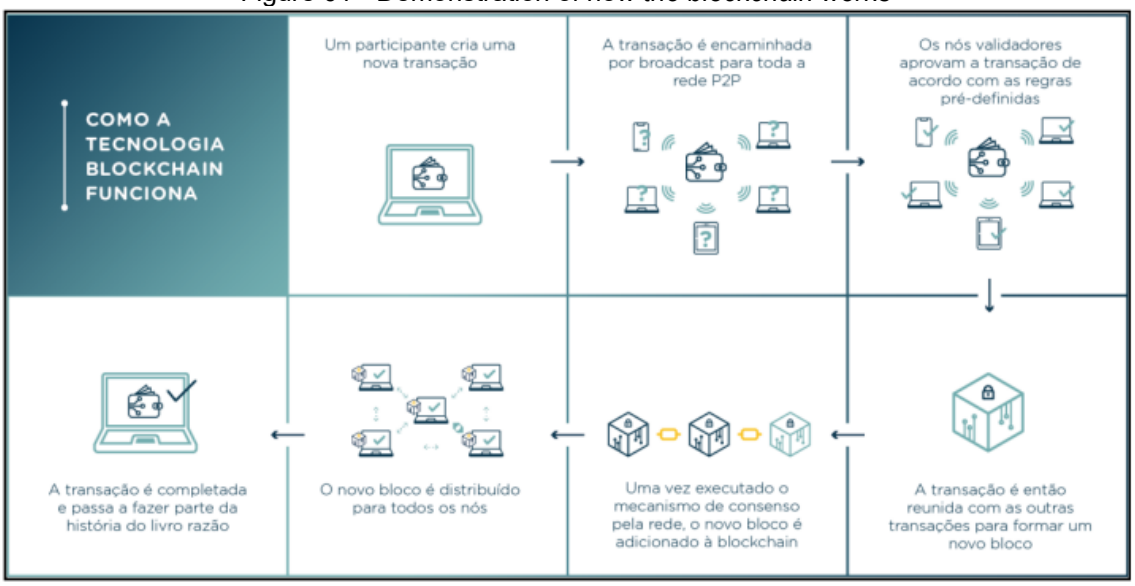
2.1 *BLOCKCHAIN*

The origin of blockchain lies in the Bitcoin protocol, described in an article published by Satoshi Nakamoto (Nakamoto, 2008), which went into operation in 2009. As Bashir (2017) mentions, this paper proposed a new peer-to-peer (P2P) network innovation in which a server, known as a miner, receives transactions with the digital currency bitcoin and, through a Byzantine consensus protocol based on cryptographic challenges, determines the order of transactions.

Blockchain is an emerging and revolutionary information technology that offers distributed, reliable, decentralized and secure support for transactions between participants in a network, based on consensus among them and ensured by a proof-of-work algorithm, whose main objective is to prevent attacks on the network (CHICARINO, JESUS, ALBUQUERQUE and ROCHA, 2017). It is understood that the chain of nodes can be updated by any participant in the peer-to-peer (P2P) network.

Blockchain's ability to create reliable and immutable records makes it notorious and suitable for areas that require high data security and integrity. This is possible thanks to the use of cryptography, allowing each participant to securely process the ledger or digital record of information, known as a *ledger*. Once a block of data is added to the *blockchain*, it is virtually impossible to change or delete it. With this, each transaction is recorded in interconnected blocks, forming a chain of blocks (*blockchain*) that can be viewed by all network participants. Through this system, transactions are visible and accessible to any authorized person, promoting a high level of transparency and accountability (ABIJAUDE, GREVE and SOBEIRA, 2021).

Figure 01 - Demonstration of how *the blockchain works*



Source: Brazil (2020).

As shown in figure 01, all participants in the network can agree on the set and order of execution of transactions through Byzantine consensus, which allows action against malicious nodes that could damage the system. Consensus is an essential element for the development of a reliable and secure system, as it allows participants to agree on the operations to be carried out to maintain the consistency of the system and make it continuous (ALCHIERI, TOMALIN, BESSANI and FRAGA, 2011).

In addition, data security and privacy are important issues that need to be addressed to ensure user trust and regulatory compliance (ALECRIM, 2019). The evolution of the blockchain project can be divided into three phases, as highlighted by Swan (2015, cited by BASHIR, 2017):

> *Blockchain* 1.0, which involved the launch of Bitcoin in 2008, with the first implementations of cryptocurrencies and an ecosystem of applications and payments with digital assets; *Blockchain* 2.0, which began with the innovative proposal of smart contracts in 2013, after the creation of the Ethereum project, conceived by Vitalik Buterin, and the various possible financial applications; and Blockchain 3.0, which characterizes the adoption of *blockchain technology* for the benefit of applications in various areas besides finance, such as government, commerce, arts, health, digital cities (BASHIR, 2017).

Encryption is used to ensure the authorization, authenticity, transaction integrity, and security requirements of the entire system. It is possible to carry out financial transactions without the need for intermediaries, such as banks, quickly, securely, and without borders. The decentralization of *blockchain* allows users to have full control over their financial transactions and data, promoting financial inclusion and individual autonomy. These

transactions are executed and stored permanently on a blockchain and replicated on each server (CHICARINO, JESUS, ALBUQUERQUE and ROCHA, 2017).

SMART CONTRACTS

According to Savelyev (2017), the term "*Smart Contracts*" or smart contracts was first mentioned in 1995 by Nick Szabo, who is a researcher and legal in the field of cryptography, as a principle the central idea was to contribute to the implementation of legal contract and trade practices on the internet. According to the author, although the term was defined in theory, there was no computational infrastructure that could be used to carry out its development (SAVELYEV, 2017).

According to Alecrim (2019), smart contracts are autonomous computer programs that automatically control and execute actions when certain predefined conditions are met. In this way, smart contracts were designed to conceive the facilitation, verification and satisfactorily comply with the negotiation or negotiation of agreements between parties without the need for traditional intermediaries, in this scenario they are considered an innovation of traditional contracts, incorporating computational logic and automation so that there is reliable execution and impartiality of the agreed clauses (ALECRIM, 2019).

It is understood that *Smart Contracts* are systems that move digital assets automatically with pre-specified rules, so these contracts are developed and written in high-level language, the contract will be executed only when a transaction is triggered, in which one contract can trigger another and so on, to a certain extent according to what was pre-defined, where the first contract in this execution chain will be called by a user's transaction (Ølnes et al., 2017).

Another aspect that should be highlighted is the security and transparency of smart contracts is that in addition to immutability and automation, security is a fundamental feature of smart contracts, as they are protected by advanced cryptography and incorporate mechanisms to ensure the authenticity and integrity of transactions. Programming languages such as the previously mentioned, Solidity, are one of those used in the creation of smart contracts

Abijaude, Greve, and Sobeira (2021) highlighted another important aspect of smart contracts, in which security and transparency are precise characteristics. In addition to immutability and automation, security is a fundamental feature of smart contracts, protected by advanced cryptography and incorporating mechanisms to ensure the authenticity and integrity of transactions, programming languages such as *Solidity* are widely used in the creation of smart contracts.

THE INTERSECTION BETWEEN *SMART CONTRACTS* AND *BLOCKCHAIN*

It is understood that the intersection between *Smart Contracts* and *Blockchain* brings with it important implications for the legal field. *Smart Contracts,* which are self-executing, code-based digital contracts, offer the opportunity to automate and streamline legal processes, eliminating intermediaries and reducing costs. In turn, *Blockchain* technology ensures the security, transparency, and immutability of transactions, which can be especially relevant in contractual matters.

Blockchain technology and smart contracts are two revolutionary innovations that are transforming the way transactions are conducted. *Blockchain* and smart contracts form the basis of many cryptocurrency projects, as well as several other applications in industries such as finance, real estate, healthcare and governance, and legal. It is important to note that smart contracts are not limited to legal documents only, but encompass the concept of contract holistically, as taught by Tartuce (2020):

Contracts are, in short, all types of agreements or stipulations that can be created through the agreement of wills and other ancillary factors. In a classical or modern view, the contract can be defined as a bilateral or plurilateral legal transaction that aims to create, modify or extinguish rights and duties of a patrimonial nature (TARTUCE, 2020).

According to Soares (2022), this technology has been widely used in the creation of the aforementioned smart contracts, which are self-executing digital contracts that use pre-defined programming to automate the execution of terms and conditions agreed upon between the parties involved in a transaction. Blockchain provides a secure, transparent, and decentralized environment for the creation and execution of these smart contracts.

One of the biggest advantages of smart contracts is the automation of the execution of an agreement without human intervention. This brings benefits such as cost reduction, increased security and trust for the parties involved and the market, in addition to reducing the chances of fraud resulting from human behavior (SOARES, 2022).

Fachini (2023) mentions that in addition to being self-executing and allowing the self-management of their clauses automatically, without the need for third parties, these contracts can be used to automate the execution of terms and conditions agreed between the parties involved in a transaction.

In practice, when correctly coded, the program that serves as the basis for the smart contract has the ability to take actions and execute the clauses of the contract. This is called programming intelligence. It should be noted that the execution of these clauses may not be immediate. In many cases, the smart contract is reactive, that is, the human being needs to request the execution of a specific clause. However, this does not diminish the

"intelligence" of the smart contract, since automated execution respects the conditions set out in the contract. In view of this, the program only executes the action if all the conditions provided for are completely met (FACHINI, 2023).

Because it is a contract stored in a block of code on the *blockchain*, as mentioned earlier, the codes stored in the blocks of this technology, which function as a ledger, are practically impossible to change. Therefore, the smart contract cannot be changed without the mutual consent of the parties involved.

An example of a smart contract, reported by the TD Team (2023), is when a company places an order for material from a supplier and formalizes the relationship with a smart contract. When the products are delivered, the contract receives this information and automatically releases the payment, without the need to send an invoice or involve professionals in the financial sector. Smart contracts allow parties to have complete freedom to negotiate and agree on their own terms, creating clauses that protect their interests (TD TEAM, 2023).

Smart contracts can be used in a wide variety of applications, such as in the legal field, identity management, property management, allowing the parties involved in a transaction to establish agreements in a reliable and transparent way, without the need for intermediaries or additional costs. Although they are not yet widely used, smart contracts are considered major drivers in the advancement of *blockchain* technology, which is gaining more and more space in several countries. Therefore, a significant increase in the use of this tool is expected, especially in Brazil.

The use of smart contracts brings significant benefits to the parties involved in a transaction. In addition to automation and cost reduction, they provide greater security and reliability, since all clauses and conditions are programmed and executed in an impartial and transparent manner. This eliminates the need for intermediaries and reduces the risks of fraud or manipulation.

Another advantage of smart contracts is the flexibility they offer. The parties have complete freedom to negotiate and establish their own terms, creating custom clauses that meet their specific interests. This allows for greater agility and efficiency in transactions, eliminating the need for lengthy bureaucratic processes and complex negotiations.

However, it is important to note that despite all the advantages, smart contracts also present challenges and limitations. Correct programming and coding are key to ensuring the effectiveness and security of these contracts. In addition, large-scale adoption still faces regulatory and acceptance obstacles by institutions and the market.

In this way, smart contracts are a promising innovation that is transforming the way transactions are carried out. With the combination of blockchain technology and programmed automation, they offer security, transparency, and efficiency for the parties involved. While there are still challenges to overcome, the use of smart contracts is expected to become increasingly common, driving the advancement of *blockchain* and bringing significant benefits to various industries such as the legal field.

However, the application of *Smart Contracts* and *Blockchain* in the legal field also presents challenges, such as the need to adapt existing legislation, ensure the legal validity of digital contracts, and deal with issues related to privacy and data protection. Given this context, it is essential that legal professionals understand the implications of this convergence and are prepared to face the changes and take advantage of the opportunities that arise with this emerging technology.

THE AGE OF QUANTUM COMPUTING

OVERVIEW OF QUANTUM COMPUTING

It is understood that the first ideas for a computer based on principles of quantum mechanics emerged in the 80s, and since then research in the area of quantum computing has intensified, attracting more and more attention from the technological and industrial sector. Quantum computers differ from conventional computing by applying concepts from Mathematics, Physics and computing in practice (NICOLAU, 2010).

According to Mattielo, Silva, Amorim and Silva (2012, p.1), the field of quantum computing and information has been revolutionary when considering that advances in quantum mechanics and Computer Science have modified the modern lifestyle in several aspects. Classical computing has evolved enough to show how significant its influence has been in today's society. It is to be expected that the large-scale commercialization of quantum computers will bring even more revolutions, along with the discoveries that will emerge from the new research using this technology that deals with problems on the atomic scale.

Mello (2018) mentions that the improvement of quantum systems may transform other areas of research, as it enables the resolution of highly complex operations, such as molecular and chemical interactions, resulting in the discovery of new structures to assist in the creation of new materials and medicines. In addition, it would allow for extremely efficient logistics and supply chains, helping to find new ways to model financial data and isolate key risk factors to make better investments.

According to Jack D. Hidary (2021), recent advances in quantum technologies have made it possible to use quantum computers, quantum sensors, and specific networks, such as Quantum Key Distribution (QKD). According to Hidary (2021, p.15), quantum computing began to stand out as a field of study of its own around 1979.

THE TECHNOLOGICAL REVOLUTION OF QUANTUM COMPUTING

In an article published by Mozelli (2023), it is presented that physicists took the first step towards building quantum computers from individual molecules attached to laser devices called optical tweezers.

According to Mozelli (2023), according to *Nature*, two groups of scientists reported their results in Science on December 7, 2023, in both cases making pairs of calcium monofluoride molecules interact in such a way that they are intertwined, a fundamental effect for quantum computing. Given these factors, these findings are considered an important milestone, as they pave the way to harness entangled states and improve the potential applications of molecular tweezer arrays. This approach utilizes molecules such as qubits, fundamental units of quantum information, rather than atoms or ions as in other quantum computing platforms.

As mentioned by Mozelli (2023), the experiments involved the use of optical tweezers to attach calcium monofluoride molecules individually to each tweezers unit. The molecules were cooled to temperatures close to absolute zero, causing them to remain virtually motionless. This technique allowed scientists to manipulate the spin state of these molecules to represent the "0" and "1" states of the qubits.

These advances could also contribute to the use of trapped molecules for high-precision measurements that could reveal the existence of new elementary particles. The researchers highlight the speed with which the field of quantum computing has advanced and say that the molecules will be the basis of a competitive platform capable of performing quantum simulations. These findings represent a significant advance in the construction of quantum computers using individual molecules attached to optical tweezers (MOZELLI, 2023).

In addition to paving the way for a new approach in quantum computing, these studies make it possible to manipulate quantum information using "qutrits" and offer the opportunity to simulate complex materials and fundamental forces of physics more accurately. With new possibilities for measuring elementary particles, this technology is expected to revolutionize science and computing in the near future (MOZELLI, 2023).

By uniting computer science and quantum physics, this field seeks to develop extremely sophisticated computational systems that go beyond the currently established and widely used models. These systems, which are considerably more efficient than classical computers that use "0" and "1" bits, mark a revolution in information processing and management, ushering in a new era in computing (HIDARY, 2021).

QUANTUM COMPUTING VS. DIGITAL SECURITY

Quantum computers are present in research universities, government agencies, and leading scientific companies, and are often out of reach of malicious individuals. However, this is not always the reality (HATTAR, 2023).

As research into quantum computing continues to advance, there is a growing concern that these computers could soon break modern cryptography. This would render all current methods of data encryption obsolete and require the development of new encryption methods to protect against these powerful machines (HATTAR, 2023).

While the concept of quantum computers is not new, the debate around them has increased in recent months, thanks to continued government actions. In May 2022, President Biden released a national security memorandum that outlined the administration's efforts to preempt security concerns related to quantum computing (HATTAR, 2023). In June, the U.S. House of Representatives passed the Quantum Computing Cybersecurity Readiness Act, requiring federal agencies to migrate their information technology systems to post-quantum cryptography.

This legislation, which still needs to be approved by the U.S. Senate, builds on the continued efforts of the National Institute of Standards and Technology (NIST) to develop post-quantum cryptography standards. In July 2022, NIST released its first four quantum-proof algorithms. Shortly thereafter, the CRYSTALS-Kyber public-key encryption and key encapsulation algorithm, recommended by NIST, was cracked using artificial intelligence combined with side-channel attacks.

Even today's fastest computers have a hard time cracking security keys due to their complexity. It would take years for a system to be able to crack standard keys, even under the best of circumstances. This is what makes encryption such a valuable security defense (HATTAR, 2023).

Quantum computing seems to drastically change this scenario, reducing the time required from years to a few hours. Although the situation can quickly get complicated, experts believe that many popular methods of public-key cryptography today, such as RSA,

Diffie-Hellman, and elliptic curve, may be relatively easy for quantum computers to solve in the future (HATTAR, 2023).

While quantum-based attacks are still in the future, organizations should think about how to protect data in transit when encryption is no longer effective. Best practices include segmenting networks, leveraging private 5G networks, and adopting zero trust architectures (HATTAR, 2023).

The growing concern about cyberattacks related to quantum technology may not be imminent, but it is not unfounded either. Cybersecurity professionals must remain agile in the face of new threats and paradigm shifts. As we move towards this next challenge, we must keep ourselves on a solid foundation.

The author mentions that we are moving towards a future with quantum computing, so it is important to prepare your organization now for this emerging threat, as well as deal with other threats affecting your business today. A defense-in-depth approach acts as a hedge against different attack vectors. It provides organizations with comprehensive coverage and a robust defense against various types of attacks (HATTAR, 2023).

CHALLENGES FOR SMART CONTRACTS IN THE AGE OF QUANTUM COMPUTING

ADVANTAGES, RISKS AND VULNERABILITIES OF *SMART CONTRACTS*

According to Cavalcanti (2020), *smart contracts* are considered a relatively new contractual instrument in the legal system, and all their possible applications are still far from being fully revealed, mainly because blockchain technology is constantly evolving. With this technology, there is a potential to gain speed, practicality, security, and effectiveness in the legal routine, as smart contracts allow the automatic execution of judicial agreements and sentences.

Pereira (2014) mentions that a contract is a bilateral legal transaction that requires consent. It must comply with legal requirements and, as a negotiable act, aims to achieve specific objectives. According to the author, a contract is "an agreement of wills, in accordance with the law, with the purpose of acquiring, protecting, transferring, preserving, modifying or extinguishing rights" or, in other words, "an agreement of wills with the purpose of producing legal effects".

Diniz (2014), in turn, states that a contract is "an agreement between two or more wills, in accordance with the legal order, with the objective of establishing a regulation of interests between the parties, with the purpose of acquiring, modifying or extinguishing legal relationships of a patrimonial nature".

According to Coelho (2016), a contract is defined as a bilateral or multilateral legal transaction that generates obligations for one or all parties involved, corresponding to rights held by them or by third parties. Therefore, there is no contract without the characteristic intention of legal transactions, since the intentional human conduct contained in the contract is the declaration of a will.

In general, Brazilian legislation does not impose a specific form for the execution of agreements. It arises from the general theory of contracts and from article 107 of the Civil Code that there will only be a specific form for a contract when the law expressly provides for it. Thus, as long as there is mutual agreement and it does not violate public order, the parties are free to draft contracts, including using programming language (USTER, 2021).

In turn, Brazilian courts recognize the importance of electronic contracts and, in particular, smart contracts, as can be seen in a recent decision of the Court of Justice of the State of São Paulo:

> It is important to emphasize that the technologies that involve smart contracts and electronic contracts, despite the modernity they bring and the need for a new interpretation of these legal relationships every day, do not imply a departure from the fundamental concepts of Private Law. Current issues, which are increasingly transformed due to the Communication Society, are the challenges that Law and Jurisprudence need to overcome in order not to be left behind (TRT-9th Region).

For these reasons, it is possible to recognize the acceptance of smart contracts by the Brazilian legal system as a new way of carrying out a bilateral legal transaction, always in accordance with the general theory of contracts and regulatory standards.

Therefore, there are positive and negative points in the adoption of *smart contracts* that contribute to the debate and evolution of the topic. Among the significant attractions are the efficiency generated by the instant conclusion and execution of the contract without the need for state intervention; the guarantee of compliance represented by the impossibility of one of the parties failing to fulfill its obligations; the reduction of disputes due to the drop in delinquency; the facilitation of e-commerce by eliminating the trusted third party in the business chain; the security provided by the high degree of accuracy in relation to the identity of the remote contractor (preserving anonymity); and the potential of smart contracts and blockchain to revolutionize the Internet of Things.

On the other hand, among the challenges and risks of adopting *smart contracts* are the integration of the entire society in the digital environment; the possibility of failure in the coding algorithm (albeit minimal); the impossibility of predicting all possible circumstances, which can lead to execution contrary to the will of the parties; bad faith in the preparation of the programming script; the deferred or continuous execution of a *smart contract* it may be

affected by factual or legislative changes; the impossibility, through current technology, of resolving subjective issues that affect the performance of the contract; be subject to the same defects of consent or capacity problems as traditional contracts; restriction of the performance of the Judiciary and its auxiliary bodies, resulting in the loss of the power of preventive protection and the reduction of the power of reparatory protection (*status quo ante).*

MITIGATION STRATEGIES

The Brazilian legal system can adopt several mitigation strategies to deal with the challenges and risks associated with *smart contracts*. These strategies aim to ensure legal certainty and the effectiveness of these contracts in the Brazilian context.

One of the strategies is the legislative update. The legislator can promote the updating of existing laws to specifically address *smart contracts*, establishing clear and appropriate rules for their use. This can include the legal definition of smart contracts, the determination of the formal requirements for their validity, and the regulation of specific issues related to the execution and resolution of disputes (Cavalcanti, 2020).

Additionally, courts can adopt a flexible interpretation of existing laws to accommodate smart contracts. This implies a broad interpretation of existing legal concepts, in order to cover smart contracts, as well as the application of general principles of law to resolve specific issues related to these contracts (TRT-9th Region).

The development of alternative dispute resolution mechanisms specific to *smart contracts*. Considering the automated and autonomous nature of these contracts, it may be necessary to create arbitration or electronic mediation mechanisms, as well as specialized courts or dispute resolution chambers dedicated to smart contracts (Cavalcanti, 2020).

It should be noted that international cooperation is fundamental. Given that *smart contracts* are a global technology, it is important to promote international cooperation to develop common standards and guidelines for their use. This may involve participation in international forums, the exchange of information and experiences with other countries, and the adoption of international conventions or treaties that address smart contracts (Cavalcanti, 2020).

These strategies, when adopted together, can contribute to mitigating the challenges and risks associated with *smart contracts* in the Brazilian legal system. It is important to emphasize that technological evolution is constant, and the legal system must be prepared to adapt and keep up with these changes (Cavalcanti, 2020).

BLOCKCHAIN SECURITY IN THE AGE OF QUANTUM COMPUTING

THE IMPORTANCE OF BLOCKCHAIN SECURITY

It is understood that the importance of using *blockchain* in the Brazilian judiciary is still limited and is in the experimental phase, not being widely adopted (ANDRIGHI, 2018). However, there are already some initiatives underway. In 2018, the Court of Justice of the Federal District and Territories (TJDFT) carried out a test of recording procedural information on a private blockchain, aiming to verify the effectiveness of the technology in judicial proceedings and ensure the authenticity of the information (ANDRIGHI, 2018).

In 2022, the Court of Justice of Santa Catarina (TJSC) developed the *LGPD JUS* application, which uses *blockchain* technology to ensure the security of user requests when validating their accounts (PORTO, LIMA JÚNIOR and SILVA, 2019). Another point that should be highlighted is that the Labor Court of the 3rd Region (TRT-3) recommended the use of *blockchain technology* for the registration of evidence in a case, and the TRT-2 recognized the registration of evidence on the *blockchain* as valid (GUSSON, 2020).

The National Council of Justice (CNJ) also launched the "Justice 4.0" platform in 2020, which allows the decentralized and secure registration and consultation of procedural data. The platform is in the testing phase and will be expanded to other courts in the future (ANDRIGHI, 2018).

In the private sector, the Azevedo Bastos Notary, in partnership with the start-up *OriginalMy*, offers digital authentication services to legal entities through a blockchain network (PORTO, LIMA JÚNIOR and SILVA, 2019).

Despite these initiatives, there is still much to be explored in terms of the potential and impact of *blockchain* technology on the Brazilian legal sector. Investment, development, and understanding of the topic are necessary so that blockchain can be widely adopted and used as evidence in the Brazilian judiciary (BURATTO, 2022).

POTENTIAL BLOCKCHAIN VULNERABILITIES AND APPROACHES TO STRENGTHEN SECURITY IN THE JUDICIARY

As for potential Blockchain vulnerabilities and approaches to strengthening, one of the main advantages is the greater possibility of intervention by the judicial system to maintain the balance of contracts. With the application of modern principles in contracts, it is necessary to humanize contractual relations and overcome outdated ideas based on liberal convictions, bringing the interest of the Social State in the regulation of contracts. This involves a weighing of the principles, where state intervention (social function of the contract) prevails over contractual freedom (autonomy of will).

In view of the numerous demands faced by the Judiciary, especially in Brazil, where there is a great deal of judicial demand, it is worth considering the implementation of technologies that enable a better functioning of the judicial system, with a focus on speed and the reinforcement of related constitutional principles, such as the reasonable duration of the process and speed.

Decree No. 10,332 instituted the Digital Governance Strategy, which is organized by principles, objectives, and initiatives, and one of these initiatives is *blockchain*. The fact that the Federal Government recognizes the importance and benefits of this technology, planning its creation and implementation as soon as possible, demonstrates its relevance.

In the legal world, it will be no different. The aforementioned decree, in its Objective 8, which deals with the public services of the future and emerging technologies, in initiative 8.3, provides that the federal government plans to make datasets available through blockchain solutions in the federal public administration by 2022. In initiative 8.4 of the same objective, on the implementation of resources for the creation of a blockchain network of the Federal Government that is interoperable, using reliable identification and secure algorithms.

The National Council of Justice (CNJ) issued Resolution No. 75/2009, which deals with public examinations for entry into the judiciary. In its Annex VI, letter F, it addresses Digital Law, highlighting the need for general notions of smart contracts, blockchain, and algorithms. This is just another demonstration of the relevance of *blockchain* in current times and, consequently, in Law. Given its proven value and the various areas in which it can be used and applied, it is necessary to analyze its application in order to incorporate it into different branches of law, seeking to make it feasible through its implementation.

GROWTH OF INNOVATIONS IN QUANTUM COMPUTING, BLOCKCHAIN, AND SMART CONTRACTS: AN ANALYSIS BASED ON THE FINDINGS OF BARON AND HOPPE (2018)

It should be noted that as we delve into the intricate relationship between quantum computing, blockchain, and smart contracts, the analysis in the study reveals profound implications of these innovations. Supported by the findings of Baron and Hoppe (2018), it highlighted how smart contracts and *blockchain* have reshaped practices in online operations, establishing a new paradigm for secure and decentralized transactions.

However, as we delve deeper into quantum computing, significant challenges emerge that threaten the security of these pioneering infrastructures become evident (Kappert, Karger, and Kureljusic, 2020). The rapid evolution of quantum computing poses a

concrete threat, requiring agile and proactive responses.

In this scenario, quantum cryptography emerges as a new tool, proposing a revolutionary approach to combat the risks posed by quantum computing (Ilie, Knottenbelt, and Stewart, 2020). Therefore, advanced methods offer an extra layer of protection, making it indispensable as we approach the quantum era.

Thus, the conclusions of our study (Macário, Morais, and Silva, 2022) raise a warning about the imminent challenges and the urgency of improved security strategies. The future of online operations holds countless possibilities, but it is vital that we are equipped to preserve the integrity of these innovations in the face of the uncertainties that lie ahead. Understanding the current context and available alternatives is critical to ensuring that the merits of *blockchain* and smart contracts are not obscured by the progress of quantum computing.

As we look to the future, it is relevant not only to continue, but also to expand our research. We must explore the robustness of quantum cryptography, understand the implications of quantum computing on frameworks such as blockchain, and furthermore investigate the potential vulnerabilities of smart contracts by considering new methods of protection.

The attention devoted to the potential of quantum computing and *blockchain* technology is growing every day. In Brazil, we can already observe initiatives such as the e-Citizenship Program and proposals for new laws, such as bill 1979/2022 and 1458/2022. These actions demonstrate a strong interest in developing regulations for these emerging technologies.

In the United States, laws such as the *National Quantum Initiative Act of 2018* (S. 3143) and the *Quantum Computing Cybersecurity Preparedness Act of 2022* (H.R. 7535) have been passed, arousing curiosity and encouraging studies in the field of quantum computing, as well as highlighting the importance of protecting these technologies.

The implementation of these legislative measures reinforces the need to take a precautionary and informed approach to ensure that innovations such as quantum computing and blockchain technology are utilized in a safe, efficient, and compliant manner with legal and regulatory guidelines. It is important to emphasize that this increase in knowledge does not mark the end of our journey, but rather the beginning of a trajectory in which we must delve into the universe of these technologies.

CONCLUSION

Blockchain *technology* has the potential to bring innovations to the field of Law in various relationships and situations. Throughout this article, the impact of this technology in the legal field was demonstrated, analyzing its advantages and highlighting the need to further explore its applications and use, especially in the face of the challenges of *smart contracts* in the age of quantum computing, another point was the analysis on the security of *blockchain* was also carried out.

It can be said that *Blockchain* emerges as a disruptive technology, making the presence of central intermediaries unnecessary for the realization of operations. As a result, the risks associated with dependence on intermediaries or their absence are suppressed by this decentralized, reliable and transparent system, which has been gaining prominence in the world, as well as in Brazil, in the legal system.

The expansion of *Blockchain* is inevitable as we move towards a future that is increasingly interconnected with technology. It works as a large globalized ledger, intrinsic to the development of new relationships, ensuring their security and transparency, thus allowing the Law to be operationalized in a concise way in digital relations.

Through the study, it can be verified that the legal feasibility of entering into *smart contracts* in the Brazilian legal system, highlighting its bilateral nature and the direct relationship with the development of *blockchain*.

The risks and benefits in adopting this contractual instrument were also addressed, contributing to the understanding of the topic. In view of all this, it is possible to conclude that *smart contracts* represent an evolution in the automation of contractual promises, with the potential to change, in the short term, the way contractual relationships occur in the legal system, bringing new parameters in law.

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THE WORLD'S FIRST UNIVERSITY OF INDIGENOUS MATURITY: AN INNOVATIVE INITIATIVE IN THE AMAZON

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ABSTRACT

Education is a fundamental right and an essential tool for personal, social and cultural development. In Brazil, educational programs seek to serve social groups, such as indigenous populations. In this context, the University of Maturity, of the Federal University of Tocantins, stands out with the creation of the first University of Indigenous Maturity in the world, aimed at the elderly of the indigenous population of the Amazon. The objective of this article is to present the creation and impacts of the University of Indigenous Maturity in Tocantínia, Tocantins, addressing its contribution to the social and educational inclusion of indigenous elders and the preservation of traditional knowledge through intergenerational educational programs. The research adopts a bibliographic approach, reviewing literature, consulting articles, government documents and university extension projects. Secondary data and reports about the University of Maturity and its extension aimed at indigenous populations were also analyzed. The results indicate that the University of Maturity has expanded its actions to include the indigenous population, becoming a pioneer in Brazil and in the world. The conclusions point out that the creation of the University of Indigenous Maturity in the Amazon represents a milestone in international education, promoting the social inclusion of a historically marginalized group.

Keywords: Indigenous education. Education in the Amazon. Traditional Knowledge. Lifelong education.

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INTRODUCTION

Education is a fundamental right and an essential means to promote the personal, social and cultural development of individuals (Freire, 1996). In Brazil, a multicultural country, it is essential that educational programs are adapted to the needs of different social groups, including indigenous populations and the elderly. In a context of population aging and the need for social inclusion, the University of Maturity, of the Federal University of Tocantins (UMA/UFT), in the Amazon, stands out with the creation of the first University of Indigenous Maturity in the world. An innovative project that aims to offer specific educational opportunities for the elderly of the Amazonian indigenous population.

This article aims to present the creation and impacts of the first University of Indigenous Maturity in the world, located in the city of Tocantínia, a municipality in the State of Tocantins, a member state of the Brazilian legal Amazon. The focus is to discuss how this initiative contributes to the social and educational inclusion of indigenous elderly people and to reinforce the importance of intergenerational educational programs for the preservation of indigenous knowledge.

The methodology of this study is based on a bibliographic research, with a literature review related to the education of elders, indigenous education and educational inclusion policies. Sources such as academic articles, national and international government documents and university extension projects were consulted to support the discussion. In addition, the research includes the analysis of secondary data and reports on the University of Maturity, focusing on its extension aimed at indigenous populations.

The results indicate that the University of Maturity, an extension program of the Federal University of Tocantins, initially created to serve elderly people from the general population, expanded its actions for the inclusion of the indigenous population, and became a pioneer in Brazil and in the world. The creation of this extension in the indigenous communities of the Amazon was the result of a series of dialogues between indigenous leaders, the state government and the Federal University of Tocantins. The main objective is to ensure that indigenous elders have access to a democratic lifelong education (Gadotti, 2016) (Libâneo, 1990) that respects and values their cultural traditions, while offering new learning opportunities (Ciavatta, 2005).

In this way, the work shares phenomenological perceptions that involve the universe of the creation of the first University of Indigenous Maturity in the Amazon, an act that represents a milestone in international education, by providing access to university for the elderly. It involves an in-depth analysis of how this initiative not only promotes the social

inclusion of a historically marginalized group, but also strengthens formative itineraries of intercultural and intergenerational dialogue (Brito et al, 2024).

METHODOLOGY

The bibliographic research seeks to theoretically support academic studies that involve the keywords, to disseminate productions that achieve the construction of knowledge based on reliable scientific sources. It was developed based on structured steps that range from the selection of databases to the critical analysis of sources. The main steps used in the bibliographic research in national and international databases are described below.

The first moment involved the clear delimitation of the research theme and the formulation of guiding questions (Minayo, 2008). In the case of this study, the research problem was related to the analysis of educational initiatives aimed at indigenous elderly populations, focusing on the performance of universities in Brazil and in the world. The main objectives were to identify similar experiences and theoretically support the analysis of the impact of this institution.

In this way, following phenomenological perceptions and experiences of the authors (Merleau-Ponty, 2018), the national and international databases relevant to the topic in question were selected (Marconi and Lakatos, 2003). The main databases used include, in the national databases: a) SciELO (Scientific Electronic Library Online), one of the main sources for articles in Portuguese and Spanish in the areas of social sciences, education and health; b) CAPES (Coordination for the Improvement of Higher Education Personnel), in its Journal Portal that offers access to a wide range of Brazilian academic publications; and c) Google Scholar, a resource widely used for broad search of articles and theses in Portuguese.

Among the international databases reached, the following stand out: a) ERIC (Education Resources Information Center), specialized in articles and documents related to education; b) PubMed, focused on articles in the health area, especially relevant to the theme of aging; and c) Scopus and Web of Science, in their multidisciplinary databases that bring together peer-reviewed scientific articles, essential to search for works of international relevance.

It is worth clarifying that the keywords and search strategies were intentional (Merleau-Ponty, 2018), and involved translation in an appropriate way to ensure the retrieval of relevant results (Minayo, 2008). On the other hand, combinations of terms in Portuguese, English and Spanish were used, in order to contemplate both national and

international literature. Among these terms are: education of older people, intergenerational teaching, indigenous maturity, indigenous elderly education, intergenerational learning, aging populations, University for the Third Age, University of Maturity, inclusive education for indigenous people, educación de personas mayores, enseñanza intergeneracional, madurez indígena, envejecimiento poblacional.

Search strategies involved the use of Boolean operators (AND, OR) to refine results and exclude irrelevant content (Marconi and Lakatos, 2003). Thus, the article selection criteria establishes a set of inclusion and exclusion criteria to ensure that only relevant sources are analyzed. The inclusion criteria involve articles and documents published in the last 10 years, in Portuguese, English or Spanish, which dealt with the education of the elderly, indigenous populations or intergenerational educational practices. And exclusion studies that did not directly address the proposed theme, publications outside the cut-off period or without peer review, and articles that were not available in full text.

During the content analysis (Bardin, 2011) exploratory reading was carried out, that is, a first quick reading of the abstracts and introductions to verify the relevance of the material. This was followed by an analytical reading, in which the selected articles were read in full, with emphasis on the analysis of the objectives, methodology, results and discussions. This stage included the organization of the data into thematic categories to facilitate the synthesis of the contents.

In the end, the data were organized and categorized (Bardin, 2011) according to the main themes identified in the critical reading, to facilitate the management of the bibliography. This stage relied on tools such as Mendeley and Zotero, which help in the organization of references and the automatic creation of citations.

The last stage of the bibliographic research involved the synthesis of the information obtained, in which the findings of the literature were related to the theme of the University of Indigenous Maturity. In addition, a comparative analysis between national and international experiences highlights the uniqueness of a University for the elderly and how this innovation becomes a reference for good practices and lessons learned, while building a solid theoretical framework for the analysis of the challenges and potentialities of this educational initiative within the scope of the communities of the Amazon.

RESULTS AND DISCUSSION

By conducting a bibliographic analysis on indigenous universities in Brazil and in other countries, the results reveal that, although these institutions are consolidating themselves as important spaces for the educational inclusion of indigenous populations,

they still focus mostly on the training of young people, leaving out the elderly population, which plays a central role in the preservation of cultures and traditions. However, there is a growing international appreciation of the knowledge generated by indigenous peoples, both before and after colonization, and international examples can inspire new initiatives in Brazil.

In Brazil, several universities have offered courses aimed at the training of indigenous people, however, there is a focus on valuing cultural traditions and training these students to act as community leaders, teachers or health agents. However, as highlighted by Evaristo (2006), the creation of indigenous universities is still a novelty in the country. Initiatives such as the Indigenous Intercultural Degree, present in federal universities through the National Program for the Training of Basic Education Teachers (Parfor), aim to train indigenous teachers and strengthen bilingual teaching in the communities, but these actions have young adults as their main target audience.

Parfor Equity, for example, aims to:

> the training of teachers in indigenous teaching degrees and pedagogies. It is an action of the Coordination for the Improvement of Higher Education Personnel (CAPES), conceived together with Secadi/MEC, and is intended to comply with strategy 15.5 of the National Education Plan - PNE, Law No. 13,005, of June 25, 2014. It is in line with the National Curriculum Guidelines for Indigenous School Education in Basic Education - Resolution CNE/CEB No. 5, of June 22, 2012 and with the National Curriculum Guidelines for the Training of Indigenous Teachers in Higher Education and High School courses - Resolution CNE/CEB No. 1, OF JANUARY 7, 2015. (Brazil, 2023)

It is noted that Parfor Equity, guided by the Coordination for the Improvement of Higher Education Personnel (Capes), made it possible for Higher Education Institutions (HEIs) to propose courses in Indigenous Intercultural Pedagogy and Indigenous Intercultural Licentiate, and the approval of 39 specific courses was found in the research, which led to the creation of 2,412 new enrollments in Higher Education Institutions offering the courses in 2024.

Even with this recent advance, it is worth noting that Evaristo (2014) points out that, although Brazil is just beginning to experiment with this university model, Latin American countries, such as Bolivia, Nicaragua, and Mexico, are already advanced in promoting indigenous universities that value traditional knowledge in its various forms. These institutions aim not only at the social and academic inclusion of indigenous peoples, but also at the preservation and transmission of ancestral knowledge.

On the American continent, the research pointed out that countries such as Bolivia, Nicaragua, Mexico and even the United States have already established indigenous universities that go beyond the training of young people, promoting the recognition of

indigenous knowledge as an integral part of higher education. According to Evaristo (2014), Bolivia is a notable example, with five indigenous universities and 22 courses aimed at training young people and strengthening culture. Nicaragua has two universities with 10 majors, while Mexico is home to eight indigenous universities and 49 majors, revealing a robust and well-established educational infrastructure. Even in the United States, which has historically had a troubled relationship with its indigenous populations, there are two indigenous universities that seek to promote higher education among native communities.

These international examples demonstrate the success of an educational policy that values indigenous knowledge at various levels and areas of training, something that Brazil is still beginning to implement (Brasil, 2024). In addition, these universities have as one of their goals the preservation of traditional knowledge, facilitating the dialogue between academic knowledge and ancestral knowledge, something essential for the identity of indigenous peoples.

In addition to indigenous universities in the American continent and youth-oriented courses in Brazil, it is also possible to find study programs focused on indigenous peoples in other parts of the world. Victoria University of Wellington in New Zealand offers an MA in Indigenous Studies, which places Māori and Pacific cultures and histories in a global context by analysing their colonial experiences (VUW, 2024). In Australia, Southern Cross University offers a Bachelor of Indigenous Knowledge, which explores the histories, knowledge systems, health, well-being, and ways of life of Indigenous peoples (SCU, 2024). In addition, the Australian Catholic University has an Indigenous research liaison officer, in an Aboriginal fishing community, bringing their experiences to the academic setting (UCA, 2024). These international examples show the growing interest in valuing and preserving the knowledge and histories of indigenous peoples in different educational contexts.

The research pointed out that, although international indigenous universities have promoted significant progress in the education of indigenous youth, the analysis reveals that most of these institutions still focus on programs aimed exclusively at youth, with little or no attention to the elderly population. In Brazil, this reality is even more evident, since indigenous universities are in the initial phase of development and there are no records of initiatives aimed specifically at indigenous elders, apart from the University of Maturity, of the Federal University of Tocantins (UMA/UFT).

This gap reflects a broader educational challenge: the aging of indigenous populations and the need to include older people in formal educational processes (Oliveira et al, 2023). Thus, indigenous elders, often considered guardians of traditional knowledge,

have not been contemplated by these educational institutions, which compromises the preservation of ancestral knowledge and the strengthening of indigenous cultural identities (Santana et al, 2023).

The bibliographic results related to the University of Indigenous Maturity (UMA/UFT), located in Tocantínia, Amazonia, reveal an innovative approach to the education of indigenous elders. The research indicates that the UMA/UFT was created with the objective of promoting inclusion, strengthening cultural identity and the transmission of ancestral knowledge, meeting the specificities and needs of the elderly indigenous population.

UMA/UFT adopts an intergenerational educational model, allowing indigenous elders to share their ancestral experiences and knowledge with younger people. This fosters an environment of knowledge exchange, where traditional and academic practices meet. It has a curriculum adapted to respect the ways of learning of older people, prioritizing methodologies that value orality, practice and life experience. Classes include topics such as literacy, health, rights, and traditional knowledge, such as handicrafts, agricultural practices, and mother tongue.

Research that points to the training of educators, teachers and cultural mediators, many of whom are indigenous, as a fundamental part of the functioning of UMA/UFT stands out. These professionals are trained to meet the specific demands of indigenous older people, respecting their learning times and modes (Brito et al., 2023). In other words, inclusion and cultural appreciation can be perceived when the university respects indigenous traditions, in pedagogical approaches that encourage the empowerment of older people, recognizing them as active agents in education, rather than mere recipients of knowledge.

In this way, the analysis also highlights the social and cultural results, considering that the UMA/UFT has a significant impact on the lives of indigenous elders, by strengthening cultural identity and promoting traditional knowledge. While participants report an increase in self-esteem and a sense of belonging, as well as a greater connection with their cultural roots (Oliveira et al., 2023; Santana et al., 2023).

When comparing UMA/UFT with other initiatives of indigenous universities in the world, it is observed that, while the former focus on the training of young people, UMA/UFT stands out for its innovative proposal to include the elderly population. This differential is crucial for strengthening intergenerationality and for reflections that contemplate traditional knowledge, areas often neglected in some higher education institutions.

The results also demonstrate that, in order to seek solutions that can include both young and elderly people in educational processes, there are extension projects and

programs that welcome the elderly in university spaces. Experiences achieved in all the countries mentioned so far, with emphasis on Bolivia. However, in a specific approach and concern for elderly people, naming them as academics, only the UMA/UFT was found, in the city of Tocantínia, a municipality in the State of Tocantins that is part of the Brazilian legal Amazon. The UMA/UFT becomes, therefore, a space that provides opportunities for indigenous elders to learn throughout their lives (Gadotti, 2016) with university practices and manages to effectively integrate traditional indigenous and academic knowledge.

Such notes culminated in the perception that the University of Indigenous Maturity, of the UMA/UFT, in Brazil, is the first in the world specifically focused on the education of indigenous elders, with the aim of promoting intergenerationality and the transmission of ancestral knowledge (Brito et al, 2021). By listening to experiences from other countries, Brazil would have the opportunity to expand its indigenous educational policies to include all age groups, respecting and valuing the different modes of knowledge of indigenous peoples.

While the current focus of indigenous universities, both in Brazil and in other countries, is directed at young people, international examples show that there is significant room to expand these programs, including older people. The creation of a University of Indigenous Maturity, as seen in the Amazon, can be an innovative initiative, capable of filling the gap in the care of indigenous elders. After all, UMA/UFT manages to promote intergenerational dialogue, where the elders share their traditional knowledge and the younger ones learn, strengthening indigenous cultural identities (Oliveira et al, 2023).

One of the great differentials of the UMA/UFT Indigenous initiative is the intergenerational and intercultural approach. In addition to offering classes focused on literacy, health, and rights, the program's indigenous centers promote activities that involve the transmission of traditional knowledge, such as handicrafts, agricultural practices, and the mother tongue (Santana et al, 2023). Actions that Gadotti (2016) considers fundamental for the preservation of culture and the strengthening of the identity of students at all ages, and, in this context, with the elderly, from the perspective that many of whom did not have access to formal education in their youth (Ciavatta, 2005).

It is found in the material analyzed that the University of Indigenous Maturity also stands out for its inclusive pedagogical practices (Oliveira et al, 2023). In which, teachers and cultural mediators, many of them indigenous, are trained to deal with the specific challenges of this public, respecting the times and ways of learning of older people (Brito et al, 2023). In other words, the institution adopts a pedagogy that values orality and practice, in addition to creating an environment of respect and welcoming.

Another relevant impact is the promotion of the protagonism of indigenous elders, who have come to be recognized not only as holders of traditional knowledge, but as active agents in the construction of new ways of educating (Brito et al, 2021 and 2023; Santana et al, 2023; and Oliveira et al, 2023). Thus, the educational experience with the elderly, young university students and other subjects reached becomes a space for exchange and empowerment, strengthening ties between different generations and communities.

In this regard, the production organized by Osório et al (2022), reveals how UMA/UFT manages to value indigenous traditions and provide new learning opportunities for older people. It is clear that the university is able to fulfill its social mission by contributing significantly to cultural preservation and to the promotion of a more inclusive and diverse education. While the experience of Tocantínia can serve as an inspiration for other regions of Brazil, America and the World, where indigenous populations are aging and need specific educational policies that respect their cultural particularities.

Finally, the analysis of the results reveals that, although indigenous universities in Brazil are still in their early stages, international experience demonstrates that these institutions can be great allies in valuing and preserving indigenous knowledge. However, there is a significant gap with regard to the inclusion of the ancestral knowledge of indigenous elders in these educational spaces. The UMA/UFT proposal can bring important contributions to the creation of more spaces such as the University of Indigenous Maturity, which offer opportunities for learning and valuing traditional knowledge in an intergenerational dialogue.

FINAL CONSIDERATIONS

The final considerations of this research point to the urgent need to expand indigenous universities in Brazil, including initiatives aimed at the elderly population. Although indigenous universities in the country and in other countries have achieved important progress in the educational inclusion of indigenous youth, the predominant focus still falls on this age group.

The innovative experience of the University of Indigenous Maturity (UMA/UFT), located in Tocantínia, Tocantins, Amazonia, stands out as the first institution in Brazil – and in the world – dedicated to the formal education of indigenous older people. By promoting intergenerational dialogue and integrating traditional, ancestral, and academic knowledge, UMA/UFT establishes a milestone in the inclusion and appreciation of older people within the indigenous educational context.

This initiative brings to light the protagonism of indigenous elders, recognizing them as holders and transmitters of ancestral knowledge, while providing new learning opportunities. The bibliographic research showed that, while other countries in the world advance in their indigenous university systems, these still focus predominantly on the training of young people. At the same time, the creation of universities that contemplate the elderly population, such as UMA/UFT, can contribute to the preservation and scientific reflection with traditional, ancestral knowledge, but also promote the construction of an inclusive intercultural and intergenerational education.

Therefore, the lessons brought by UMA/UFT can serve as a model to expand the offer of indigenous universities in Brazil and in other countries, strengthening educational policies that integrate people of all ages, especially those who, historically, have been left out of formal educational processes. Thus, Brazil has the opportunity to lead a global movement in favor of indigenous education that values ancestral, traditional knowledge placed by elders of older generations, ensuring the continuity and preservation of indigenous cultures in all their diversity.

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INFLUENCE OF CLIMACTERIC SYMPTOMATOLOGY ON THE SEXUAL FUNCTION OF PANKARARU INDIGENOUS WOMEN

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ABSTRACT

Objectives: The aim of this study was to explore the statistical association between climacteric symptoms and sexual function in women of the Pankararu ethnic group.

Study design: A cross-sectional descriptive study was carried out with 188 indigenous women, aged between 35 and 65 years, for which a sample of 108 women who met the inclusion and exclusion criteria was obtained, and answered all three questionnaires: one socioeconomic and demographic, the Menopause Rating Scale (MRS) and the Sexual Quotient-female version (SQF). The study site was the municipalities of Tacaratu and Petrolândia, Pernambuco State, Brazil, during the months of August and September 2019.

Main outcome measures: Assessment of the intensity of climacteric symptomatology and the overall quality of sexual performance/satisfaction.

Results: The mean age was 44.4 years, with the majority (72.2%) between 35 and 49 years. The prevalence of climacteric symptoms was high (67.6%), with intensity directly associated with age. The most intense symptoms included physical and mental exhaustion (16.7%), shortness of breath, sweating and hot flashes (13.0%) and muscle and joint problems (12.0%). In sexual function, 51.9% achieved a score indicative of female sexual dysfunction and 35.2% of the women were categorized as having poor or unfavorable performance/satisfaction and inversely associated with age, with the worst being in the foreplay sexual and comfort domains.

Conclusions: The prevalence of climacteric symptoms was high among the indigenous women studied, with increasing intensity with age and inversely associated with satisfactory sexual performance/satisfaction, indicating an association between advancing age, increased climacteric symptoms and reduced quality of sexual function.

Keywords: Climacteric. Menopause. Menopause Rating Scale. Sexual Quotient Female version. Sexual function. Quality of life. Health of indigenous populations.

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1 INTRODUCTION

The transition to menopause is a remarkable phase in a woman's life, marked by endocrine changes that can affect various aspects of her health and well-being [1,2]. The World Health Organization (WHO) describes the climacteric as a natural biological stage in a woman's life and not as a pathological condition. This phase, which occurs from 35 to 65 years old, marks the transition from the reproductive to the non-reproductive period. Within this phase, menopause is a remarkable event that usually happens between the ages of 48 and 50 [3–6].

Among the most commonly reported symptoms are changes in sexual function and climacteric symptoms, which include hot flashes, night sweats, mood swings, and sleep difficulties. These changes can have a profound impact on women's quality of life [7–10].

While most research on menopause and sexual function has focused on urban and Western populations, there is a lack of studies that address these issues in diverse cultural and ethnic contexts. Specifically, little is known about how these experiences manifest in indigenous communities, who may have different cultural and social perspectives on menopause and sexuality [11].

Although menopause has been accepted as inevitable and a natural phase of women's life, including the benefit of the cessation of menstruation, it has also been associated with some negative feelings, such as loss of fertility and youth, and the appearance of bothersome symptoms [12]. Substantially these aspects can affect the quality of life related to health, sexual life, daily and work activities [13].

Previous studies have identified geographic and ethno-racial differences in the severity and duration of menopausal symptoms [14-16]. However, in some studies, most women classify climacteric symptoms as severe (56.3%), in addition to loss of sexual interest (41%) [17]. This condition can persist for up to 10 years [18,19] and commonly results in seeking treatment [20,21], which may indicate a general vulnerability to chronic conditions related to menopausal changes [22].

Considering these gaps in the literature, the objective of the research was to explore the association between climacteric symptoms and sexual function in climacteric women, seeking to understand how climacteric symptoms present in the Pankararu indigenous population and what is their impact on sexual function. Climacteric symptomatology is thought to be positively associated with a decrease in sexual function in Pankararu indigenous women, and symptom intensity is expected to increase with age, inversely associated with sexual satisfaction.

To investigate these issues, the research uses a descriptive and cross-sectional approach, employing instruments such as the Menopause Rating Scale (MRS) [23] and the Sexual Quotient-female version (SQF) [8], to assess these relationships. By exploring these associations, this study aims to shed light on the climacteric and sexual experience in a culturally distinct population, contributing to a broader and more inclusive understanding of climacteric in diverse contexts.

2 METHODS

2.1 STUDY DESIGN

A descriptive study with a cross-sectional approach was carried out with 108 indigenous women from the Entre Serras Pankararu People, in the cities of Tacaratu and Petrolândia, Pernambuco, between August and September 2019. Data were collected through structured interviews, lasting 30 to 40 minutes, using specific questionnaires: Socioeconomic and Demographic, Menopause Rating Scale (MRS) [12] and Sexual Quotient-female version (SQF) [8].

The sample was random, including women who had been sexually active in the last six months and excluding those who used hormonal therapies, continuous use of medications that interfere with sexuality or had undergone surgical menopause, criteria necessary for the application of the questionnaires, which were previously validated for the study population.

The interviewers were female health professionals, accepted by the community and trained to ensure consistency in the application of the questionnaires, being blinded to the specific objectives of the study to minimize performance bias and losses to follow-up. The interviews were conducted in private and comfortable environments for the participants, such as under a tree, in order to ensure comfort and privacy.

Additional efforts were made to avoid response bias by ensuring that prevalence estimates and associations were accurate. The socioeconomic and demographic questionnaire included open-ended and closed-ended questions, as well as details on clinical, behavioral, and cultural aspects, to facilitate the transition to the deeper and more central questions of the study.

Statistical analysis controlled for confounding factors using multivariate logistic regression, with analyses stratified by age and menopausal status. The response rate was 97%, and there were no significant differences between participants and non-participants.

The ordinal categorical variables of interest in the study are the intensity of climacteric symptomatology (independent variable) and the quality of sexual performance/satisfaction (dependent variable), measured by the MRS and SQF questionnaires, respectively. These

variables were chosen due to their cause-and-effect relationship, allowing us to test hypotheses and analyze their associations. The quantitative variable age group was divided into two subgroups: 35 to 49 years and 50 to 65 years, often used in similar studies because it documents different menopausal states [24]. The study was conducted in accordance with ethical standards, with the approval of two ethics committees, one from the University of Pernambuco and the other from the national level. No financial incentives were used for participation.

2.2 REVIEWS

The Menopause Rating Scale (MRS) is an instrument of German origin, validated and adapted for use in 25 languages. Its objective is to assess the intensity of climacteric symptoms, and consists of 11 questions distributed in three domains: Somatovegetative symptoms (hot flushes, heart discomfort, sleep problems, and muscle and joint pain); Psychological symptoms (depressive mood, irritability, anxiety, physical and mental exhaustion); and Urogenital symptoms (urinary and sexual problems and vaginal dryness). The higher the score, the more severe the symptoms and the worse the woman's quality of life. The overall score ranges from 0 to 44 and the intensity of the symptomatology is classified as: absent or occasional (0-4 points), mild (5-8 points), moderate (9-15 points) and severe (>16 points) [12].

The Sexual Quotient-female version (SQF), of Brazilian origin, with cultural adaptations made in other populations, evaluates the general quality of sexual performance and satisfaction through 10 questions distributed in five domains: Sexual desire and interest; Foreplay; Personal arousal and attunement with the partner; Comfort; and Orgasm and satisfaction. The final score classifies sexual performance/satisfaction in the following categories: null to poor (0 to 20 points), poor to unfavorable (22 to 40 points), unfavorable to fair (42 to 60 points), fair to good (62 to 80 points), and good to excellent (82 to 100 points). Higher scores indicate better sexual performance/satisfaction, with 60 being the cutoff point for screening for female sexual dysfunction [8].

2.3 CALCULATION OF THE PREVALENCE OF CLIMACTERIC SYMPTOMS BY MRS

We used the MRS to calculate the prevalence of climacteric symptoms with intensity from absent to severe [12]. The interviewees were in different menopausal states: late reproductive (47.2%), menopausal transition (26.9%) and postmenopausal (25.9%) [24]. These and other detailed statistics are described in Table 1. Prevalence was determined globally.

2.4 CALCULATION OF THE PREVALENCE OF SEXUAL RESPONSE BY SQF

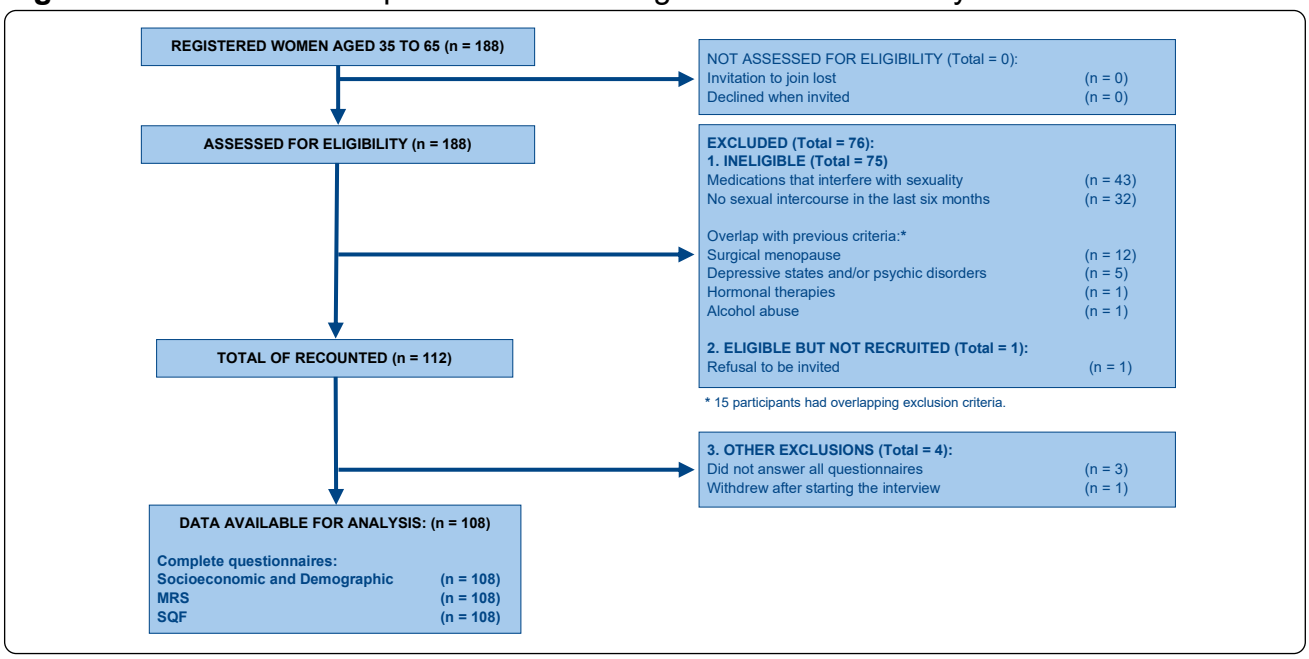
We used the SQF to calculate the prevalence of overall sexual performance/satisfaction quality from null to excellent [8]. Prevalence was determined globally.

2.5 STATISTICAL ANALYSIS

Data analysis involved the descriptive summarization of continuous and categorical variables, using Excel for the database and STATA for statistical analysis. An exploratory analysis was carried out focusing on varied characteristics of the respondents and statistical tests were applied to investigate the relationship between climacteric symptoms and sexual function, with adjustments for confounding factors via multivariate logistic regression, resulting in odds ratios with 95% confidence intervals, adopting a significance level of 5%.

Participants were recruited according to the flowchart shown in Figure 1. Of the participants evaluated, 76 were excluded because they did not meet the eligibility criteria, with the most frequent reasons being the use of medications that interfere with sexuality and the absence of recent sexual activity.

Figure 1. Flowchart of the process of recruiting women for the study



3 RESULTS

3.1 CHARACTERISTICS OF THE PARTICIPANTS

The study participants were all women aged between 35 and 65 years, derived from the registration list of the population served by the Pankararu Entre Serras Base Pole in 2019, which had a total of 188 eligible women. The final sample consisted of 108 participants (57.4% of the total eligible), determined by the inclusion and exclusion criteria, who fully completed all three questionnaires. Only 1.6% of the initially selected participants had missing data and were excluded from the main analysis. However, we performed a sensitivity analysis using multiple imputation to assess the potential impact of these missing data, which did not substantially alter the results and avoided bias.

Table 1. Sociodemographic and reproductive characteristics of the participants

Variable	n = 108	%
Age range (in years)		
35 - 49	78	72.2
50 - 65	30	27.8
Menopausal states		
Late reproductive	51	47.2
Menopausal transition	29	26.9
Post-menopause	28	25.9
Ascendancy		
Indigenous father and mother	68	63.0
Indigenous mother	29	26.8
Indigenous father	11	10.2
Estado marital		
Single (including separated/divorced/widowed)	15	13.9
Married (including common-law marriage)	93	86.1
Religion		
Indigenous religion ("*Encantados")*	108	100.0
Indigenous and Catholic religion	107	99.1
Indigenous and Evangelical Religion	1	0.9
Education (completed years of study)		
Didn't study	4	3.7
From 1 - 5	40	37.0
From 6 - 9	39	36.1
From 10 - 12	10	9.3
More than 12	15	13.9
Profession		
Farmer	84	77.8
Other (1)	24	22.2
Paid	26	24.1
Unpaid	82	75.9
Auxílio Brasil Program (formerly Bolsa Família)		
Receives	57	52.8
Does not receive	51	47.2
Single source of income	11	19.3
Per capita income (minimum wages) (2)		
Up to (1/2)	40	37.0
More than (1/2) to 1	17	15.7
More than 1	22	20.4
Don't know or don't want to inform	29	26.9

(1) Teacher, general services assistant, cook, indigenous health agent, nursing technician, janitor, and street sweeper.
(2) Income values were calculated based on the minimum wage in force (R$ 880.00) in 2016.

Most women (72.2%) were between 35 and 49 years old, the mean age was 44.4 ± 8.3 years (median of 42 years), 76.8% had only attended elementary school, 77.8% declared themselves to be farmers, 75.9% had no paid profession and almost a fifth of all interviewees (19.3%) declared that they lived exclusively with resources from the Auxílio Brasil Program, a Conditional Cash Transfer Program (PTCR) of the Federal Government (Table 1).

3.2 PREVALENCE OF MENOPAUSAL SYMPTOMS WITH MRS

The prevalence of climacteric symptoms was 67.6%, highlighting symptoms such as: depressive mood, physical and mental exhaustion, and irritability. About half of the women reported anxiety, shortness of breath, sweating, hot flashes, sexual problems, muscle and joint problems. Less common symptoms included bladder problems and vaginal dryness, which were present in one third of the interviewees (Table 2). According to MRS, 32.5% of women had no symptoms or were occasional.

In the analysis of climacteric symptoms, higher scores indicated greater symptomatic severity, especially in the psychological domain, suggesting a reduced quality of life. The general intensity of symptoms was classified as moderate, with the psychological domain also moderate, while the somatovegetative and urogenital domains were considered mild. About 27.8% of the interviewees reported severity in the psychological domain, against 15.7% and 5.6% for the urogenital and somatovegetative domains, respectively.

Table 2. Prevalence of climacteric symptoms by Domain

Variable	n = 108	%
Psychological domain		
Depressed mood	73	(67.6%)
Physical and mental exhaustion	70	(64.8%)
Irritability	66	(61.1%)
Anxiety	56	(51.9%)
Urogenital domain		
Sexual problems	59	(54.6%)
Vaginal dryness	36	(33.3%)
Bladder problems	31	(28.7%)
Somatogevetative domain		
Joint and muscular discomfort	58	(53.7%)
Shortness of breath, sweating, hot flashes	56	(51.9%)
Sleep problems	52	(48.1%)
Heart discomfort	47	(43.5%)

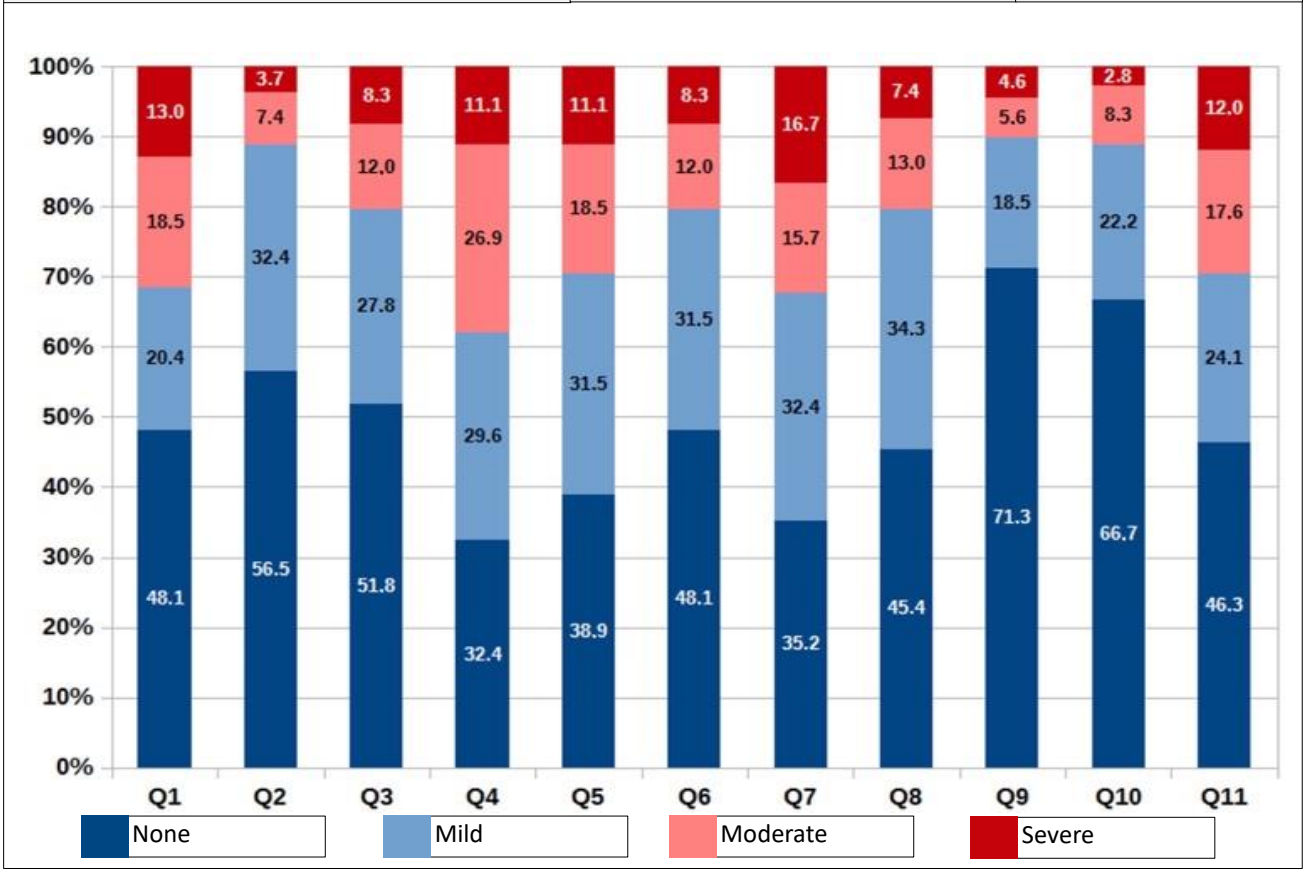
Note: A symptom was considered present if the score was above zero (ranging from mild to severe).

Analyzing the distribution of the scores in each of the climacteric symptoms separately (Figure 2), the symptoms in which more women reported severe or very severe intensity

were: physical and mental exhaustion (16.7%), shortness of breath, sweating and hot flashes (13%) and muscle and joint problems (12%).

Figure 2. Distribution of climacteric symptom intensity (n=108)

Q1. Shortness of breath, sweating, hot flashes; **Q2**. Heart discomfort; **Q3**. Sleep problems; **Q4**. Estado de ânimo depressivo;	**Q5**. Irritability; **Q6**. Anxiety; **Q7**. Physical and mental exhaustion; **Q8**. Sexual problems;	**Q9**. Bladder problems; **Q10**. Vaginal dryness; **Q11**. Joint and muscular discomfort.



Note: Q = question.

3.3 PREVALENCE OF SEXUAL RESPONSE WITH SQF

In the evaluation of sexual function, most of the interviewees reported being stimulated by foreplay (81.5%) and by increased arousal with the partner (77.8%). About two-thirds showed enough interest in sex to be actively involved, while just over half (53.7%) maintained focus during the act. Less than half (47.2%) reached orgasm, 25% reported pain during sex (Figure 3). A quarter of the women had never experienced orgasm (Table 3).

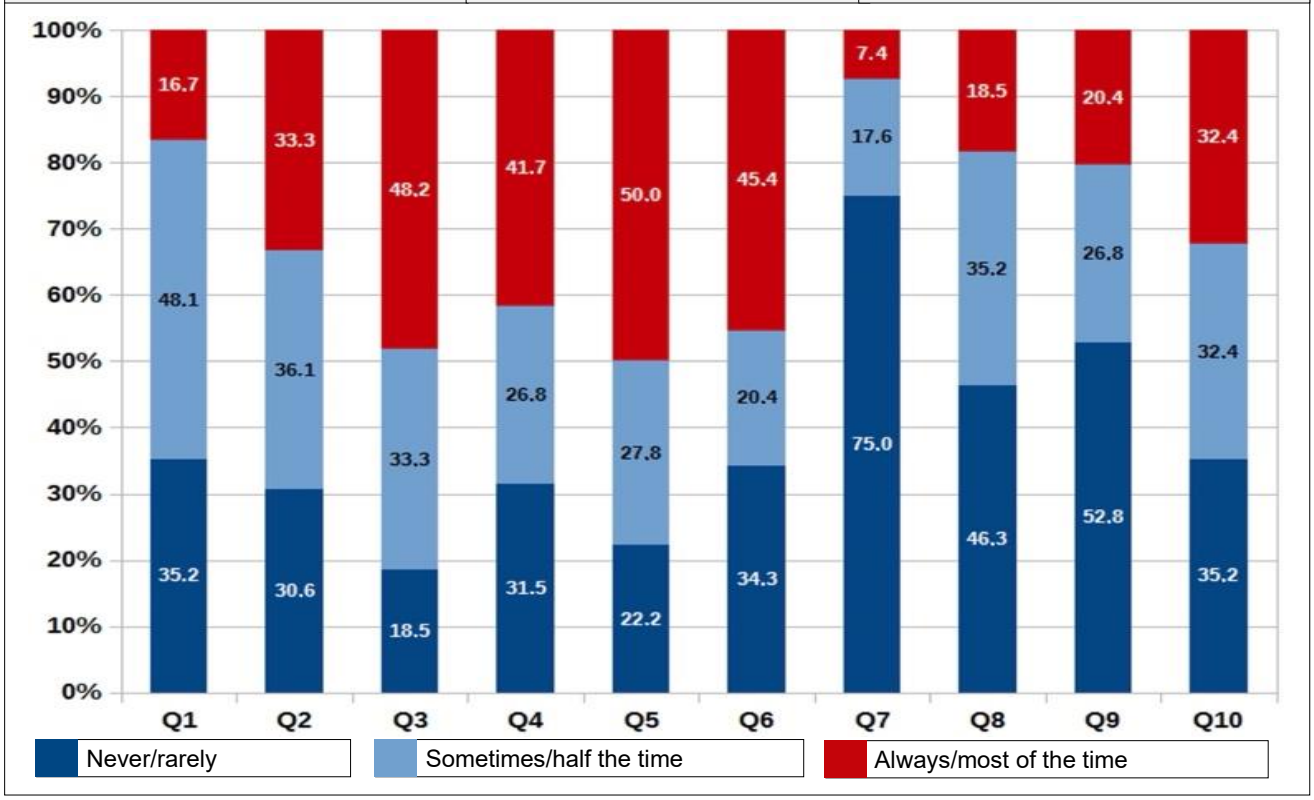
Table 3. Prevalence of aspects of sexual function by Domain

Variable	n = 108	%
Desire domain		
Interest in sex is enough to participate in the relationship willingly	75	69.4
Spontaneously thinks about sex, remembers sex, or imagines doing it	70	64.8
Can engage without being distracted during intercourse	58	53.7
Foreplay domain		
Foreplay encourages her to continue sexual intercourse	88	81.5
Excitation domain		
As your partner's arousal increases, you feel more stimulated	84	77.8
It is usually lubricated during sexual intercourse	74	68.5
Comfort domain		
Relaxes the vagina enough to facilitate penis penetration	71	65.7
Feels pain during sexual intercourse, when the penis penetrates the vagina	27	25.0
Orgasm domain		
Satisfaction in sexual intercourse makes you want to do it other times, on other days	70	64.8
You can reach orgasm during sexual intercourse	51	47.2

Note: 27 women (25.0%) reported that they never reached orgasm in their lives.

Figure 3. Frequency distribution of sexual performance/satisfaction (n = 108).

Q1. Spontaneously thinks about sex; **Q2**. Interest in sex is enough to participate in the relationship willingly; **Q3**. Foreplay encourages her to continue sexual intercourse; **Q4**. It is usually lubricated during sexual intercourse;	**Q5**. With your partner's arousal, you feel more stimulated; **Q6**. Relaxes the vagina enough to facilitate penis penetration; **Q7**. You feel pain during sexual intercourse when the penis penetrates your vagina;	**Q8**. Can get involved, without being distracted, during sexual intercourse; **Q9**. You can reach orgasm during sexual intercourse; **Q10**. Satisfaction in sexual intercourse makes you want to do it other times, on other days.



Note: Q = question.

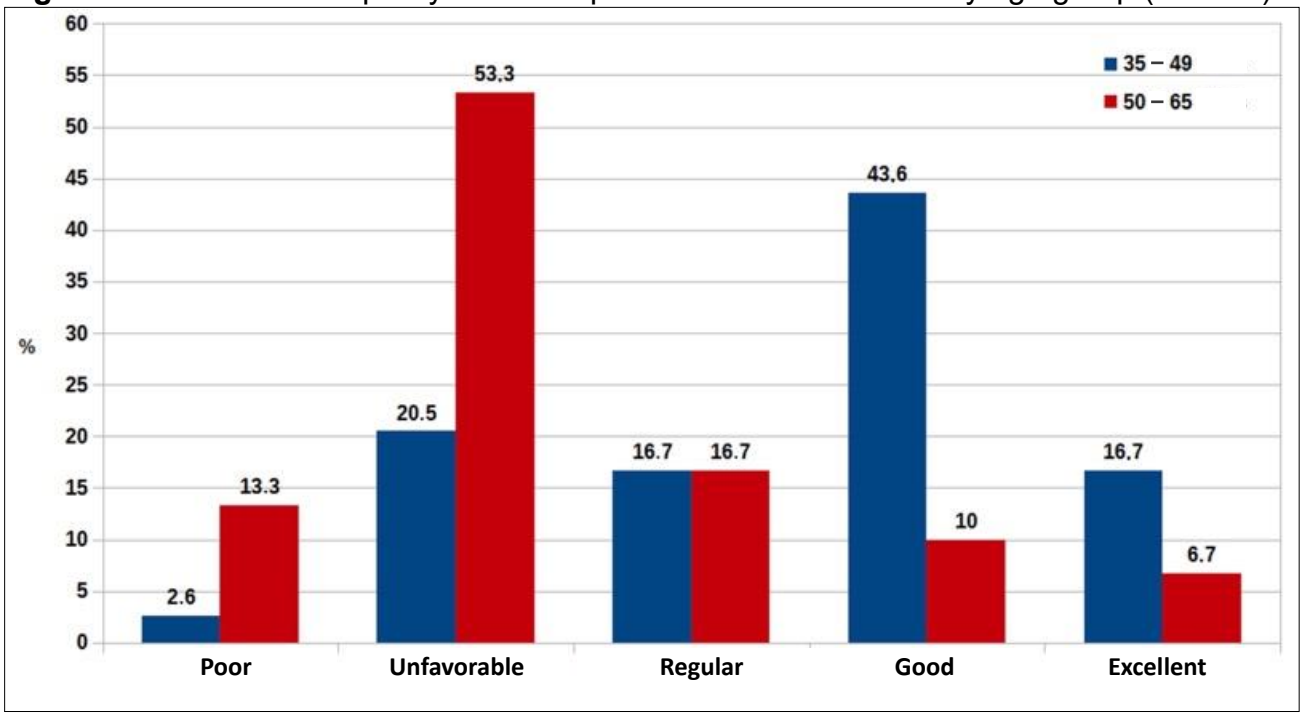
In the analysis of the median of sexual performance points in the climacteric, the highest scores were observed in the comfort domain ("approximately 50% of the time") and

in the desire and orgasm domains ("sometimes"). The analysis indicated that pain during sexual intercourse is "never or rarely" experienced by women (75%).

Among the interviewees, 51.9% had a score ≤60 on the SQF, indicating possible sexual dysfunction. While 35.2% were categorized with poor to unfavorable sexual performance, 48.2% had good to excellent performance.

The analysis by age group showed an association between age and sexual performance among indigenous women aged 35 to 65 years. Participants aged 50 to 65 years had a higher prevalence of poor to unfavorable sexual performance (66.6%), in contrast to 23.1% among those aged 35 to 49 years. Good to excellent sexual performance (60.3%) was more common in younger women (Figure 4).

Figure 4. Distribution of quality of sexual performance/satisfaction by age group (n = 108)



Note: Association: p < 0.001.

3.4 ASSOCIATION BETWEEN CLIMACTERIC SYMPTOMATOLOGY AND SEXUAL FUNCTION

Women with moderate to severe climacteric symptoms are more likely (65.8%) to have unfavorable sexual performance. On the other hand, those without symptoms or with occasional symptoms have a 46.2% probability of achieving regular to excellent sexual performance, showing that more pronounced climacteric symptoms have a statistically significant association with a worse quality of sexual life (Table 4).

Table 4. Association between intensity of climacteric symptoms and quality of sexual performance/satisfaction

Symptoms climacteric	Sexual function (n = 108)						p-valor
	Unfavorable		Regular		Good/Excellent		
	n	%	n	%	n	%	
Absent or occasional	6	(15.8)	5	(27.8)	24	(46.2)	0.027[a]
Mild	7	(18.4)	4	(22.2)	10	(19.2)	
Moderate or severe	25	(65.8)	9	(50.0)	18	(34.6)	
Total	38	(100.0)	18	(100.0)	52	(100.0)	

[a] Statistically significant difference ($p < 0.05$).

3.5 PERCEPTION OF DISCOMFORT ASSOCIATED WITH CLIMACTERIC SYMPTOMS AND SEXUAL FUNCTION

Perceptions of the discomfort of climacteric symptoms and sexual function varied among participants, but there was a general acceptance of menopause as a natural phenomenon, mainly due to the end of menstruation. Physical and mental exhaustion was the most prevalent symptom and most associated with unfavorable sexual performance/satisfaction. And, secondly, shortness of breath, sweating and hot flashes, but with less damage to sexual function. Tiredness, muscle and joint pain were symptoms less reported as negative in this aspect. Weight gain was the most bothersome finding.

3.6 IMPACT ON LABOR PRODUCTIVITY AND DAILY ACTIVITIES

Night sweats had a greater impact on daily activities (e.g., work from home, shopping, childcare, exercise, and study) than on work activities. However, the impact on labor productivity or daily activities was generally low. This trend was amplified when the data was filtered by women complaining of physical and mental exhaustion.

3.7 SEEKING HEALTH SERVICES

Few women have sought doctors or health care teams in the past 12 months to discuss climacteric symptoms or sexual function, often because they perceive these symptoms as natural and temporary. Most preferred consultations with general practitioners to gynecologists or menopause specialists. Although they consider the latter as the main sources of advice, there is limited availability of free specialized medical services and, when they exist, they are more often aimed at women in the reproductive period.

3.8 TREATMENT FOR SYMPTOMS

Some women have opted for natural treatments with specialists in traditional indigenous medicine, not necessarily to directly treat symptoms of climacteric or sexual function, but due to these symptoms being exacerbated by other perceived problems,

especially mental ones. Knowledge about these treatments is limited to what is common in the community. Those who used over-the-counter supplements and medications or were on hormone replacement therapy were excluded from the study due to the possibility of interference with natural symptoms.

3.9 OTHER APPROACHES TO COPING WITH CLIMACTERIC SYMPTOMS

The vast majority of women (65%) adopted lifestyle changes to cope with menopausal symptoms, with variations in the activities adopted. More than half reported an improvement in climacteric symptoms and sexual function after these changes.

3.10 USE OF OVER-THE-COUNTER PRODUCTS

Between 32% and 49% of participants used over-the-counter products such as vitamins D and E, soy products, calcium, sage, evening primrose oil, sleep aids, black cohosh, ginkgo biloba, St. John's wort, star flower oil, agnus-castus, to treat menopausal symptoms. The effectiveness of these products was perceived by approximately half of the users. However, there is little information on Integrative and Complementary Practices (PICs) in the region.

3.11 LOW SUPPLY OF FREE SPECIALIZED MEDICAL SERVICES AND DIRECT COSTS

Medical visits were the largest monthly cost in treating menopausal symptoms, with less than 5% of women seeking paid health services. Some reported the need to compare prices before deciding whether or not to purchase the prescribed medication.

4 DISCUSSION

Depressive mood emerged as the most prevalent symptom, affecting most participants, followed by physical and mental exhaustion and irritability suggesting a considerable impact on well-being during climacteric.

Comparison with other studies indicates variations, up and down, in symptoms and quality of life among different populations, suggesting the influence of cultural, age, and health factors on the experience of climacteric. These findings are comparable, although with variations, to those of previous studies [25-30], such as the international Vaginal Health survey, where the most frequent symptoms in 3,520 postmenopausal women were somatogenic, night sweats, interrupted sleep, and weight gain [28], as well as in Nepalese women [30] and in Brazilian women [6], highlighting the significant impact of the climacteric on psychological well-being.

The results of this survey demonstrate that the prevalence of climacteric symptoms is relatively high and causes negative impacts on the lives of indigenous women, especially when associated with sexual function and with age. Globally, the prevalence of climacteric symptoms has shown differences [28]. Other studies have reported similar findings, such as a study of postmenopausal women showing that these symptoms were associated with humanistic and economic outcomes [27]. A telephone survey in several European countries found that the most frequent symptoms of menopause were shortness of breath, sweating, hot flashes, insomnia, irritability, mood swings, and reduced sexual desire [29].

The urogenital dimension was also explored, revealing the prevalence of women with bladder problems. This result contrasts with studies in indigenous populations, such as the Zenúes of Colombia, the Mayas of Guatemala, and the Movimas of Bolivia, where urogenital symptoms were the most prevalent, reaching twice those found in this study [31,32]. This suggests differences possibly related to age, childbirth care, and racial or sociocultural factors, requiring specific research for a more in-depth understanding.

Quality of life, assessed by the total MRS score, indicated a moderate intensity of climacteric symptoms, with variations between the psychological, somatovegetative and urogenital domains. Compared to studies of other Latin American and global populations, there is a consistency in the patterns of symptoms, although with generally higher intensities [10,16,32-35].

Regarding the association between the intensity of climacteric symptoms, through the MRS, and the sexual performance, via SQF, of indigenous women, no Brazilian or international studies were found that would allow comparisons with our findings using the same data collection instruments. Thus, the discussion of this topic was based on studies that similarly indicated that the intensity of climacteric symptoms can negatively affect sexuality, despite being carried out in non-indigenous populations [35-38].

Brazilian studies using the SQF found that one-fifth of the participants had a poor or unfavorable pattern of sexual performance, and about half of the women studied had sexual dysfunction [39] and no desire to have sex again on other days [40]. As found in our study, other studies suggest that symptoms in the psychological domain (depressive mood, irritability, anxiety, and physical and mental exhaustion) were the most associated with sexual dysfunction [35,41-43], suggesting that in this disorder the psychological state may be its greatest determinant.

In this study with women from the Entre Serras Pankararu people, it was observed that more than half reported never or rarely reaching orgasm. Of these, a quarter had never experienced an orgasm in their lives, and the same number reported feeling pain during sex.

In addition, approximately half of the interviewees are at risk of facing some level of sexual dysfunction. These findings indicate that, for many of these women, sexual experiences are not fully satisfactory, as other studies have found [39] and exactly the opposite when the participants did regular physical activity [38].

Interestingly, despite the challenges brought by the climacteric, many women manage to maintain a satisfying sex life. This underscores the importance of a comprehensive care approach and specific drug interventions to reduce the impact of symptoms on sexual life. In exploring the prevalence of sexual dysfunction, we highlight the need to take into account biopsychosocial aspects in the management of climacteric. This investigation broadens the understanding of the relationship between climacteric symptoms and female sexuality, underlining the importance of inter- and multidisciplinary health care, both inside and outside the territories.

This work enriches knowledge about climacteric among indigenous women Entre Serras Pankararu, emphasizing the variety of experiences and the need for health care that is personalized and culturally sensitive. A strength of our study is its originality in associating climacteric symptoms with sexual function in an indigenous population, bringing valuable insights from a realistic and population-based perspective. Also relevant is the possibility that women of this ethnicity may not seek medical help because they consider their symptoms tolerable. However, we faced limitations, such as selection and memory bias, since the participants needed to volunteer and remember, not only to be using treatments and/or medications that could interfere with natural experience, but also to report past experiences at this stage of life. Longitudinal studies to explore the causal relationships between climacteric symptoms and sexual function could be promising future strategies.

We believe that the observed differences in symptom intensity reflect more cultural nuances than ethnic-racial distinctions. However, studies indicate variations in the frequency and severity of climacteric symptoms between different races [44,45]. While menopause is a natural and inevitable process, positively marked by the cessation of menstruation for some women, it also carries negative connotations such as loss of fertility and youth, as well as uncomfortable symptoms. A 2021 Italian survey showed that almost half of women have felt a significant impact on their sex life due to physical or psychological changes. Only a few investigated saw menopause as a positive phase to avoid pregnancy. This study noted that menopausal symptoms affect everyday activities more than work [22].

Opinions about menopause were consistent, despite individual variations, possibly due to differences in health education and awareness. Notably, the hesitancy to seek treatment, common in other regions of the world, was evident here. Even with knowledge

about the symptoms, many women delay seeking help or do not treat their symptoms, suggesting the need for more guidance and new treatment options [46-47].

In summary, although lifestyle changes relieved symptoms in more than half of the women, for the rest no significant improvements were observed. This highlights the need for caution regarding non-hormonal therapies and over-the-counter products, such as herbal treatments and certain lifestyle adaptations (e.g., cooling techniques and the avoidance of "triggers"), which can delay the implementation of effective therapies for menopausal symptoms, as pointed out by the North American Menopause Society's position statement on the non-hormonal management of menopause [48]. In addition, the costs of medical consultations and medications represent most of the expenses in the treatment of these symptoms. As noted in other studies, most women who face climacteric-related symptoms remain without adequate treatment [49].

5 CONCLUSIONS

A large part of women face climacteric symptoms, which range from moderate to severe, and the psychological symptoms were the most intense, impairing sexual function. Many of these women, even those with major symptoms, do not seek medical advice, which suggests that the real impact of these symptoms may be underestimated if we only consider cases diagnosed in clinical settings. Other consequences are added, such as sleep disorders and weight gain, profoundly affecting quality of life and increasing the risk of chronic diseases. The symptoms reported include psychological and physical aspects, with the "depressive mood" being the most common. However, only a fraction of those affected receive treatment, and an even smaller number resort to paid health services, due to difficulty in accessing or non-existence of public services. Although we did not find women who resist treatment, the availability of effective non-hormonal treatment alternatives could significantly improve the management of these symptoms.

TAXPAYERS

Aécio Menezes Nogueira reviewed the literature, wrote the manuscript, contributed to the interpretation of the data, and prepared the tables and figures.

Pedro Henrique Nogueira de Souza contributed with the conception and design and translation. Edemilson Antunes de Campos contributed with the conception and project.

Claudinalle Farias Queiroz de Souza contributed to the conception, design and financing of the publication.

Aurélio Molina da Costa reviewed the final version for important intellectual content, assisted in the writing of the manuscript and approved the final version to be submitted.

All authors approved the final version of the manuscript.

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ETHICAL APPROVAL

The study followed appropriate ethical standards, including approval by two Ethics Committees, one from the University of Pernambuco and the other from the National Committee.

PROVENANCE AND PEER REVIEW

This article was not commissioned and has been externally peer-reviewed.

RESEARCH DATA (DATA SHARING AND COLLABORATION)

The research datasets linked to this article strictly complied with the legality recommended by the research ethics committees.

CONFLICTING DECLARATION OF INTEREST

All authors declare that they have no competing interests.

ACKNOWLEDGMENTS

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APPENDIX A. SUPPLEMENTARY DATA

Additional data to this article can be requested by e-mail.

STATEMENT OF USE OF AI IN THE WRITING PROCESS

During the preparation of this work, the authors used OpenAI's ChatGPT-4 for text proofreading and readability enhancement. After using this tool/service, authors have reviewed and edited the content as needed and take full responsibility for the content of the publication.

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PUBLIC POLICIES DEVELOPED IN WOMEN'S PRISONS IN ARGENTINA

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ABSTRACT

The main objective of this paper is to analyze the public policies of rupture in women's prisons in Argentina, seeking to understand their implications for social reintegration, the reduction of recidivism and respect for the human rights of incarcerated women. The study addresses the programs developed in the prison context for women, analyzing the conditional guidelines of international bodies, as well as the Argentine legislation that aims to promote the dignity and rehabilitation of these inmates. Starting from a theoretical and methodological review, questions were raised about relative gender inequalities, the conditions of incarceration and the challenges of resocialization. The theoretical framework covers studies on gender, criminal policies and human rights, providing a critical and multidimensional view. A qualitative approach was used, with documentary analysis and interviews with professionals from the penitentiary system. The final considerations reveal that, although there has been progress in foreign policies for the female prison population, inequalities persist and deactivate greater attention from the State and civil society. It is concluded that the effectiveness of policies depends on an integrated approach, focusing on the empowerment of women and combating the conditions of social exclusion that many face before and after incarceration.

Keywords: Women's prisons. Public policies. Argentina. Gender. Human rights.

INTRODUCTION

In recent years, the increase in the female prison population in Argentina has brought to light questions about the penitentiary system and public policies aimed at this population. Reflection on the specificities of female incarceration is essential, since women face particular conditions and challenges, different from those experienced by men in the same context.

The growth in women's incarceration rates in Latin America, especially in Argentina, is directly related to worsening poverty, social exclusion, and involvement in illicit activities, such as drug trafficking, which, according to studies, disproportionately affects women from lower social classes (Alvarez, 2019).

In this context, the public policies developed for the women's prison system have sought, in theory, to meet the specific needs of this population. However, there is a significant gap between legal guidelines and the implementation of these policies (Zambrano, 2021). The debate on the role of the State and civil society in promoting a more inclusive and equitable justice is central to understanding the transformations that have taken place.

Living conditions in women's prisons are often marked by human rights violations, such as overcrowding, precarious access to health, lack of adequate education programs, and absence of professional training. According to data from the Argentine Ministry of Justice (2020), approximately 80% of incarcerated women in the country are mothers, which further aggravates the challenges faced in the incarceration process, especially with regard to maintaining family ties.

Public policies aimed at women in Argentine prisons must incorporate a gender perspective, as recommended by international organizations such as the United Nations (UN) and the Inter-American Commission on Human Rights (IACHR). However, there is criticism about the effectiveness of these policies, since most prisons do not have adequate infrastructure to house women with dignity and to offer effective rehabilitation programs (López, 2022).

In this sense, it is essential that public policies for incarcerated women are not limited to isolated initiatives, but that they involve a profound restructuring of the Argentine prison system. The adoption of measures that guarantee educational training and insertion in the labor market is one of the central points for reducing criminal recidivism and promoting a dignified life after serving the sentence (Martínez, 2020).

This article aims to analyze the public policies developed in women's prisons in Argentina, from a critical perspective that takes into account not only the formal guidelines,

but also the reality experienced by women deprived of liberty. The analysis is carried out in the light of key concepts of human rights, gender equity and social justice.

In the end, the article seeks to offer contributions to the improvement of public policies, considering the structural and social challenges that hinder the effective reintegration of women into the social fabric when they leave the prison system.

PUBLIC POLICIES AND INCARCERATION

Public policies aimed at the prison system aim to ensure public safety, as well as the rehabilitation of individuals deprived of liberty (Costa, 2017). However, these policies, when applied to the female public, must consider the specificities related to gender, such as maternity and the history of violence experienced by most inmates before their incarceration (Wacquant, 2010). It is important to highlight that many of these women were victims of domestic or sexual violence before being arrested, which implies that policies need to deal not only with the deprivation of liberty, but also with the psychological and emotional consequences of these traumas (Macedo, 2018).

In addition, incarcerated women have particular health needs, including reproductive and mental health, that are often overlooked in a system designed predominantly for men (Rodrigues, 2019). Female incarceration requires public policy planning that goes beyond the issue of security, prioritizing access to specialized health care, such as gynecological follow-up, treatment for psychological trauma, and maternity support programs, since many inmates are mothers and have immense difficulty in maintaining bonds with their children (Tavares, 2021).

Motherhood is a central aspect to be considered in women's prison policies, since many women, especially in contexts of social vulnerability, are the main or only caregivers of their children. Incarceration generates a rupture in the lives of these children who may end up in the custody of family members or even the social protection system (Martínez, 2020). According to the Argentine Ministry of Justice (2020), about 80% of women imprisoned in the country are mothers and this requires a specific approach that makes it possible to strengthen family ties during the period of serving their sentence (González, 2019).

Another challenge faced by women in Argentine prisons is the lack of educational and professional training programs that allow them to reintegrate into the labor market upon leaving prison. The absence of opportunities to develop skills and acquire knowledge is a factor that contributes to criminal recidivism, since many of these women return to the environment of exclusion and poverty that led to the crime in the first place (Santos, 2021).

In this sense, education and professional training policies within the prison system are essential to ensure that inmates can rebuild their lives after incarceration (Nunes, 2022).

Another critical point is the precariousness of facilities in women's prisons in Argentina, since many units do not have adequate infrastructure to meet the basic needs of detention, such as access to drinking water, hygiene conditions, security, and adequate spaces for recreational and educational activities (López, 2022). In addition, overcrowding is a recurring problem, further aggravating living conditions inside prisons. According to the report of the Inter-American Commission on Human Rights (IACHR, 2020), Argentine women's prisons suffer from a high occupancy rate resulting in violations of the human rights of inmates.

Another point to be addressed in public policies is the issue of institutional violence. Many incarcerated women report experiences of physical, psychological, and sexual violence within prisons, both by other inmates and by prison system staff (Alvarez, 2019). The absence of effective protection and rejection mechanisms aggravates this situation, reinforcing the need for a stricter approach to combat gender-based violence within the prison system (Saavedra, 2018).

It is crucial that public policies external to the female prison system consider the preparation of women for life after incarceration. Social reintegration programs that include psychological support, employment opportunities, and housing are key to reducing recidivism rates (Zambrano, 2021). However, reintegration goes beyond immediate assistance and involves a broader cultural and social change, including the creation of support networks and raising society's awareness of the reception of these women after serving their sentences (López, 2022).

In this way, the development of effective public policies for women's prisons in Argentina depends on an intersectoral approach that addresses not only justice and confinement, but also the rehabilitation and guarantee of the human rights of these women. This requires a continuous commitment from the State, civil society organizations, and the international community to promote profound structural changes in the penitentiary system.

FEMALE INCARCERATION IN LATIN AMERICA

In Latin America, the significant increase in the female prison population in recent decades can be attributed, in large part, to the so-called "war on drugs". Women, generally with low education and belonging to disadvantaged classes, are often recruited to act as "mules" for international drug trafficking (Saavedra, 2018). This aspect is accompanied by repressive penal policies that share some of the situations that lead these women to crime.

One of the most devastating effects of these policies is the rupture of family ties, since most of these women are mothers and play a central role in the care of their children. The forced separation of children, who are often left in the care of family members or placed in institutions, has profound impacts on both inmates and their children, contributing to intergenerational cycles of poverty and exclusion (Martínez, 2020). In addition, penalties for drug trafficking, especially when applied in a generalized manner, do not take into account the relatively minor role of these women in criminal networks, resulting in disproportionate sentences compared to drug lords (Lima, 2019).

It is worth highlighting the lack of gender policies in the Latin American penal system that do not consider the specific needs and vulnerabilities of women. Women's prisons are often ill-equipped to deal with issues such as reproductive health, psychological assistance, protection from abuse and violence within the prison system (Rodrigues, 2019). Inhumane conditions and overcrowding also exacerbate the situation, violating the fundamental rights of women prisoners and perpetuating cycles of marginalization that are difficult to break without serious political intervention (Alvarez, 2019).

It is worth noting that drug policies in Latin America often ignore the structural factors that lead these women to crime, such as extreme poverty, unemployment, and lack of access to education. Initiatives that aim to punish involvement in drug trafficking, instead of offering economic and social development solutions, end up widening existing inequalities and increasing the vulnerability of women prisoners, making it even more difficult for them to reintegrate socially after serving their sentence (Zambrano, 2021). These policies need to be reassessed, prioritizing approaches that consider gender dynamics and seek alternatives to incarceration, such as more inclusive rehabilitation programs.

In addition, it is necessary to consider that the criminalization of these women often takes place in a context of pre-existing gender violence, that is, many of these women involved in drug trafficking have already been victims of abuse, domestic violence, and exploitation, thus resorting to these activities as a form of survival (Alvarez, 2019). The penal system, however, despises these situations, treating them indifferently to their personal realities, ignoring the role of structural inequality and gender oppression in the increase in female incarceration (Gomes, 2020).

It is important to highlight another aspect in this analysis: recidivism. The lack of effective social reintegration policies and post-prison support means that many of these women return to criminal activities after serving their sentences. The absence of job opportunities, social stigma, and difficulty in rebuilding family ties are factors that affect the return to crime (Rodrigues, 2019). Policies to combat drugs that only punish, without

offering social rehabilitation programs, fail to promote true resocialization, perpetuating a cycle of exclusion and recidivism (Saavedra, 2018).

Therefore, it is urgent that Latin American governments reassess their policies to combat drugs and adopt more humanized strategies considering the social and economic reality of women involved in trafficking. This includes not only a review of sentences, but also the development of preventive programs focused on education, creating economic opportunities, and strengthening social support networks for women in vulnerable situations. Only through a multidimensional approach, which recognizes the complexities of the problem, will it be possible to break the cycle of incarceration and exclusion that affects so many women in the region (Zambrano, 2021).

HUMAN RIGHTS AND GENDER IN THE PRISON SYSTEM

The recognition that incarcerated women are subjects of rights and deserve treatment that respects their dignity is relatively recent. The UN, through the Bangkok Rules (2010), establishes that prison policies must be adapted to meet the specific needs of women prisoners. However, most of these guidelines encounter significant barriers, especially in countries such as Argentina, where prison systems face structural problems (Reis, 2019). These challenges include overcrowding, lack of adequate infrastructure, and the absence of policies that effectively address gender issues, resulting in a continued violation of the human rights of female inmates (López, 2022)

One of the most critical aspects affecting the application of the Bangkok Rules is the precariousness of the health services offered to incarcerated women. While these guidelines require inmates to have access to adequate medical care, including reproductive health, many prisons in Argentina and other Latin American countries do not provide such care (Rodrigues, 2019). Problems such as the lack of specialized doctors, medications, and the absence of adequate prenatal care for pregnant women are common, aggravating the vulnerable conditions of women in prisons (Alvarez, 2019). In addition, the absence of specific mental health programs, especially in cases of women who have suffered abuse and trauma before incarceration, prevents their recovery and rehabilitation effectively.

Gender violence inside prisons is another point that deserves a lot of attention. Incarcerated women are particularly exposed to various forms of institutional violence and abuse of power by prison officers and other inmates (Saavedra, 2018). The prison system, by its very repressive nature, tends to aggravate the situation of these women who already arrive in prisons with a history of domestic violence, sexual abuse or economic exploitation. Even with the establishment of international norms, such as the Bangkok Rules, there is a

huge gap between the norms and the daily reality in women's prisons, which requires not only the creation of policies, but also their effective implementation and strict supervision (Zambrano, 2021)

The rehabilitation of incarcerated women continues to be one of the greatest challenges of the prison system. Public policies aimed at the social reintegration of these women often fail to consider the additional barriers they face when leaving prison, such as social stigma, lack of employment opportunities, and disconnection from children and family (Martínez, 2020). The Bangkok Rules emphasize the need for professional training and psychological support programs that prepare inmates for reintegration, but without adequate support from the State and society, these women end up trapped in cycles of criminal recidivism and social exclusion (Gomes, 2020). It is necessary that rehabilitation policies be reinforced with a focus on social justice and gender equity so that inmates can truly rebuild their lives outside the prison system.

FINAL CONSIDERATIONS

This study adopted a methodology of a **bibliographic** nature based on the analysis of legal documents, reports from international organizations and academic literature on the women's prison system in Argentina. Publications covering the period between 2010 and 2023 were examined, including studies on public policies, human rights, and gender issues in the penitentiary context. The bibliographic research allowed the identification and analysis of international guidelines, such as the Bangkok Rules, as well as critical studies on the application of these standards in the Argentine context. This approach enabled an in-depth reflection on innovative public policies and their challenges.

The public policies developed in women's prisons in Argentina represent a step forward in recognizing the specific needs of incarcerated women, but they still face significant challenges to be effective. Issues such as overcrowding, lack of adequate infrastructure, and the need for educational and professional programs persist, limiting women's ability to reintegrate socially.

The results indicate that the effectiveness of these policies depends on a more integrated approach that not only respects the rights of inmates, but also prepares them to face social and economic challenges after incarceration. The fight against social exclusion and the promotion of true gender equality in the Argentine penal system are fundamental steps to transform this scenario.

In addition, it is crucial that public policies are articulated with continuous social assistance initiatives and psychological support after serving the prison sentence to prevent

recidivism and facilitate the reintegration of these women into society. The creation of community support networks, programs for reintegration into the labor market and access to housing are fundamental elements to break the cycles of marginalization and poverty that affect a large part of the incarcerated female population. Only through a joint effort between the State, civil society and the former inmates themselves will it be possible to build a fairer system that promotes social reintegration and guarantees human rights effectively.

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INTEGRATION OF MENTAL HEALTH INTO THE DAILY LIVES OF EDUCATORS AND HUMAN RESOURCES MANAGERS TO PROMOTE A HEALTHY WORK ENVIRONMENT

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ABSTRACT

The integration of mental health in the workplace is an increasing necessity to promote the well-being and productivity of professionals. Educators and human resource managers, in particular, face unique challenges that can significantly impact their psychological health. Therefore, practices that encourage a healthy work environment are fundamental for balancing professional demands and quality of life. This research adopted a qualitative approach, seeking to understand the phenomena related to mental health in the educational and corporate contexts through interpretative and exploratory analysis. The overall objective of this study is to investigate how the integration of mental health into the daily lives of educators and human resource managers contributes to promoting a healthy work environment, addressing practices and policies that favor psychological well-being in both educational and corporate settings. The results indicate the importance of more effective and integrated policies in addressing mental health issues, highlighting the need for preventive actions in both the educational and corporate sectors. The research also revealed that, although support interventions exist, there are still gaps in the approaches

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adopted by institutions, suggesting a need for greater investment in training programs and ongoing support for educators and human resource managers.

Keywords: Mental Health. Workplace Integration. Educators. Human Resources.

INTRODUCTION

In an increasingly challenging landscape for professionals across various fields, mental health stands out as an essential factor in creating healthy and productive work environments. Educators and human resources managers, who are often exposed to high demands and responsibilities, are particularly vulnerable to psychological issues such as stress, anxiety, and burnout. These issues not only affect the quality of life of these professionals but also have a direct impact on organizational climate and team efficiency.

Promoting the mental health of these professionals requires an integrated approach that considers both institutional support policies and daily practices of care and prevention. In this sense, understanding the specific demands and effective practices for the well-being of educators and human resources managers is an essential step toward developing strategies that improve the work environment and strengthen organizational commitment to mental health.

This research adopted a qualitative approach, aiming to understand phenomena related to mental health in educational and corporate contexts through an interpretative and exploratory analysis. The general objective of this study is to investigate how the integration of mental health into the daily lives of educators and human resources managers contributes to promoting a healthy work environment, addressing practices and policies that foster psychological well-being in both educational and corporate settings.

The specific objectives are as follows: to identify the primary mental health demands of educators and human resources managers, as well as the factors influencing workplace well-being; to analyze existing practices and policies aimed at supporting the mental health of educators and managers, focusing on intervention and prevention programs for psychological issues; and to evaluate the impact of promoting mental health on the quality of the work environment and professional performance, observing effects on productivity and organizational climate.

This article is organized into four sections. The introduction presents the research objectives, the study's relevance, and the importance of addressing mental health in educational and corporate contexts. The materials and methods section details the qualitative approach adopted and the literature review procedure, explaining how scientific sources were selected to construct the study. The theoretical framework is divided into three subtopics, covering stress factors and mental health demands, support practices and policies, and the impacts of these issues on productivity and organizational climate. Finally, the conclusions summarize the main findings of the research, highlight the study's

contributions, and propose suggestions for future investigations in the field of workplace mental health.

METHODOLOGY

This study adopted a qualitative approach to explore and understand phenomena related to mental health in educational and corporate settings through an interpretative and exploratory analysis. Qualitative research is highly valued in the scientific community as it enables an in-depth, detailed examination of the subjective and complex aspects of the phenomena under study. Unlike quantitative research, which seeks measurement and quantification, qualitative research focuses on understanding perceptions, meanings, and experiences of individuals involved, providing a richer, more contextualized view of the issues addressed (Guerra et al., 2024).

The research method chosen for this study was a literature review, an essential scientific tool for consolidating existing knowledge on a given subject. The literature review enabled a critical and comparative analysis of prior studies, allowing for the identification of trends, research gaps, and various perspectives on the topic. This approach not only expanded the understanding of the study's focus but also established a robust, updated theoretical foundation to guide future research and practices in this area. According to Dorsa (2020, p. 02), "the literature review is fundamental to the writing of a scientific text, regardless of genre: a thesis, dissertation, project, or scientific review article."

The sources for the literature review were selected from high-quality, reputable scientific databases such as SCIELO, PubMed, Google Scholar, and other esteemed sources, ensuring both credibility and currency. The selection primarily included articles published in impactful scientific journals, dissertations, and theses that provided significant and in-depth contributions to the topic of mental health within educational and corporate contexts.

This selection process aimed to ensure information quality, prioritizing peer-reviewed works with scientific relevance, thereby strengthening the reliability and validity of the data analyzed in this study. Thus, the proposed methodology consolidated existing evidence and provided a critical and comprehensive analysis of the impacts of mental health on workplace and educational settings, contributing to the advancement of scientific understanding on the topic and its practical implications.

THEORETICAL FRAMEWORK

This theoretical framework explores fundamental aspects of mental health in the workplace, beginning with the stress factors and mental health demands affecting educators and human resources managers. In this first section, the primary sources of psychological pressure faced by these professionals are discussed, including intense workloads, emotional responsibilities, and the ongoing need for adaptation—factors that contribute to both mental and physical exhaustion.

Subsequently, the discussion shifts to mental health support practices and policies, examining preventive interventions and support strategies aimed at mitigating the impact of professional demands on these individuals. In this subsection, psychological support programs, institutional policies, and self-care practices encouraged in educational and corporate environments are analyzed, assessing the effectiveness of these measures in promoting a healthier work environment.

Finally, the framework addresses the impacts of mental health on productivity and organizational climate, highlighting how promoting psychological well-being can benefit both individual and collective performance. The positive effects of environments that prioritize mental health are discussed, illustrating how this contributes to increased productivity, improved interpersonal relationships, and the creation of a more collaborative and sustainable organizational climate.

STRESS FACTORS AND MENTAL HEALTH DEMANDS IN EDUCATIONAL AND CORPORATE CONTEXTS

Currently, concerns about mental health in the workplace have grown and intensified, as working conditions and mechanisms often have complex precedents in mental strain and psychological distress. This scenario calls for new strategies to promote mental health in the workplace (Seligmann-Silva, 2022).

In this context, in today’s environment, stress factors and mental health demands in the workplace are increasingly prevalent, especially in sectors such as education and human resources management. Educators face challenges like pressure for results, the need for constant adaptation to new educational technologies, and the emotional management required to address students' needs. Conversely, human resources managers, in addition to their traditional roles, bear the responsibility of creating and maintaining a healthy work environment, including addressing employees' emotional and mental health issues. This scenario places both groups under high levels of stress and at risk of mental exhaustion. Recent studies indicate that in educational settings, work

overload and lack of resources directly impact educators' mental health. With the increase in administrative workload, many teachers find themselves performing additional duties, such as managing behaviors and supporting students with diverse needs, without adequate support. The covid-19 pandemic intensified these challenges, requiring a rapid transition to remote learning and, subsequently, to a hybrid model, which demanded constant readjustment from educators and brought significant psychological health impacts (Pereira, Santos & Manenti, 2020; Ribeiro, Scorsolini-Comin & Dalri, 2020; Santos & Rossetto, 2023).

According to Moreira and Rodrigues (2018, p. 11), the primary factors affecting teachers' mental health include:

> The erosion of wages, the lack of material and human resources in schools, the discontinuity of school years due to frequent strikes, and the rising violence in communities, among other factors, are both products and producers of professional devaluation and resultant work-related suffering. In the corporate sector, especially for human resources professionals, the demand for innovation and efficiency is combined with the pressure to create inclusive work environments that promote well-being. With the growing emphasis on mental health in companies, human resources managers are at the forefront of implementing support policies while managing their own pressures.

Human resource management has increasingly proven to be essential in the corporate environment, as it contributes to business competitiveness in an ever more challenging market. Since it is well-established that people are the primary source of knowledge, organizations must know how to care for them. In this regard, the significance of organizational climate, along with the implementation of measures aimed at improving quality of life, can positively impact stress factors and mental health demands in the organizational context (Ferreira, 2017).

Additionally, hyperconnectivity and remote work, which have become widespread, have heightened the expectations of constant availability, creating what is known as "digital fatigue," a new factor in work-related stress (Ferreira et al., 2024). These stress factors affect both the individual well-being and performance capacity of professionals. The pressure to maintain productivity while managing emotional issues contributes to a state of exhaustion and disconnection known as burnout. In recent years, burnout has been formally recognized by the World Health Organization (WHO) as an occupational phenomenon, reflecting the seriousness and impact of this issue, particularly in professions involving intense human interaction and emotional responsibilities (Ferreira et al., 2024).

In addition to burnout, professionals in these sectors report high rates of anxiety and depression. This reality challenges organizations to adopt policies that not only aim to reduce stress factors but also promote mental health preventatively. Creating environments

that offer a balance between professional and personal life, along with encouraging self-care practices, are some actions that can help mitigate negative impacts on the health of educators and human resources managers (Ribeiro, Scorsolini-Comin & Dalri, 2020).

Understanding the stress factors and mental health demands in these contexts is essential for creating effective support and prevention strategies. Analyzing these aspects enables educational and corporate organizations to develop actions that not only meet the needs of professionals but also contribute to a healthier and more sustainable work environment, benefiting all involved (Ribeiro, Scorsolini-Comin & Dalri, 2020; Ferreira et al., 2024).

MENTAL HEALTH SUPPORT PRACTICES AND POLICIES: AN ANALYSIS OF PREVENTIVE AND SUPPORTIVE INTERVENTIONS

In recent years, attention to mental health in the workplace has become a priority for many organizations, leading to the development and implementation of specific support policies. In both the educational and corporate sectors, mental health support practices encompass interventions ranging from stress prevention programs to continuous emotional support for employees at all hierarchical levels. These initiatives aim not only to respond to the growing demand for healthier work environments but also to promote the emotional sustainability of professionals (Merçom & Constantinidis, 2020).

In the educational context, mental health support practices have included training programs for educators, helping them to identify signs of stress and burnout in themselves and their colleagues. Educational institutions are increasingly engaged in providing resources such as socio-emotional skill training and tools to promote self-care. These actions contribute to creating a culture of prevention and support, offering educators strategies to manage stress and maintain a balance between professional and personal life. In the corporate environment, companies across various sectors have adopted mental health policies that include not only the implementation of employee assistance programs but also the creation of spaces for relaxation and decompression activities. Some psychological support programs offer access to therapy sessions, mental health lectures, and workshops on stress management techniques. These practices aim to strengthen the emotional well-being of workers and, consequently, increase productivity and improve the organizational climate (Merçom & Constantinidis, 2020).

Moreover, flexibility in work, such as adjustable hours or remote work options, is one of the most successful policies for reducing stress and promoting work-life balance. Companies that adopt this practice have observed positive impacts not only on employees'

mental health but also on performance and motivation, as these professionals have greater autonomy to manage their demands. Another significant intervention has been the promotion of mindfulness programs and meditation practices, which help workers develop emotional resilience. These practices are particularly useful for managing daily stress and improving concentration, and are increasingly common in sectors where emotional workload and pressure for results are high, such as in schools and human resources companies (Assumpção et al., 2019; Resende et al., 2021).

However, as Ferreira (2017) emphasizes, it is essential to adopt a comprehensive perspective on professionals, considering various aspects such as psychological, economic, and social factors. Taking care of individuals is crucial, aiming to mitigate or minimize occupational risks through measures that ensure workplace safety, addressing not only physical efforts but also the mental demands that may arise in the work context.

Thus, when well-structured, mental health support practices and policies can transform work environments, promoting the psychological health of employees and reducing rates of absenteeism and turnover. By analyzing these interventions, this study highlights the importance of a proactive and integrated approach that takes into account the specific needs of each sector and offers accessible and effective solutions for all involved.

IMPACTS OF MENTAL HEALTH ON PRODUCTIVITY AND ORGANIZATIONAL CLIMATE: PERSPECTIVES AND BENEFITS

Mental health plays a crucial role in productivity and organizational climate, directly affecting how professionals perform their tasks and interact with colleagues. When employees' mental health is not adequately supported, the impacts can be profound, leading to decreased task performance, increased absenteeism, and interpersonal difficulties, which can compromise team collaboration (Motta & Romani, 2019).

In the educational context, teachers' mental health is directly linked to the quality of education provided to students. Educators facing high levels of stress and emotional exhaustion may have reduced concentration, which impacts their lesson planning and interaction with students. Furthermore, emotional burnout can create a cycle of demotivation, affecting the classroom atmosphere and the overall school environment (Motta & Romani, 2019).

In corporate organizations, the impact of mental health on productivity is equally significant. Employees with impaired mental health show less motivation to complete tasks, have more difficulties meeting deadlines, and may feel overwhelmed, which reduces the quality of their work. The lack of emotional and psychological support can also lead to

higher employee turnover and absenteeism, disrupting operations and increasing the costs associated with hiring and training new staff (Motta & Romani, 2019; Schmidt et al., 2020).

On the other hand, investing in employees' psychological well-being can bring numerous benefits. Companies and schools that implement mental health policies, such as psychological support programs and stress reduction initiatives, observe significant improvements in both productivity and organizational climate. Environments that promote mental health care tend to be more collaborative, with fewer internal conflicts, higher employee satisfaction and loyalty, and a significant reduction in turnover rates (Motta & Romani, 2019; Schmidt et al., 2020).

Various studies have shown that when employees perceive that their employers care about their emotional well-being, motivation and commitment increase, fostering a more positive organizational culture. According to Bock, Furtado, & Teixeira (2021), motivation for work can be influenced by numerous factors. Providing spaces for leisure and social interaction among workers, fostering more collaborative practices in the workplace, and improving working conditions, for example, directly impact productivity and the quality of work. Meanwhile, implementation of effective mental health practices, such as providing psychological support services, relaxation programs, and stress management initiatives, contributes to creating a healthy organizational climate characterized by open communication, mutual support, and a sense of belonging (Motta & Romani, 2019; Schmidt et al., 2020).

Table 1 – Impacts of Mental Health on Productivity and Organizational Climate

Impacted Factors	Negative Effects	Positive Effects
Productivity	Low concentration, task commitment issues, decreased performance	Increased focus, higher productivity and work quality
Organizational Climate	Interpersonal conflicts, tense and strained work environment	Collaborative environments, reduced conflicts, employee satisfaction
Absenteeism	Increased absences due to psychological issues, work leave	Fewer absences, higher work attendance
Satisfaction and Motivation	Feelings of demotivation, frustration, and disengagement	Increased engagement, satisfaction, and organizational loyalty
Employee Turnover	Higher turnover due to stress and dissatisfaction	Lower turnover, better talent retention

Source: Researchers' Data

Table 1 summarizes the key impacts of mental health on factors that directly influence both productivity and organizational climate. The promotion of a mentally healthy

environment can lead to substantial gains in both the individual well-being of employees and the collective and organizational performance.

FINAL CONSIDERATIONS

The research successfully achieved all the proposed objectives, providing a detailed analysis of the stress factors and mental health demands in both the educational and corporate contexts, while also exploring mental health support practices and policies, and the impacts of this topic on productivity and organizational climate. Through the qualitative approach and the literature review procedure, it was possible to consolidate a deep understanding of the mental health issues faced by these professionals, based on up-to-date, high-impact scientific sources.

The research highlighted that both the educational and corporate contexts present significant challenges related to stress and workers' mental health. The analysis revealed the relevance of support practices, such as psychological support programs and preventive policies, in mitigating the negative impacts on mental health. Furthermore, it was evident that mental health is directly correlated with productivity and organizational climate, showing that healthy work environments are crucial for team performance and individual well-being.

The results indicate the importance of more effective and integrated policies in addressing mental health issues, highlighting the need for preventive actions in both the educational and corporate sectors. The research also showed that, while support interventions exist, there are still gaps in the approaches adopted by institutions, suggesting the need for greater investment in training programs and continuous support for educators and human resources managers.

For future research, an empirical approach is recommended, involving case studies in schools and companies to assess the effectiveness of mental health practices and policies in real-world environments. Expanding the study to different regions and cultural contexts would also be valuable, to understand how local specifics influence the results related to mental health at work.

Finally, further investigation into the relationship between different types of stress in educational and corporate contexts and their effects on mental health could provide valuable data for the development of more effective public policies and corporate initiatives. In summary, this study significantly contributes to the advancement of knowledge regarding mental health in the workplace and educational environments, providing insights for future management actions and public policies aimed at promoting a healthier and more productive work environment for all involved.

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INTESTINAL PARASITOSIS AND ITS INFLUENCE ON THE ONSET OF ANEMIA IN ELEMENTARY SCHOOL CHILDREN

https://doi.org/10.56238/sevened2024.037-025

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ABSTRACT

The incidence of intestinal parasitosis in poor locations is a problem for public health. The lack of basic sanitation, drinking water, correct food and adequate hygiene make parasitosis constantly present in vulnerable populations, leading to other diseases such as anemia, which negatively influence child development and the quality of life of adults. The objective of this study was to analyze fecal and blood samples from children at the Fita Bisol Municipal School, in the town of Imasa, in the municipality of Monte Carlo, Santa Catarina, in order to identify the presence of intestinal parasites and anemia. To better study the locality, data were obtained through a questionnaire applied to 30 families living in the neighborhood, containing questions about sanitary conditions. Fecal and blood samples were analyzed in the Parasitology and Hematology sectors of the Clinical Analysis School Laboratory of the Alto Vale do Rio do Peixe University. To instruct health education, folders with information on simple ways to prevent intestinal parasitosis were distributed. The results showed that 66.7% of the families eat raw food, 43.3% use untreated water, 46.7% have septic tanks and 50% have garbage collected by the city hall. Among the 24 stool samples collected, 16.66% had intestinal parasites, including Giardia lamblia, Entamoeba coli and Endolimax nana. The results of blood counts did not show any alterations. Inadequate hygiene and sanitation practices facilitate the transmission of parasites. Collection limited to one stool sample per patient, rather than three, represents a limitation to diagnostic accuracy.

Keywords: Intestinal parasitosis. Anaemia. Social vulnerability.

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INTRODUCTION

Intestinal parasitosis is a disease caused by parasites of the phylum helminths and protozoa, its main forms of infection are oral-fecal. Human infection most often occurs through the ingestion of water and food contaminated by the parasites due to poor hygiene, or because they are consumed raw, as well as by skin contact with the infective form of the parasite (Vilar et al., 2021). The principle of pathophysiology of parasitic diseases occurs through a complex relationship between the parasite, host and the environment in which both coexist. In this dynamic, factors such as the host's immune response and the parasite's infectious potential stand out, which play crucial roles in the progression and severity of the infection (Júnior; Alves; Barbosa, 2020).

Parasites are classified as neglected diseases by the World Health Organization (WHO), predominantly affecting populations in social and economic vulnerability. The absence of basic sanitation, access to clean water, good hygiene practices, as well as the lack of knowledge about the risks they cause to health, are the main factors that contribute to the high incidence of these diseases in these groups (PAHO, 2022).

The precarious socioeconomic conditions of the population contribute to the increase in the prevalence of intestinal parasitosis and other health complications, particularly in children aged 0 to 9 years. In addition, childhood susceptibility to parasitic diseases can be explained by the immaturity of the immune system, dependence on third-party care, contaminated water, among other factors. Children who are in a situation of social vulnerability, therefore, may be more prone to the occurrence of intestinal parasitosis (Rivero et al., 2017).

Intestinal parasitosis is responsible for human health problems, especially in countries with less socioeconomic development, where environmental and cultural conditions also favor the maintenance and dissemination of the biological cycles of parasites responsible for intestinal diseases. The main complications associated with intestinal parasitosis include intestinal malabsorption, malnutrition, abdominal pain, and anemia, factors that contribute significantly to reduced work and learning capacity (Vega et al., 2023).

The worsening of host health due to intestinal parasitosis occurs mainly through three mechanisms, nutrient depletion action, induction of irritation and inflammation of the intestinal mucosa and obstruction of the gastrointestinal tract. Spoliation occurs by the parasite's absorption of essential nutrients from the host, which can lead to malnutrition and nutritional deficiencies. Irritative actions include local inflammatory responses that can result in tissue injury and abdominal pain, while obstructive actions can lead to partial or total

blockage of the intestinal lumen, especially in intense infections (Naveed and Abdullah, 2021).

Due to the parasites' spoliative actions on the host, parasitosis can trigger some other diseases, such as anemia, which has become a very prevalent disease in school-age children (Francisco et al., 2020). It is common to associate anemia with parasitic diseases, since a large part of the absorption of nutrients takes place in the intestine, where the parasites affect it directly, depending on their actions on the host, and due to the relationship with social vulnerability, where there is a lack of good nutrition (Antunes; Moraes, 2019).

Anemia is caused by a drop in hemoglobin in the blood, causing a deficit in the transport of oxygen to the tissues, and can be caused by a lack of iron, vitamin B12, among other important nutrients for the proper functioning of the body. Anemia, when left untreated, can harm child development, and lead to weakening and physical fatigue in adults (Paula et al., 2020).

The diagnosis of parasitosis is made through the examination of fecal samples, the parasitological examination of feces, which consists of performing macroscopic analyses, such as color, appearance, consistency and odor, and microscopic analyses, where the most appropriate technique for the study of the suspected parasite is chosen. In addition, to complement the diagnosis, a blood count is performed, where the presence of factors that may indicate a parasitosis is seen, such as eosinophilia, common in infections caused by helminths, as well as changes suggestive of anemia (Sadovsky et al., 2020).

In view of the importance of conducting studies associated with intestinal parasites, especially in populations that are socially vulnerable, the objective of this study was to analyze the feces and blood samples of children enrolled in the Fita Bisol Municipal School, in the Imasa locality, Rua Projeta, in the municipality of Monte Carlo, in Santa Catarina, in order to identify the presence of intestinal parasites and anemia. It should be noted that this research is aligned with the Sustainable Development Goals (SDGs) of the United Nations (UN), especially SDG3 (Health and Well-being), by providing essential data to implement public health interventions that improve child well-being. As the study was carried out in a socially vulnerable community that is in precarious conditions of basic sanitation, the study also addresses SDG 1 (eradication of poverty) and SDG 4 (Quality education), since children with parasitosis and anemia may have impairment in their physical and cognitive development, directly impacting school performance and future prospects.

METHODOLOGY

PLACE OF STUDY

The study was carried out in a peripheral neighborhood, Imasa, which is the farthest from the center of the municipality of Monte Carlo/SC, with emphasis on the Fita Bisol school. The Imasa neighborhood is shown in image 1. The choice was made because it is a place that is neglected in terms of basic sanitation conditions and the population is in conditions of social vulnerability

Image 1 - Territorial map of the Imasa neighborhood in the municipality of Monte Carlo/SC.



Source: Google Maps (2024).

SAMPLE CHARACTERIZATION

The study was carried out in a group of school-age children aged 5 to 9 years, enrolled in the Fita Bisol School, located in an economically vulnerable community in the city of Monte Carlo/SC. Parasitological examinations of feces and blood count of the children enrolled in the School were carried out, using the facilities of the School of Clinical Analysis Laboratory of the Alto Vale do Rio do Peixe University (UNIARP), totaling a group of 24 children.

DATA COLLECTION

The collection of socioeconomic data from the region studied was carried out by government platforms, Open Data Portal and by the implementation of a questionnaire to the 30 families residing in Imasa, chosen at random. The questionnaire was delivered on printed paper to facilitate those who do not have access to the internet, with questions

related to the intake of raw food, treatment of the water used, sewage distribution and disposal of the garbage produced in the houses.

The results of the parasitological examination of feces were obtained using the Hoffman, Janer and Pons (HPJ) method, which uses spontaneous sedimentation to identify parasites. In this method, the fecal sample is diluted in water and homogenized. After a resting period, the sediment that forms at the bottom of the container (image 2) is removed and a small drop is placed on a microscopy slide. Then, a drop of Lugol is added to facilitate the visualization of the parasites' structures (Carli; Geraldo. 2001).

Image 2 - Method of spontaneous sedimentation in a calyx.



Source: The authors (2024).

The results of the blood count were obtained through the AUDH5 Automatic Hematology Analyzer, available at the School of Clinical Analysis Laboratory of UNIARP, which allows results of platelets, size and color of red blood cells, hemoglobin, hematocrit, as well as leukocyte differentiation. For the verification of the white and red series in the blood samples, slides were made, stained with hematological dye and read under a microscope.

The collections were carried out at the school, through a schedule created from the availability of the students' parents. The transport of the biological material was done by the academic, during the collection days, in boxes suitable for transport, ensuring the good storage of the samples.

ETHICAL CRITERIA

This is a prospective study, where all procedures were only carried out after approval by the Human Research Ethics Committee (CEP), receiving approval opinion 6,978,159, and in sequence, a declaration of awareness and agreement of the institutions involved was filled out by the Monte Carlo Secretary of Education, and finally, they were filled out by the parents, an informed consent form (ICF) for minors.

All biological samples (blood and feces) from school-age children enrolled at the Fita Bisol School, whose parents or guardians signed the Informed Consent Form, were included. Blood samples were collected in an EDTA tube, with sufficient volume, adequate transport and storage, and collection time within the compliances, in addition to fecal samples collected in a collection bottle, suitable for parasitology.

Blood samples collected with incorrect anticoagulants, or that were coagulated, and stool samples that were not collected in sufficient volume for analysis, as well as those contained in non-standardized containers, were excluded.

After the informative meeting with the parents, and the signing of the Informed Consent Form, the samples were collected on school days, during the month of September, and later taken to the School Laboratory of Clinical Analysis for parasitological examinations, using the Hoffman, Pons and Janer method, based on spontaneous sedimentation. The blood count was performed with the aid of a hematology analyzer, thus obtaining the necessary results for the preparation of the report.

After obtaining the report, they were delivered to the parents or guardians and when they presented any alteration they were oriented and referred to a medical consultation.

HEALTH EDUCATION: APPLICATION OF AN EDUCATIONAL FOLDER

To assist in health education, folders were given to the children, consisting of information and figures indicating simple acts that can prevent infection and spread of parasitic diseases. The educational folder is shown in image 3. Parents and guardians were also instructed on health education issues and ways to prevent parasitosis.

Image 3 - Educational folder on the prevention of intestinal parasitosis.



Source: The authors (2024).

DATA ANALYSIS

Initially, it was planned to perform correlational analyses between the results of parasitological feces and blood count to investigate potential associations between the parasitosis present and the development of anemias. However, due to the sample size, the low number of parasitized children and the lack of adherence to the collection of 3 samples, it was not possible to perform these analyses in a robust way. Instead, a descriptive analysis of the data was chosen, with presentation of frequencies, to characterize the profile of the variables studied. This approach allowed the interpretation of the results within the limitations found, providing an overview of the data collected.

RESULTS AND DISCUSSIONS

During the development of the study, 24 stool and blood samples from children of both sexes between 5 and 9 years of age were analyzed. Of the total of 34 children living in the locality, 10 of them did not participate in the research due to the absence of the signature of the informed consent form or the non-delivery of the requested stool samples. Table 1 presents the characteristics of the children participating in the study.

Table 1 - General characteristics of the children participating in the study.

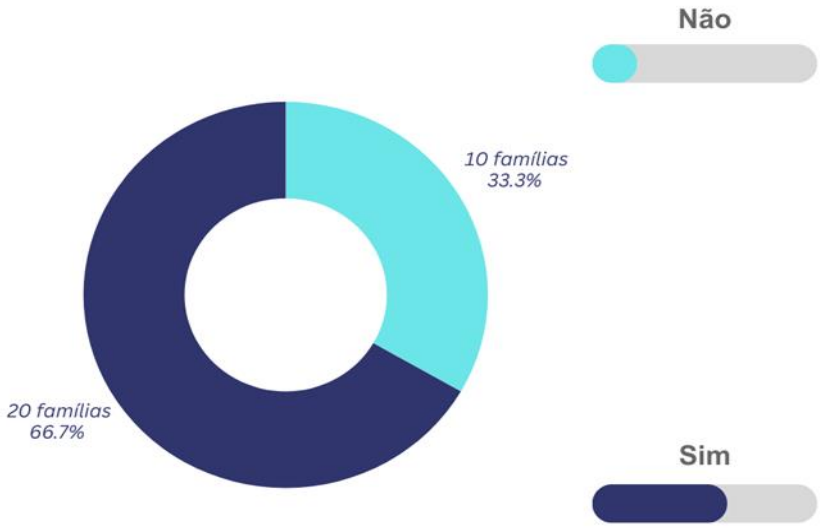
Sex	Number	%
Female	11	45,83
Male	13	54,16
Age (years)		
5	9	35,5
6	7	29,16
8	3	12,5
9	5	20,83

Source: The authors (2024).

The predominant gender among the participants was male, corresponding to 54.16% of the sample, while females represented 45.83% of the population studied. Regarding the age group, it was observed that 9 children (37.5%) were 5 years old, 7 children (29.16%) were 6 years old, no child was 7 years old (0%), 3 children (12.5%) were 8 years old and 5 children (20.83%) were 9 years old. Intestinal parasitosis is more frequent in school-age children, due to social and recreational activity, increasing exposure to the outdoors, together with the habit of poor hygiene habits, in addition to living in a group, which can increase the transmission of parasites, due to the sharing of toys, being more common, protozoan infections in children between 3 and 8 years old, and by diners, in children over 8 years of age (Kantzanou; Maria, 2021).

The interpretation of the questionnaire applied to the families showed that 10 (33.33%) of them do not have the habit of eating raw food, while the other 20 (66.66) consume raw food (Graph 1).

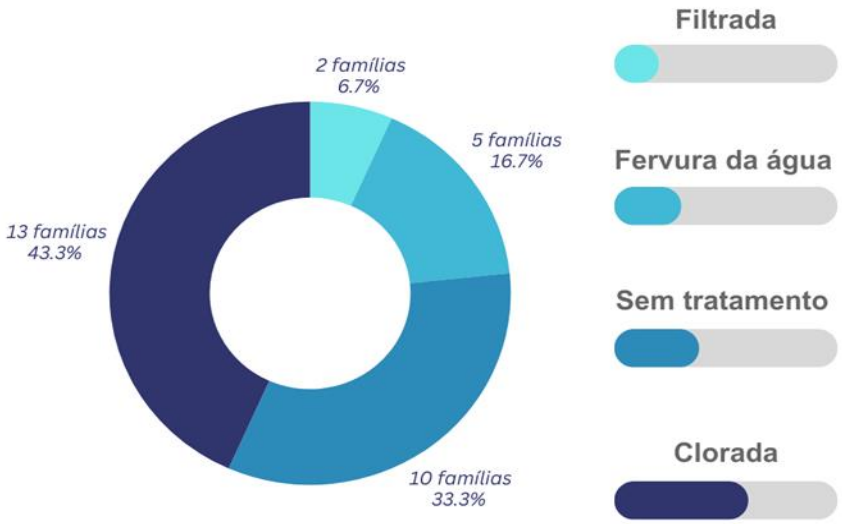
Graph 1 - Raw food intake.



Source: The authors (2024).

Regarding water treatment, only 2 (6.66%) families consume filtered water, 13 (43.33%) use chlorinated water, 5 (16.66%) boil before consuming and 10 (33.33%) have no treatment at all (Graph 2).

Graph 2 - Water treatment used.

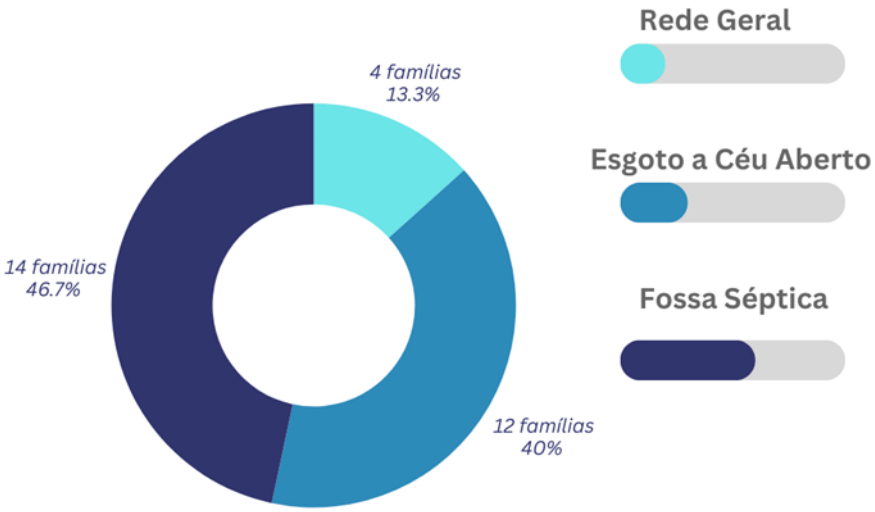


Source: The authors (2024).

The survey showed that a large part of the population does not use treated water, which can bring serious health risks, due to contamination with pathogenic microorganisms, causing gastrointestinal infections, which may be the main reason why there are cases of intestinal parasitosis in children in the neighborhood (Freitas; Magnabosco, 2023).

Regarding sewage treatment in their homes, 4 (13.33%) of the families use the general network as disposal, 14 (46.66%) of them have septic tanks and 12 (40%) dispose of open sewage (Graph 3).

Graph 3 - Destination of the household sewage used.

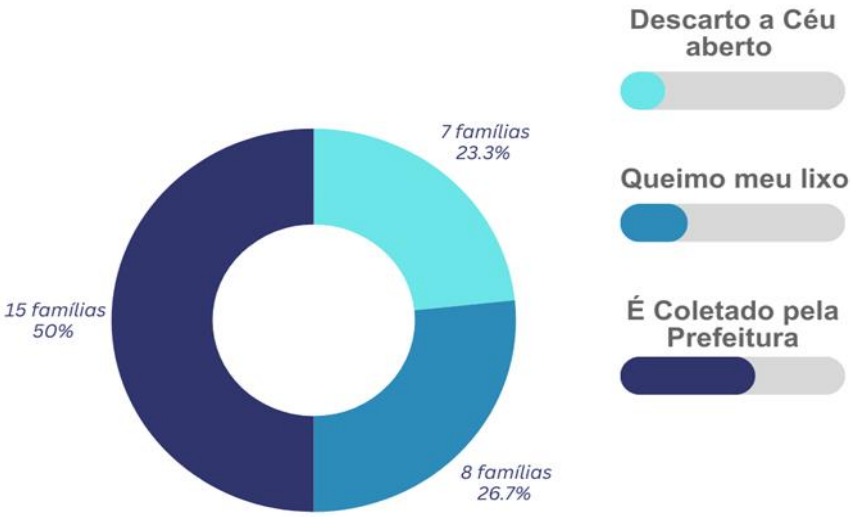


Source: The authors (2024).

These data make the subject even more worrying, since sewage, when disposed of in the open, can contaminate the soil, preventing vegetables and greens from being grown in a healthy way in that place, and contaminating water sources, can harm not only human health, but also the local fauna and flora (Teixeira *et al*, . 2018).

Regarding the destination of household garbage, 7 (23.33%) of the families dispose of their garbage in the open, 8 (26.66%) of them burn the waste and 15 (60%) families have their disposal collected by the city hall (Graph 4).

Graph 4 - Destination of household garbage.



Source: The authors (2024).

In addition to the spread of intestinal parasitosis, garbage, when not disposed of correctly, can cause other diseases, such as leptospirosis and dengue, in addition to leading to visual and olfactory pollution, deteriorating the quality of life and well-being of the population (Lemos; Ferreira; Guimarães, 2019). Therefore, it is necessary to find out why the garbage of some families is not being collected and adopt meditations so that they can solve this problem.

When analyzing the graphs, it can be observed a lack of basic sanitation for these families, which may be related to the appearance of intestinal parasitosis in the children studied, including these indices can lead to the spread of these diseases throughout the neighborhood.

Intestinal parasitosis is linked to the lack of health education, and this may be a strategy to minimize the spread of these diseases (Santos; Bezerra, Costa, 2021). Therefore, it is valid to consider that efforts aimed at reducing environmental contamination can reduce the risk of exposure to parasites. Measures such as access to clean water, adequate sanitation, and hygiene practices are essential for preventive control. The intervention should start with education and dissemination of knowledge to the population, followed by a continuous evaluation of the effectiveness of these actions (Nery et al., 2019). Thus , after the conclusion of the research, educational folders were distributed that teach ways to prevent the spread of these diseases, in order to improve the health of the residents of the neighborhood.

The parasitological analyses of the 24 fecal samples revealed that 4 of them were positive for intestinal parasites, and *Giardia lamblia* (4.16%), *Entamoeba coli* (8.32%) and *Endolimax nana* (8.32%) were identified in these samples. Polyparasitism was observed in 2 samples (8.32%), one containing *Giardia lamblia* and *Entamoeba coli* (4.16%), and the other *Endolimax nana* and *Entamoeba coli* (4.16%). The positive samples show a prevalence of parasites considered non-pathogenic, which characterize a clear sign of lack of access to drinking water, basic sanitation and precarious housing conditions, as well as contact with contaminated soils and ingestion of poorly sanitized food or food handled with dirty hands (Kantzanou *et al*., 2021). The other 20 samples (83.33%) did not present protozoa or helminths, as shown in Table 2.

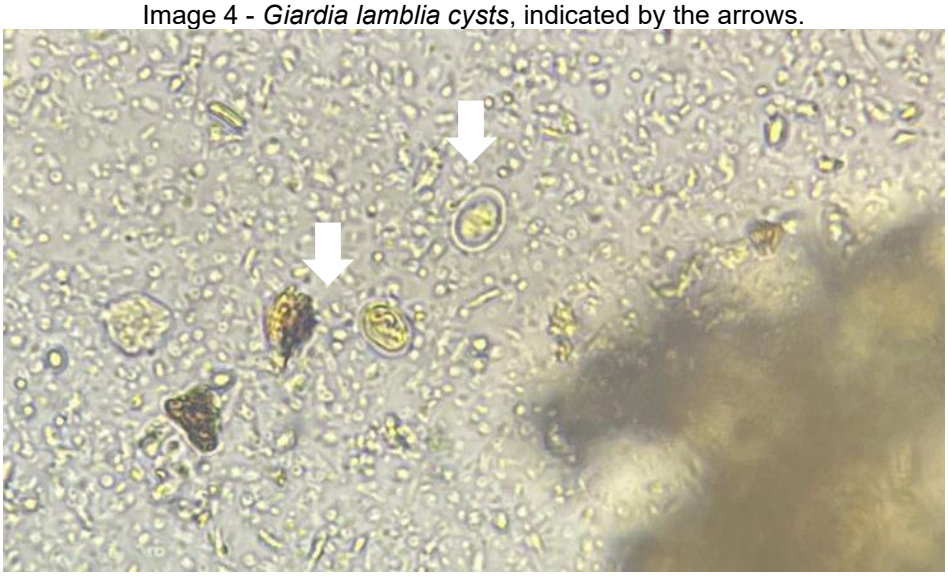
Table 2 - Results of parasitological examination of feces.

Parasitis Intestins	**N**	**%**
Positive		
Polyparasitism - *Giardia lamblia and Entamoeba coli*	1	4,16
Polyparasitism - *Endolimax dwarf and Entamoeba coli*	1	4,16
Monoparasitism- *Entamoeba coli*	1	4,16
Monoparasitismo- *Endolimax Nana*	1	4,16
Negatives for Protozoa and Helminths	20	83,33

Source: The authors (2024).

Giardia lamblia was the only pathogenic parasite found during this research, which causes giardiasis, is the most common cause of diarrhea in children, and can lead the patient to malnutrition and developmental delay. It is a strong indicator of poor sanitation and hygiene conditions, and is commonly present in communities with socioeconomic problems (Márcia *et al*., 2024). The low prevalence of *Giardia lamblia* may be related to its intermittent elimination factor, and it may not have been eliminated in the feces on the day of the collection analyzed, therefore, to increase the chances of finding cysts, it can be recommended to perform three collections on consecutive days (Felipe *et al.,* 2021). Image 4 shows *Giardia lamblia* cysts, found in the giardiasis-positive sample, viewed under a microscope.

Image 4 - *Giardia lamblia cysts*, indicated by the arrows.

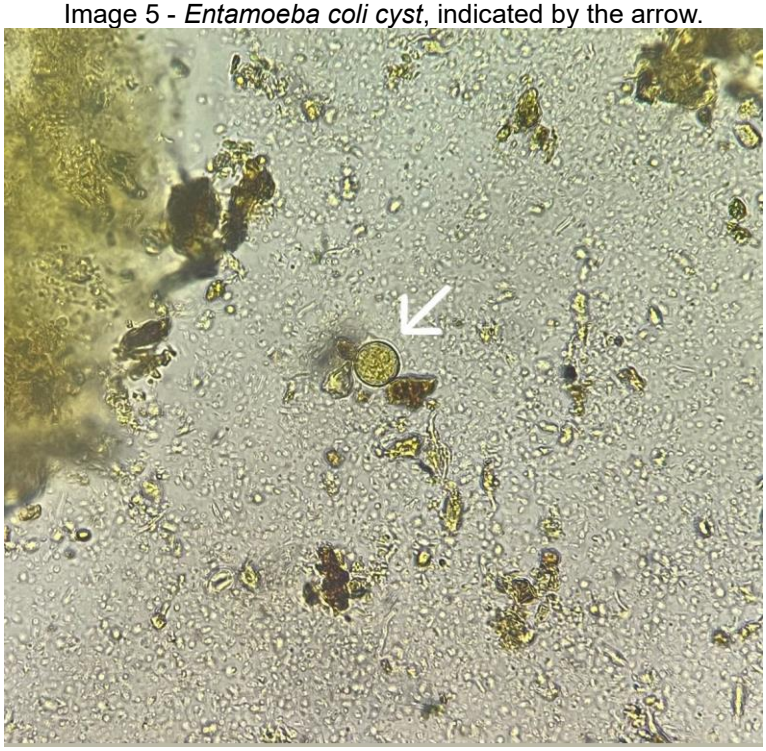


Source: The author (2024).

Although *Giardia lamblia* and *Entamoeba coli* have the same means of propagation, *Entamoeba coli* is not considered pathogenic to humans, but rather commensal, however it can help as an indicator of inadequate sanitation conditions and contamination (Bellin; Grazziotin, 2011).

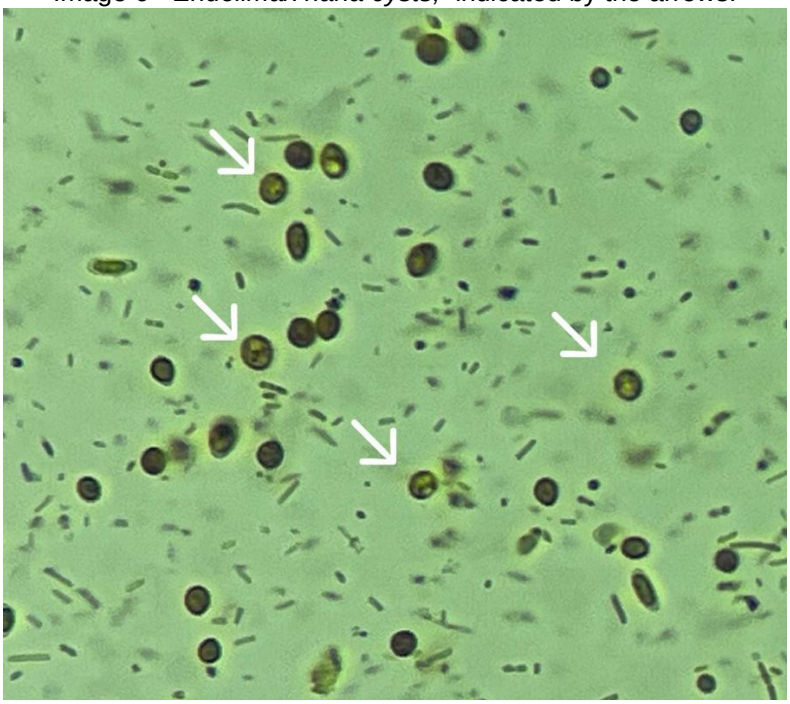
Like *Entamoeba coli*, *Endolimax nana* is also considered commensal, however, they are of great value in the diagnosis during the stool examination, indicating fecal contamination in the environment in which the individual is inserted (Santos; Juliano et al., 2014). Considering that the socioepidemiological data revealed precarious conditions of basic sanitation and inadequate water treatment, the low prevalence of intestinal parasitosis may be associated with the absence of parasite cysts in the samples collected. For a more accurate analysis, it would be recommended to collect three samples on consecutive days. In addition, the lack of information on the history of parasitic infections in participating children may indicate that the low incidence observed is possibly related to previous drug treatments. In image 5, there is the presence of an *Entamoeba coli* cyst, in image 6, *Endolimax nana cysts*, indicated by arrows.

Image 5 - *Entamoeba coli cyst*, indicated by the arrow.



Source: The authors (2024).

Image 6 - *Endolimax nana cysts,* indicated by the arrows.



Source: The authors (2024).

Analyzing the characteristics of patients who presented positive samples for a parasite, it is possible to highlight the male sex as the only one affected, totaling 100% of the positive samples. When analyzing the age range of the positive samples, it was found that two children are 5 years old (50%), one is 9 years old (25%) and one is 6 years old (25%), as shown in Table 3.

Table 3 - Age group and sex of the samples that presented some parasitosis.

Intestinal parasites present in the samples	**N**	**Age (years)**	**Sex**
Polyparasitism - *Giardia lamblia and Entamoeba coli*	1	9	Male
Polyparasitism - *Endolimax dwarf and Entamoeba coli*	1	5	Male
Monoparasitism- *Entamoeba coli*	1	5	Male
Monoparasitismo- *Endolimax Nana*	1	6	Male

Source: The authors (2024).

The reason why males may have been more affected, when compared to females, may be because boys, especially in the school environment, tend to be more active and may be more exposed to environments where parasites are common, such as outdoor play, or due to cultural issues, where they have more freedom to explore risky places and less supervision in hygiene matters (Rengifo; Maria, 2020).

The results of the blood counts, including those of patients whose stool samples show some parasitosis, did not show any alteration. The reference values (RV) considered standard were taken into account, both in the red series, as well as hematocrit (RV=35 to

45%), erythrocytes (RV=3.9 to 5.1 million/mm³), hemoglobin (RV=11 to 14g/dL), V.C.M (RV=77 to 95UM³/dL), H.C.M (RV=25 to 33pg) and C.H.C.M (RV=31 to 37g/dL), and in the white and platelet series.

The research did not show a relationship between positive samples for parasitosis and any anemia. Although parasitosis is the main cause of anemia, it is important to note that in most positive samples, except for the positive sample for giardiasis, only non-pathological parasites were found, which may be the reason why the blood counts did not show alterations (Moraes et al., 2019). In the case of *Giardia lamblia*, it is likely that despite its despoiling action, it has not yet formed the cystic carpet, which is the mechanism responsible for preventing the body from absorbing the necessary nutrients (Fabiana *et al*., 2022). Anemia is indeed associated with the presence of protozoa, however, it is worth mentioning that anemias are more related to the presence of helminths, when compared to protozoa, since helminths have a chronic and long-term interaction with the host, causing anemia through blood loss and nutrient consumption, reducing absorption by the intestine, protozoa, on the other hand, can cause acute crises, which may be the reason why the children studied did not have anemia (*Bandyopadhyay, Mamata et al, 2021).*

After the conclusion of the research, the parasitological reports and blood count of their children were given to the parents, and those who presented positive results for some parasitosis were instructed to look for the neighborhood health agent to make an appointment with the general practitioner of the health center responsible for the locality.

FINAL CONSIDERATIONS

Parasitological analyses of feces showed the presence of intestinal parasitosis in the region studied, probably associated with socioeconomic factors, given that the questionnaires indicated the absence of basic sanitation in some residences. Lack of access to information on proper personal hygiene and food practices can also contribute to the transmission of parasitosis. Although the children's blood counts did not identify anemia, it is recommended that parents maintain routine annual exams, considering the frequent association between parasitosis and anemia.

The study has some limitations that should be highlighted. The analysis was based on only one fecal sample per child, rather than the recommended three samples on consecutive days, which may have increased the risk of false-negative results. In addition, the sample size was small, including only 24 children, which limits the generalization of the findings and reduces the statistical power for detecting possible associations.

However, as intestinal parasitosis continues to be largely neglected, studies such as this one associated with health education programs emerge as essential tools for improving public health.

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MULTIDISCIPLINARY APPROACH IN EDUCATION AND HEALTH: BORBOLETANDO PROJECT

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ABSTRACT

This study presents an analysis of the "Borboletando Project: at home you can also learn!", focusing on the multidisciplinarity that involves the area of education, focused on health. The Project presents its relationship between health and education of the human being, in a virtual space. It aims to use playfulness through various resources such as the art of storytelling, music and animations produced in an artisanal way, integrated with digital technology in the continuum of informal education, enabling information and learning about the reality and imagination of children, meeting contemporary needs.

Keywords: Multidisciplinarity. Education. Health. Innovation.

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INTRODUCTION

This study presents an analysis of the "Borboletando Project: at home you can also learn!", focusing on the multidisciplinarity that involves the area of education, focused on health. The Project presents its relationship between health and education of the human being, in a virtual space. It aims to use playfulness through various resources such as the art of storytelling, music and animations produced in an artisanal way, integrated with digital technology in the continuum of informal education, enabling information and learning about the reality and imagination of children, meeting contemporary needs.

The virtual space is open/conducive to non-formal education (Libânio, 2010), providing opportunities for innovation scenarios to work on themes in the area of education, associated with the reality of the problems that arise and affect the community in general and becomes an opportunity to educate and educate oneself, making it possible to give wings to imagination, creativity and the formation of principles and values in children, young people and adults. Such a space has been used by educators, such as the Borboletando Project, the object of this study, which uses various educational resources (music, cordel and children's stories) in a playful, creative and innovative way to educate children, young people and adults interested in the information contained in the videos.

The Project emerged in 2020, instigated by the emerging theme in the reality experienced at the time – "Covid 19 - coronavirus", as part of an initiative that produced educational videos involving songs and stories for children and adolescents during the social isolation of that period. The experiences lived during the Project led to the understanding that, in addition to artistic and technical skills, knowledge and skills related to health education and the construction of values and principles were also achieved.

Such understanding raised scientific questions, triggering this qualitative study that started from the following problem: what are the characteristics of the Borboletando project in its multifaceted/multidisciplinary character? It was also questioned: what are the textual typologies of the videos? What is the reach of these stories as a vehicle for information and training? What are the stories that involve the interrelationship between Health and Education about?

To answer these questions, the study in question seeks to analyze the main characteristics of the Borboletando Project: at home you also learn!", in its multidisciplinarity in the field of Education and Health. The following objectives are listed: to characterize the video-stories in terms of multidisciplinarity and its contribution to health; present data on people's access/reach in relation to the Project Channel (number of views, likes and

comments); identify the messages that enable changes in attitude; analyze the contents of the stories in their various aspects.

With this in mind, the first video-stories of the Borboletando Channel, a repository used to publicize the actions of the Project, were selected: "Beware of the coronavirus"; "The three little pigs and the coronavirus"; "Dona Baratinha's wedding"; "Little Red Riding Hood and the Coronavirus"; "Goldilocks' disobedience; " Antivirus Squad"; "The Princess, the Frog and the Coronavirus"; "Coronavirus in Cordel". The justification for this choice is due to the fact that these videos were created with the intention not only of entertainment, but as a way to educate people about protection against the virus. This involves knowing what the virus is, the danger of contamination, health prevention care at a time when the whole world has been surprised by a pandemic.

To analyze the results achieved by the project, a qualitative study was developed, which has as its main source the set of videos posted on the channel, considered as virtual documents (Pimentel, 2001). It is based on Minayo (2014), on the understanding that qualitative research is linked to experiences and interpretation understood from the social phenomena in which education is inserted. A categorization of the information was carried out based on content analysis based on Bardin (2011).

EDUCATION AND MULTIDISCIPLINARITY

The transformations present in the world of work, caused by globalization, impose a level of qualification for new workers, which is reflected in the means of production, represented by more qualified, flexible workers, with a new technical and scientific basis, specifically constituted in the last century by information technology, currently (twenty-first century) focused on the domain of Digital Information and Communication Technologies (DICT). These transformations reflected directly on education, causing a trend in the productive sector, leaving the area of the discourse of valuing training, turning to investment in general training of professionals, in search of multifunctionality. In this sense, multidisciplinarity is a reflection of multifunctionality.

Multidisciplinarity is something present in education and consists of developing skills to bring together different fields of knowledge in order to achieve a means, a central objective. Nicolescu (et al. 2000) states that multidisciplinarity corresponds to the search for integration between knowledge from different areas through the study of an object, a discipline or several disciplines at the same time.

It is observed that there is a certain exhaustion in the actions of teachers, in relation to the school, in seeking multidisciplinarity in attempts to work together. In this perspective

of integration, each one deals with common themes from their own point of view, without an effective articulation. Thus, Almeida Filho (1997) states that in multidisciplinarity, people, when it comes to the school curriculum, study closely, "but not together", expressing an idea of juxtaposition of disciplines.

Therefore, unlike just a collection of ideas, it can be said that multidisciplinarity approaches an object or a certain subject from the perspective of several disciplines, in search of an overall view. It is considered that in the study carried out on the Borboletando Project: at home you also learn! There is the integration of knowledge (multidisciplinarity) of plastic, musical, ethical, moral, and psychological arts, but specifically in the areas of health and education, which is dealt with in this text. In addition, it is necessary to highlight that the Project had the collaboration of professionals who work in different areas, in this multidisciplinary perspective.

EXTENSION AS A MULTIDISCIPLINARY PRACTICE

It is necessary to highlight that the "Project 'Borboletando... At home you can also learn!' is part of the extension project 'In Search of Extensionists to Confront the Coronavirus' of the Dean of Extension and Culture (PREXC)", belonging to the Federal University of Piauí (UFPI), whose objective is to encourage and ensure the participation of extensionists, at the national level, for the development of extension actions remotely, with a view to confronting the coronavirus". The Project develops actions that seek to meet the needs of various segments of society, in areas such as: health, education, culture, technology, infrastructure, among others. (UFPI, 2020).

University extension, together with teaching, research and innovation form the pillars of higher education in Brazil. At the Federal University of Piauí (UFPI), extension activities are regulated through Resolutions No. 35/2014, No. 021/18, No. 022/18 and No. 085/18, issued by the Council for Teaching, Research and Extension (CEPEX). In this context, based on the principle of indissolubility between teaching, research and extension, Resolution No. 35/2014, in its Article 2, defines the latter as "an interdisciplinary, educational, cultural, scientific and political process that promotes transformative interaction between the University and other sectors of society" (UFPI, 2014).

Being interdisciplinary/multidisciplinary, the realization of an extension makes it possible to operate in various areas and fields of knowledge, without losing the focus of educational centrality. From this perspective, extension dispenses with innovation. It is noteworthy that in the specialized literature the term "innovation" is polysemic, has different conceptions, presenting itself under different theoretical approaches that vary according to

the field of knowledge and the branch of activity to which it refers (Faria; Fonseca, 2014). By this logic, the Project is innovative.

The Borboletando project: extension as a multidisciplinary practice

Innovation is conceived as the expression of behavior or activities that aim to solve problems and achieve tangible objectives, as abstracted from the discussions of the referenced authors. It is understood that the Borboletando Project values not only an innovative posture, resulting from the needs imposed by digital technologies, but above all it is focused on the recognition of the importance of building an innovative culture, which requires the creation of a favorable environment, creative people who are willing to try new paths, capable of undertaking efforts and research to achieve satisfactory goals. And this culture is built on the basis of ethics and social responsibility. (Faria; Fonseca, 2014).

Faced with the proposition that one of the functions of university extension is to place itself in a position of dialogue with society, seeking innovative solutions to contemporary problems, the opportunity arises for the development of the Borboletando Project. The Project found at the time of health emergency, and in view of the concern about the consequences of social isolation for mental health, especially of children, as well as for their schooling process, a possibility to take information about "COVID 19".

In view of these needs, the Project developed videos that integrate traditional resources such as "storytelling", through the making of artisanal resources (construction of puppets) and technical resources, as the stories told with puppets were then digitally edited and transformed into videos, highlighting their innovative character. In this way, it was possible to achieve the intention of addressing themes that permeate the discussions about health in a playful way with the use of stories and tales posted on the *You Tube Channel* * that has the same name as the project.

Through storytelling, it is possible to envision a way to dialogue with children about these challenges, as it is understood that this art involves aspects related to Psychology, Education and Linguistics, as well as non-verbal languages, ethics and cybernetics (Dohme, 2008, p. 20).

From this perspective, the act of storytelling was invested in a multidisciplinary bias by combining linguistic (the act of telling stories), artistic (making puppets with recyclable materials), cultural (by taking advantage of popular textual genres such as cordels and parodies), digital (by recording and editing the videos of the stories) with educational and health information purposes. The educational issues were noted in particular, with the

* link canal: https://www.youtube.com/@borboletandoemcasa/featured.

concern to ensure the children's learning and the conduction of the pedagogical process, offering didactic sequences (Zabala, 1998), for each of the stories focused on health themes, being attached to the description of the videos. It is noteworthy, during the pandemic period, that these didactic sequences were requested by education professionals and some families, being made available by the Project's coordination, through a messaging application (WhatsApp).

It should be noted that currently, the literature in the area of Health has pointed to the need for a multidisciplinary approach when it comes to, in particular, treatments aimed at mental health, while in education there are current discourses on multidisciplinary, interdisciplinary, and transdisciplinary aspects that address the objects of knowledge present in the curricula of all levels of education (Pires, 1998). In this sense, seeking to establish a dialogue between these two areas, the term multidisciplinary is used in this text in allusion to health practices that approach teams from various areas of knowledge.

The Project thus acquires the sense of articulating the various knowledge and practices of different professionals who make up certain teams, aiming to ensure a more comprehensive service to individuals (Silva; Miranda; Andrade, 2017). This multidisciplinary perspective was achieved by the Project in the proportion that its team was composed of professionals from different fields (health, education, arts, computing, etc.) and they collaborated so that the videos offered had these different perspectives, enabling different readings in compliance with the desired areas and objectives.

The multidisciplinarity/transdisciplinarity of the project that involves students from the Federal University of Piauí – UFPI, through **the Institutional Program for the Promotion and Induction of Innovation in the Initial Continuing Education of Teachers and School Principals – PRILEI/CEAD/UFPI, is ratified.**

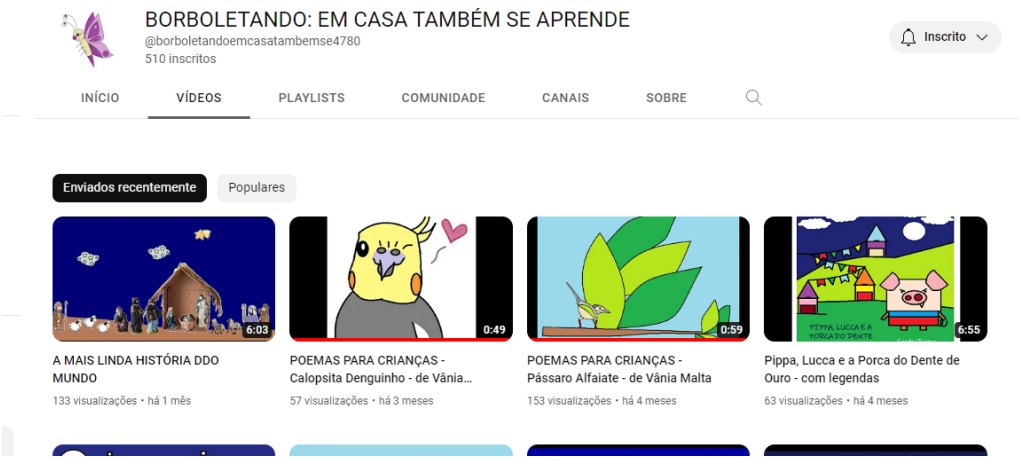
THE BUTTERFLY CHANNEL AT HOME IS ALSO LEARNED! EDUCATING FOR HEALTH PROTECTION

The Project "Borboletando: at home you can also learn!" created in 2020, in the context of the COVID 2019 Pandemic, whose immediate objective was to provide educational support to children who were in social isolation, became a health education tool.

The channel (Image 01) was created as part of the UFPI Extension Project, with the **Institutional Program for the Promotion and Induction of Innovation in the Initial Continuing Education of Teachers and School Directors – PRILEI/CEAD/UFPI. The Borboletando Project** : at home you also learn", initially aimed to make storytelling videos

available to children aged 3 to 7 years who were in social isolation as a result of the COVID-19 pandemic (Borboletando, 2022), later expanding with several extension actions with the participation of UFPI students.

Image 01: Canal Borboletando homepage: at home you can also learn



Fonte: internet - (https://www.youtube.com/@borboletandoemcasa), 2024.

The channel had 1,023 subscribers as of November 21, 2024 and can be accessed at the following address: https://www.youtube.com/@borboletandoemcasa . To date, 76 videos have been located in total. They are videos of various nature (stories, presentation of events, courses, workshops, testimonies, etc.), functioning both as a means of transmission and as a repository of the Project's actions.

Among these materials, 8 (eight) videos were selected, with an average duration of 5 minutes. All videos were published during the pandemic period and are related to the theme of COVID-19 prevention, demonstrating the multidisciplinary nature of the Project.

WHAT THE CONTENT EXPRESSED IN THE VIDEOS IS ABOUT

The characterization of the stories told in the videos can be analyzed both by their textual typology and by the contents addressed. In this sense, based on the Content Analysis (CA) guided by Bardin (2011), the following categories were developed: textual typologies of the stories; reach of the stories by people in relation to the Project (subcategory 1 – quantitative aspects – number of views, likes; and subcategory 2 – qualitative aspects: comments); key messages; content of stories.

As for the textual typology of the stories told, 06 short stories and 01 parody were found, 01 cordel according to table 02.

Category I - Textual typology of stories

This category, presented in the following table, demonstrates multidisciplinarity with linguistic knowledge, which demonstrates the various communicative purposes.

Table 01: typologies represented by the videos

	Kind	Quantity	Securities
01	Tales	06	Beware of the Coronavirus; The three little pigs and the Coronavirus; The wedding of Dona Baratinha; Little Red Riding Hood and the Coronavirus; Goldilocks' disobedience; Antivirus Squad.
02	Parody	01	Coronavirus Parody
03	String	01	Coronavirus in Cordel The princess, the frog and the coronavirus
	Total	08	

Source: internet - Canal Borboletando... At home you can also learn! 2024.

It is also added that the stories told "provide a context with which to work in different ways, making children invited to create". (Dohem, 2008, p. 138). Thus, several possibilities are opened up for the creation and recreation of what the child watches, as well as for parents and teachers to explore the videos didactically. In this sense, the channel provides didactic sequences that can be used by educators in order to organize a more consistent educational practice (Zabalza, 1998).

It can be seen that the videos produced during the pandemic period are based on traditional children's tales, whose plot and character are in the public domain and therefore easier to assimilate by Internet users. The aesthetics of the videos are simple, possible to be reproduced by children and therefore close to their taste. Taking advantage of the known plot, the first notions about what the disease was, what its forms of contagion were and how to avoid them were presented to children, in order to reduce the feeling of fear of an unknown disease and how to protect themselves from contagion. In this sense, the Project made use of one of the functions of storytelling, which is to address thorny themes in a way that children understand and thus improve their emotional condition (Dohme, 2008), since the structure of a fairy tale allows us to address the nature of evil as the situations and characters of the tales are presented.

In general, it is understood that the stories told, given their functions, can "help emotional stability, to incite imagination, attention and critical sense, either to form narrative competence, or to motivate reading and to help the formation of a scale of values" (Dohme, 2008, p. 51). They become an attractive means of transmitting basic health information,

allowing children more security to deal with the stress caused by the pandemic. In this way, children and adults were able to assimilate how COVID-19 affected people.

Another approach strategy used by the Project was the use of cordel, a form of literature that is very popular in the Northeast of Brazil and which uses the resource of rhymes and rhythms to address any theme in a playful way and in simple language.

CATEGORY 2 - REACH OF STORIES

In relation to this category of analysis, the criterion was chosen to verify the reach of the stories posted on the channel, observing the relevance of the Channel as a vehicle of information and trying to present the preventive ways to act in relation to the pandemic.

It is reinforced that children, like most adults, like to listen to stories and this becomes a preponderant factor in a communication process, as it can constitute a channel for communication between adults and children.

Storytelling favors affectivity and awakens trust, increasing the possibility of dialogue, making communication clearer and more productive. (Dohem, 2008, p. 30). It is necessary to remember that through stories one can explore a variety of themes and with that, also express the most varied messages. Thus, it is possible to send messages in a way that children understand what was meant. Therein lies the educational and multidisciplinary character of the stories.

As a strategy for presenting this category, two subcategories emerged: Subcategory 1 - quantitative reach of the stories, represented in chart 02, and Subcategory 2 - qualitative reach - comments.

Table 02 – Subcategory 1 - quantitative scope of the stories

Story Name	Number of views	Number of likes
Beware of Coronavirus- Story 1	2.800	81
The three little pigs and the coronavirus"	8.400	192
Dona Baratinha's wedding	938	38
Little Red Riding Hood and the Coronavirus	1887	54
The Princess, the Frog and the Coronavirus	287	16
Coronavirus in Cordel	280	16
Antivirus Squad	399	13
The disobedience of the Goldilocks	756	34

Source: Canal Borboletando, 2024.

The relevance of the analyzed videos can be inferred in terms of communication and people's reach in relation to information about health and prevention of the coronavirus. There is a total of 1.23 thousand subscribers, with the second video being the one that most interested Internet users, with the highest number of views and likes, which

quantitatively demonstrates the interest of Internet users in relation to the videos and when making a parallel with the face-to-face presentations, it is considered positive, for expanding this reach. In this sense, the category on the quality of the videos, inferred from the comments, was highlighted.

Subcategory 2 - qualitative reach: comments from internet users



This subcategory is based on the qualitative aspects presented, most frequent and common, in the comments, with opinions that portray the content and importance of the information. Some comments/messages stand out:

> This project is very good;
> Wonderful educational video. Congratulations to you! My 3-year-old son was able to follow the story and loved it;
> The children are following and liked it";
> Do you have the script of the story?
>
> Liked!!! Congratulations! Excellent initiative;
> Congratulations on your initiative to entertain our children or better our near future.
> "Hugs xeloss";
> How good to value these professionals.
> Very wonderful. Congratulations;
> Wonderful congratulations
> Congratulations prof. Sandra. Excellent explanation;.
> Excellent creative helps all family educators
> I liked it, very good
> Creative how to work with coronavirus.

A sample of the common ideas of the posted messages was raised, noting that positive comments predominated. It is necessary to highlight that, in the case of messages such as: "Would you have the script of the story?", it denotes that the internet user understood the video in its educational and pedagogical aspects, since the script characterizes a didactic concern. In this case, it is inferred that the Project achieved its intentionality of qualitative scope – to bring information in a scientific/playful/educational way, collaborating with the school through informal education. The script is considered by educators such as Zabala (1998) as a didactic sequence necessary for a good development of work with children, specifically by professionals in the field of education.

In comments such as: "Wonderful educational video". "You are to be congratulated! My 3-year-old son was able to follow the story and loved it"; "The children are following and liked it" – you can extract important information such as:

**Follow-up by parents/family;

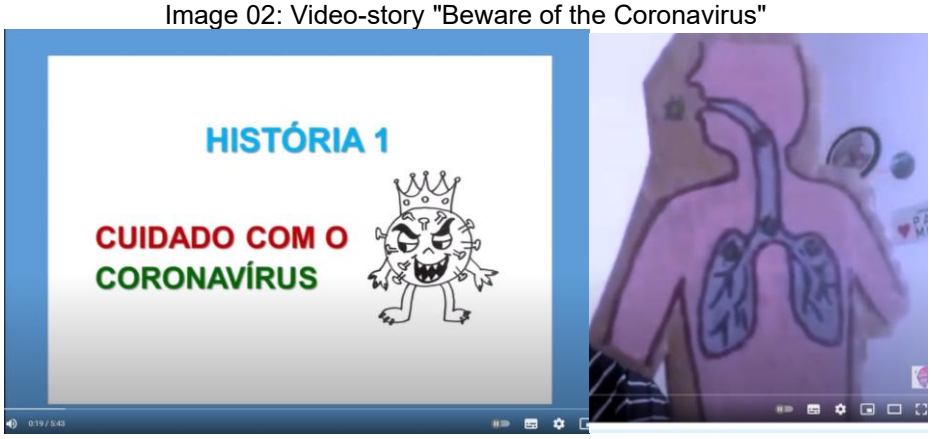
**The educational/pedagogical quality of the videos.

In other comments, there is recognition of the initiative and collaboration in an educational way, in the dissemination of relevant information about health care, in a timely manner for the moment, ratifying the appreciation of informal education through virtual communication vehicles. Highlights: - Congratulations on your initiative to entertain our children or improve our near future. "Hugs xeloss"; Excellent creative helps all family educators

CATEGORY 3 – CONTENT OF THE STORIES

In this category, videos with images, content and aspects of ethical formation, values and customs, as well as information focused on health and its protection in the prevention of coronavirus – COVID 19 are presented.

Image 02: Video-story "Beware of the Coronavirus"



Source: Canal Borboletando: at home you also learn, 2024.

In the video "Beware of the Coronavirus", the first scientific information we had about the disease was presented, in a very accessible language and in a very didactic way. He drew special attention to the care of the elderly and the ways in which the virus is transmitted. Also noteworthy is the musical background placed throughout the duration of the video, being a cheerful and bold arrangement, with its various aspects that value playfulness.

It is interesting to highlight the artisanal character for the production of the material used in the video, integrating traditional practices with technological innovation. This

demonstrates the creativity and capacity of teachers/education professionals to adapt resources and produce didactic-pedagogical materials in the context of DICTs.

It is then observed that although there were few comments, the video reached a large number of Internet users, which leads to the inference that at that moment safe information reached several homes, making up for the lack of formal schooling in that context, since classes were initially suspended.

Image 03: The three little pigs and the coronavirus

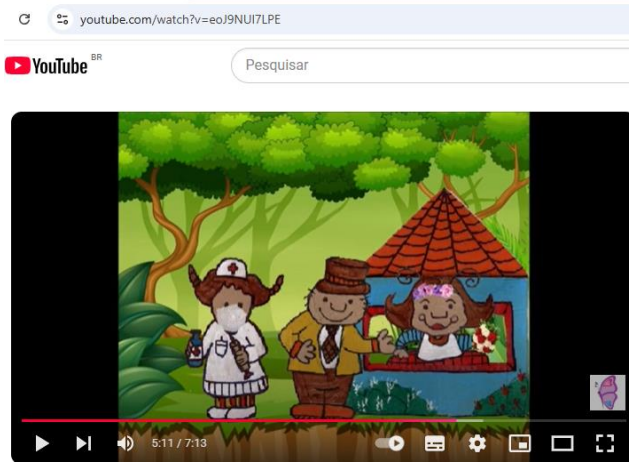


Source: https://www.youtube.com/watch?v=9cUvCRoRk7A

The video merges the traditional narratives of the children's tale with the scientific information presented, at the time, on the prevention of COVID. The Three Little Pigs has the coronavirus as its antagonist, highlighting the use of masks as a prevention tool. In the preparation of the material to produce the videos, the use of scrap stood out for the making of storytelling resources. These materials were made and painted manually, to represent scenarios, characters, among other elements used to contextualize the story. It is interesting to note that the resources of the classic story were maintained, such as the music, but making mention of the 'coronavirus' in its lyrics. Despite the simplicity of the resource used, the reach was satisfactory, as it reached 8,400 views.

The third story posted was "The wedding of Dona Baratinha", an adaptation of the popular tale of the same name, presented below.

Image 04: Scene from "The Wedding of Dona Baratinha"



Source: https://www.youtube.com/watch?v=eoJ9NUI7LPE

Using a popular tale, the insertion of the theme about the disease took place at the moment in the story when the character Baratão begins to invite the animals to his party, being prevented by the pandemic. On the occasion, the need for isolation and the possibility, at that moment, of interactions being held virtually is reinforced.

It is considered that the story was a timely way of convincing the children to understand the need to stay at home, as the festive activities could be carried out online and be celebrated later in person.

The next video-story analyzed was "Little Red Riding Hood and the Coronavirus" (Image- 05). This story reached 1887 views and 54 likes.

Image 05: Little Red Riding Hood and the Coronavirus



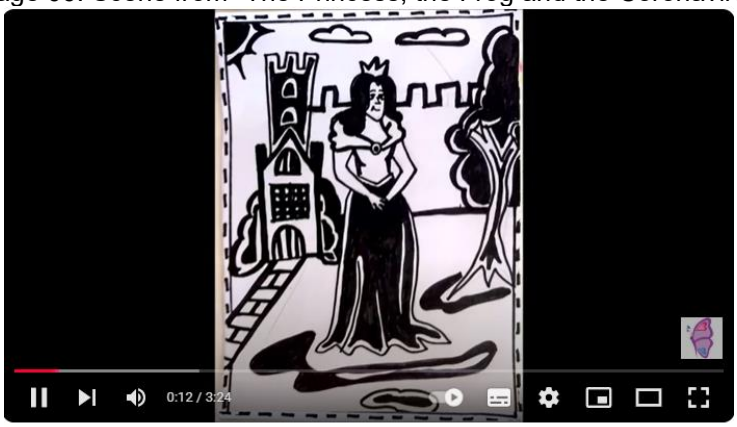
Source: Canal Borboletando, 2024.

The video takes advantage of the original tale to thematize the situation of health professionals, who had to be on the front line of the fight against the virus and at the same time have the challenge of not transmitting it to their families. It is noteworthy that all the characters portrayed appear wearing masks. On the date the video was posted, the lethality of the virus was accentuated and this also did not go unnoticed by the Channel, taking advantage of the stories to intensify preventive care, especially for the elderly. From a

technical point of view, the video shows an improvement in the quality of the drawing and in the animation of the story, giving more life to the characters and more rhythm to the narration, important elements to hold the attention of those who follow stories.

Next, the adaptation of the popular story "The Princess and the Frog" is presented with the name "The Princess, the Frog and the Coronavirus". This video was viewed by 287 *You Tube users* and received 16 likes.

Image 06: Scene from "The Princess, the Frog and the Coronavirus"



Source: Canal Borboletando, 2024.

The video stands out for two characteristics: the story is told in the form of cordel literature, within the metrics generally used in popular culture. In addition, the richness of the illustrations stands out, made through the woodcut technique, an art that is representative of the Northeast region of Brazil, whose images used in the texts of the cordels are first carved in low relief on wood, dyed and then compressed on paper to generate the impression. It was a strategy that the Channel found to take health messages through a popular genre appreciated especially in rural regions and small towns.

On the mainstay of popular culture, the video "Coronavirus in Cordel, which got 280 views and 16 likes", was posted, as seen in the image below.

Image 07: Scene from the video "Coronavirus in Cordel"



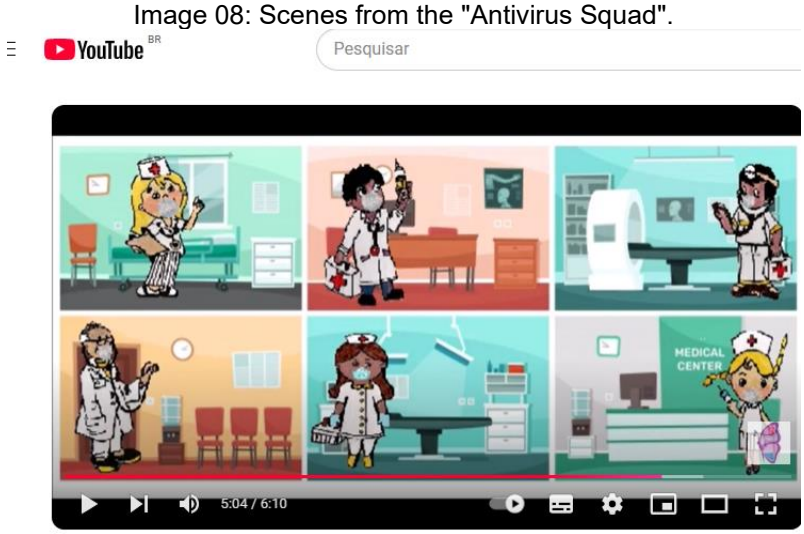
Source: Canal Borboletando, 2024.

The video uses the same resources as the previous one, with the difference that the information about the Coronavirus is passed on in the form of music, using the melody of the popular song "Teresinha de Jesus".

It should be noted that in these two stories, the narratives and songs that circulate, especially in the Northeast of Brazil, were used. Analogous to the art of storytelling, it can be said that both the cordel and the popular songs, in which rodas were played, are remnants of the ancestry of a people, who perpetuate their culture and knowledge every time they update their traditional forms of expression. So, the Channel innovates when it preserves this type of manifestation of popular culture with the mediation of technology, integrating multidisciplinary knowledge related to education and health.

The next video-story (Image 08), analyzed in this survey, is entitled "Antivirus Squad".

Image 08: Scenes from the "Antivirus Squad".



Source: Canal Borboletando, 2024.

The story is a tribute to the professionals who were at the *forefront* of the battle against the pandemic: doctors, nurses, and other health professionals. In the video, these professionals are equated with contemporary superheroes. The intention was to recognize the professionals, value them in their heroic actions to face a highly lethal disease and comfort their families, especially the children who had difficulty accepting the absence of their parents – health professionals – in their homes.

The last story analyzed in this process of integration of themes on education and health dealt with in this period of the "Coronavirus" is presented below (Image – 09).

Image 09: Goldilocks' disobedience



Source: Canal Borboletando, 2024.

In this adaptation of the classic tale "Goldilocks", the representation of the main character receives physical characteristics of a regional ethnicity, different from the original tale, making it possible for Internet users to recognize ethnic and cultural diversities, since the traditional character is represented as white and with blond hair (golden curls).

The video explains, among other issues, the reason for the name of the virus and the necessary care to protect all people. In this regard, the narrative focuses on the child's disobedience, providing the opportunity to discuss the need to obey, in a specific way, the sanitary norms at a time when the country needed to follow health protection protocols/norms/impositions.

From the above, in this text, it can be stated that the analysis of the posted video stories point to the understanding that storytelling in social networks promotes the intertwining of various areas of knowledge, and its effects can be dimensioned in several aspects, specifically here the educational and health aspects stand out.

In the educational - the stories posted on the channel allowed the children, at the beginning of social isolation, to continue with their learning process, as the didactic sequences made available by the Project served as a guide for families to approach the videos in an educational way.

Looking at the aspect of the Health area - it can be said that the objectives of providing the channel's audience with the scientific information that was available at that time were achieved, always in a playful and lighthearted way. It is inferred that the illustrations used in the videos may also have helped in this process. It is also worth highlighting the collaboration of video stories for the formation of hygiene habits (such as correct hand washing and the use of masks), as well as attitudes, such as safeguarding the elderly and understanding the situation of mothers and fathers who are health professionals.

It is also considered that the stories posted on the Channel have the potential to improve the psychological conditions of children and adults in that context, as the way the

"Coronavirus" pandemic and its lethal effect were treated in a playful and gentle way, which can help contain the anxiety and fear caused in people, since the stories always pointed to an end where there was an overcoming or positive reaction to the problem.

In this context, it can be said that storytelling on the channel fulfills the same functions as traditional storytelling, as Malba Tahan (1964) emphasizes, when she highlights important aspects provided by this art: the educational aspect, which is related to the expansion of children's language, mentioned above, to the stimulation of intelligence, to the acquisition of knowledge, socialization, respect for differences, to the formation of social and moral habits and attitudes, to the development of sensitivity and imagination, memory, attention and even awaken interest in reading.

Likewise, we agree with Dohme (2018), when he corroborates the statements about these aspects mentioned in this text and adds the development of critical sense, observation and creativity, necessary skills in both the areas of Health and Education.

One cannot fail to draw attention to the aspects of the interactions that were made possible by the videos, especially due to the use of colloquial language, being able to reach the audience of different characteristics.

FINAL CONSIDERATIONS

We sought to raise elements that can establish the relationships between education and health, making use of multidisciplinary approaches that encompass these two areas, among others. In the context of the Borboletando Project, this dialogue was made possible by making use of storytelling in virtual media.

Used as a strategy, this ancestral art of passing on knowledge and knowledge, of creating habits and strengthening values and attitudes, allowed, throughout the Project and in the situation of social isolation caused by the pandemic, to disseminate the available scientific information about the Coronavirus and how to prevent contagion to children and their families, in a didactic and playful way.

In this sense, when proceeding with the survey of the video-stories posted on the Borboletando Channel during the pandemic period, it was found that the textual genres short stories, parodies and cordels were used, according to the classification understood by the producers of the videos. These genres were adapted to the present day and being inserted in the plots, information and characters related to the theme of the Coronavirus, thus providing a multidisciplinary vision associated with playfulness.

As for the quantitative aspects indicative of the achievement of the Project's objective, it can be said that they were positive, considering that it is a Channel formatted in

the molds of school practices of telling stories and planning the educational intentions of the stories, produced by amateurs in the area of digital media. In this sense, the views were satisfactory, if one takes into account the size of the audience that would be reached if the activity were developed in person.

As for the messages conveyed by the stories, they focused on scientific information, which circulated until the date of the posts, as well as on guidelines aimed at the formation of hygiene habits and assertive attitudes about living with the pandemic situation. Seen in this way, it is inferred that there was a positive impact for Internet users who accessed the Channel.

Observed from another perspective, it can be said that the extension experiences developed by the Project are a beacon to guide discussions on health and education in times of technological mediation, raising data and reflections on how educators and health professionals can use the strategies to achieve the objectives of their respective areas, allowing a multidisciplinary look at the theme.

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INTEGRATION OF ARTIFICIAL INTELLIGENCE AND RENEWABLE ENERGIES IN SCIENCE EDUCATION: FOUNDATIONS AND PATHWAYS FOR INTERDISCIPLINARITY

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ABSTRACT

This chapter explores the integration of Artificial Intelligence (AI) into science education, emphasizing its theoretical foundations and pedagogical potential. It highlights the importance of interdisciplinarity in fostering a more dynamic and personalized learning experience. Furthermore, it examines the ethical and epistemological challenges associated with this transformation in the educational context. The research adopted a qualitative approach, essential for an in-depth exploration of the relationship between Artificial Intelligence (AI) and science education. The methodology involved a literature review, drawing from sources categorized into three groups: (1) sources on AI, (2) sources on science education, and (3) sources discussing the intersection of AI and science education. This approach enabled a detailed analysis of the pedagogical, epistemological, and ethical implications of this integration. The overarching aim of this study is to explore the foundations and possibilities of integrating Artificial Intelligence (AI) into science education, with a focus on promoting interdisciplinarity while addressing the ethical and epistemological challenges inherent in this pedagogical process. The findings reveal that AI can serve as a powerful tool to transform science education, particularly by fostering more

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personalized and interactive learning environments that enhance interdisciplinarity and critical skill development among students. However, the study also underscores significant challenges in implementing AI in science education, including ensuring equity, transparency, and data privacy, as well as addressing epistemological issues related to the redefinition of knowledge and the educator's role.

Keywords: Artificial Intelligence. Science Education. Pedagogical Potential. Learning.

INTRODUCTION

The integration of Artificial Intelligence (AI) into science education has gained increasing relevance, particularly in light of the digital transformations shaping contemporary society. Traditional science education, often focused on the linear and disciplinary transmission of knowledge, now faces the challenge of adopting new approaches aligned with technological innovations. AI, with its capabilities for data processing, machine learning, and content personalization, offers novel perspectives for constructing scientific knowledge, enabling educators and students to experience more dynamic and interactive teaching models. Interdisciplinarity emerges as a key concept in this process, as AI necessitates more flexible disciplinary boundaries, fostering a learning experience that mirrors the complexity of real-world scientific issues. Moreover, AI has the potential to redefine the educator's role, extending it beyond mere content transmission to that of a facilitator of autonomous and critical learning (Moura, & Chagas, 2023).

However, the implementation of AI in science education also raises a series of challenges, particularly concerning ethical and epistemological issues. The use of technologies that directly influence learning processes requires careful reflection on their impacts on both pedagogical methods and students' cognitive structures. Issues such as data privacy, algorithmic fairness, and the redefinition of knowledge must be meticulously analyzed.

This research aims to explore these aspects, providing a comprehensive perspective on the benefits and limitations of AI in education, with a focus on interdisciplinarity and the ethical dilemmas that arise from adopting these technologies. This study adopted a qualitative approach, essential for a thorough exploration of the relationship between Artificial Intelligence (AI) and science education. The methodology involved a literature review, with sources categorized into three groups: (1) sources on AI, (2) sources on science education, and (3) sources discussing the intersection of AI and science education. This method allowed for a detailed analysis of the pedagogical, epistemological, and ethical implications of this integration.

The primary aim of this study is to explore the foundations and possibilities of integrating Artificial Intelligence (AI) into science education, emphasizing interdisciplinarity while addressing the ethical and epistemological challenges inherent in this pedagogical process.

The specific objectives are as follows: 1. To present the fundamental concepts of Artificial Intelligence and its application in the context of science education, highlighting the basic principles guiding its pedagogical use. 2. To analyze the potential contributions of AI to

science education, exploring interdisciplinary approaches that promote pedagogical transformations and foster dynamic, contextualized learning. 3. To explore how the integration of Artificial Intelligence with renewable energies can be utilized to develop interdisciplinary approaches in science education, enhancing understanding of scientific and technological concepts related to sustainability. 4. To investigate the key ethical and epistemological challenges associated with implementing AI in science education, focusing on issues such as privacy, fairness, and the transformation of educational knowledge.

This chapter is organized into four sections to provide a comprehensive analysis of AI integration in science education. The first section, Introduction, outlines the central theme of the study, contextualizing the relevance of AI in education and addressing interdisciplinary and ethical concerns. The second section, Materials and Methods, details the methodological approach adopted for the research, including data collection and analysis strategies, as well as tools used to investigate the implications of AI in science education. The third section, Theoretical Framework, reviews key concepts, theories, and studies on the impact of AI and renewable energies in science education, examining their potential and the ethical and epistemological challenges arising in this context. Finally, the fourth section, Final Considerations, synthesizes the study's key findings, highlighting the practical implications of AI in science education and proposing directions for future research in this field.

METHODOLOGY

The approach adopted in this research was qualitative in nature, as the main objective was to understand the complex interactions between Artificial Intelligence (AI) and science education, as well as to explore the pedagogical, epistemological, and ethical implications of this integration. The qualitative approach is widely recognized in the scientific community for its ability to provide deep and contextual insights, enabling a detailed analysis of experiences, perceptions, and practices that cannot be easily quantified. Instead of seeking numerical generalizations, qualitative research focuses on the interpretation and understanding of complex phenomena, which is essential in areas involving education and technology, where variables are multifaceted and dynamic.

Regarding the qualitative approach, González (2020, p. 02) states that:

> The qualitative approach refers to a wide range of perspectives, modalities, approaches, methodologies, designs, and techniques used in the planning, conduct, and evaluation of studies, inquiries, or investigations aimed at describing, interpreting, understanding, or addressing social or educational situations considered problematic by the social actors who are their protagonists or who, for

> some reason, have an interest in addressing such situations from an investigative standpoint.

The research procedure adopted was a literature review, an essential methodology in the construction of scientific knowledge, as it allows for a critical and integrated analysis of existing academic works on a given topic. The literature review serves to map the state of the art, identify gaps in knowledge, and build a solid theoretical foundation upon which new research can be based.

According to Lunetta and Guerra (2023, p. 03):

> The literature review is a research procedure based on existing materials, such as books and scientific articles. In many studies, it is common to find research focusing exclusively on bibliographic sources. Often, exploratory studies fall into this category. Moreover, research aimed at analyzing ideologies and different perspectives on a problem is also frequently developed solely based on bibliographic sources.

For this review, the research sources were carefully selected and classified into three main categories: (1) sources specific to AI, which address theories, applications, and advances in AI; (2) sources specific to science education and renewable energies, which discuss pedagogical methodologies and the challenges of this area; and (3) sources addressing the relationship between AI and science education, which investigate how AI can transform science teaching and the practices and challenges arising from this interaction.

This classification of sources enabled a more precise and segmented analysis, allowing for the construction of a robust discussion on the interconnections between AI and science education. The review was conducted through consultations with renowned academic databases, articles, books, and recent publications, ensuring comprehensiveness that reflected the most relevant and current contributions in the field.

THEORETICAL FRAMEWORK

To understand the contributions of artificial intelligence (AI) to science education from an interdisciplinary perspective, it is essential to construct a theoretical foundation that encompasses fundamental concepts as well as the ethical and epistemological implications of this technological integration in the educational context. This foundation addresses three central aspects that underpin this discussion.

Firstly, we will explore the fundamental concepts and principles of AI and its application in science education, highlighting the key technologies and strategies that enhance personalization and efficiency in teaching. This conceptual foundation is indispensable for understanding the potential applications of AI in pedagogical contexts (Cavalcante, 2024).

Subsequently, we will discuss the potential of AI to transform pedagogical practices in science education, with a focus on interdisciplinary approaches. This section will emphasize how AI can foster the integration of diverse areas of knowledge, enriching learning experiences and offering new teaching possibilities aligned with the complexity and dynamism of contemporary sciences.

The third subtopic examines how AI can be integrated into science education to connect scientific, technological, and environmental concepts with renewable energy, promoting education for sustainability. It will explore opportunities for personalized teaching and the significance of this integration in preparing critical citizens capable of addressing global environmental challenges.

Finally, we will address the ethical and epistemological challenges arising from the application of AI in education. This subtopic highlights fundamental issues related to accountability, technological bias, and the development of a critical understanding of AI tools in educational environments, contributing to a balanced and conscious perspective on their benefits and limitations.

ARTIFICIAL INTELLIGENCE AND SCIENCE EDUCATION: FUNDAMENTAL CONCEPTS AND PRINCIPLES

Artificial Intelligence (AI) has emerged as a transformative force in education, offering new opportunities to enhance teaching and learning. In recent years, the application of AI in education has rapidly expanded, ranging from adaptive learning platforms to intelligent tutoring systems. These systems are designed to personalize the educational experience by adapting to students' individual needs, fostering more effective learning outcomes. AI not only facilitates the automation of administrative tasks but also enables educators to focus on more complex aspects of teaching, such as developing critical and creative skills in students. Thus, the integration of AI in science education represents not just a technological innovation but a reconfiguration of pedagogical practices aimed at improving educational results (Cavalcante, 2024; Santos, 2024).

The fundamental concepts of AI include machine learning algorithms and neural networks, which underpin many of the current educational tools. Machine learning allows systems to analyze large datasets to identify patterns and predict student behaviors, while neural networks simulate human brain functions to solve complex problems. This analytical and predictive capability is particularly valuable for early identification of learning difficulties, enabling quicker and more effective interventions. Furthermore, AI can help create more interactive and engaging learning environments by employing techniques such as natural

language processing to develop chatbots that provide instant support to students (Cavalcante, 2024).

However, implementing AI in science education is not without challenges. The "opacity" of the algorithms used in many AI systems raises concerns about transparency and ethics in education. Educators must be aware of the limitations of these technologies and ensure that AI complements rather than replaces the human role in teaching. Continuous teacher training is crucial for effectively integrating these tools into pedagogical practices, ensuring that students not only consume information but also develop critical skills to evaluate and question the content presented. Moreover, it is essential to address the social and ethical impacts of AI in education, including issues related to student data privacy and equitable access to technology (Duque et al., 2023; Siqueira, Wiziack, & Zanon, 2023).

It is already evident that the future of AI in science education looks promising, with growing interest from researchers and educators in exploring its practical applications. International conferences have increasingly focused on discussing the latest innovations in educational AI, emphasizing the importance of collaboration across disciplines such as computer science, psychology, and pedagogy. As new technologies emerge, including large language models used in platforms like ChatGPT, educational institutions must adopt a critical and reflective approach to integrating these tools to enhance learning. While the potential for AI to transform science education is significant, its success will depend on educators' ability to integrate these technologies ethically and effectively into their classrooms (Paiva, 2023; Cavalcante, 2024).

THE POTENTIAL OF AI IN SCIENCE EDUCATION: INTERDISCIPLINARY APPROACHES AND PEDAGOGICAL TRANSFORMATIONS

Artificial Intelligence (AI) holds vast potential to transform science education, fostering interdisciplinary approaches that connect different areas of knowledge and enrich the educational experience. Integrating AI into pedagogical practices enables educators to develop more dynamic and adaptive curricula that cater to the diverse needs of students. For instance, by using adaptive learning systems, teachers can personalize science content based on individual student performance, identifying knowledge gaps and providing specific resources to address them. This personalization not only enhances the understanding of scientific concepts but also increases student engagement, making learning more relevant and meaningful (Cavalcante, 2024).

Furthermore, AI can facilitate collaboration across disciplines, helping students see connections between science and other fields such as mathematics, technology, and even the arts. AI tools can be used to create interdisciplinary projects that encourage students to apply scientific concepts to real-world contexts. For example, with AI-based simulations, students can explore complex natural phenomena like climate change or chemical reactions in a virtual environment. This approach not only fosters a deeper understanding of scientific content but also develops essential skills such as critical thinking and problem-solving (Oliveira & Silva, 2023).

The pedagogical transformations driven by AI also include leveraging data to inform educational practices. With the ability to collect and analyze large datasets on student performance, educators can make more informed decisions about their teaching strategies. Predictive analytics can help identify which methods are most effective for different groups of students, enabling a more evidence-based approach to science teaching. Additionally, AI tools for automated feedback can help students better understand their strengths and weaknesses in real-time, promoting a continuous learning cycle (Paiva, 2023).

Table 1 summarizes the main potentials of AI in science education, as highlighted by Cavalcante (2024), emphasizing how these innovations can be practically applied to foster more effective and integrated educational practices.

Table 1 - Potencialities of AI in Science Education

Potentialities of AI	Description	Practical Example
Personalization of Learning	Adaptation of content based on the individual needs of students.	Adaptive learning systems that adjust exercises accordingly.
Interdisciplinary Approaches	Connection between science and other disciplines to enrich the learning experience.	Projects that combine science with mathematics and technology.
Analysis of Educational Data	Utilization of data to inform pedagogical practices and improve academic outcomes.	Predictive analysis to identify effective teaching methods.
Immediate Feedback	Tools that provide instant responses regarding student performance.	Platforms that automatically grade online exercises.
AI-Based Simulations	Creation of virtual environments to explore complex scientific phenomena.	Simulations of chemical reactions or climate change scenarios.

Source: Cavalcante (2024)

It is crucial to consider the ethical and social implications of integrating Artificial Intelligence (AI) into science education. Central to these concerns is equity in access to technology; ensuring that all students have equal opportunities to benefit from these

innovations is essential. Moreover, educators must be prepared to address issues related to student data privacy and the transparency of the algorithms used in educational tools.

By adopting a critical and reflective approach to implementing AI in science education, educational institutions can maximize the benefits of this emerging technology while mitigating its risks. This involves not only training educators to effectively integrate AI tools into their teaching but also fostering discussions on the broader societal impacts of AI in education, such as the potential for algorithmic biases and the implications of automated decision-making processes.

As highlighted by Siqueira, Wiziack, and Zanon (2023), addressing these challenges requires collaboration between educators, policymakers, and technologists to establish ethical guidelines and best practices. This proactive approach ensures that the transformative potential of AI is harnessed responsibly, contributing to a more inclusive and equitable educational landscape.

THE ROLE OF ARTIFICIAL INTELLIGENCE IN SUSTAINABILITY EDUCATION: BRIDGING SCIENCES AND RENEWABLE ENERGY

The integration of Artificial Intelligence (AI) into science education signifies a substantial leap forward in fostering sustainability-focused learning, particularly in the realm of renewable energy. AI can be utilized to develop interactive and personalized tools, such as simulation platforms for solar, wind, and biomass systems. These tools allow students to practically and interdisciplinarily explore the scientific and technological principles underlying these energy sources. This approach not only makes learning more dynamic but also deepens the understanding of the connections between science, technology, and the environment (Galvão, Spazziani, & Monteiro, 2018).

AI-driven predictive models offer another promising application. These models can be employed in classrooms to forecast weather patterns, estimate the energy efficiency of renewable systems, or analyze the environmental impacts of adopting these technologies in various contexts. Such applications enable students to apply their knowledge of physics, chemistry, and mathematics to real-world scenarios, addressing contemporary sustainability challenges. Moreover, using real data in these models fosters critical thinking and enhances problem-solving skills (Oliveira & Silva, 2023).

AI facilitates interdisciplinarity in science education by integrating knowledge from biology, physics, and information technology. Educators can design pedagogical projects connecting topics such as the carbon cycle, energy efficiency, and socio-environmental

impacts. For instance, students might employ machine learning algorithms to assess the feasibility of renewable energy sources for urban or rural communities (Paiva, 2023).

This interdisciplinary approach not only enriches learning but also demonstrates how science can address global challenges. Additionally, AI supports personalized teaching by adapting content and pedagogical strategies to individual student profiles. AI-based tools can identify gaps in prior knowledge and suggest targeted activities to reinforce fundamental concepts related to renewable energy and sustainability (Galvão, Spazziani, & Monteiro, 2018; Paiva, 2023).

This individualized approach enhances engagement and the effectiveness of teaching, promoting more meaningful learning experiences aligned with student interests. Ultimately, the convergence of AI and renewable energy in science education paves the way for education to contribute directly to preparing environmentally conscious citizens equipped to tackle 21st-century challenges. The interdisciplinarity enabled by these technologies not only underscores the relevance of scientific content but also equips students to innovate and act ethically toward a sustainable future (Galvão, Spazziani, & Monteiro, 2018; Machado & Souza, 2023).

ETHICAL AND EPISTEMOLOGICAL CHALLENGES OF ARTIFICIAL INTELLIGENCE IN EDUCATION

The integration of Artificial Intelligence (AI) into education introduces a range of ethical challenges that must be carefully addressed. Among the most prominent dilemmas is the issue of student data privacy and security. As educational platforms employ AI to collect and analyze information about students' performance and behavior, concerns arise regarding how this data is stored, used, and shared. Educational institutions must establish clear guidelines for data protection, ensuring students' rights are respected and sensitive information is not exposed to third parties without proper consent.

Beyond privacy concerns, the epistemological challenges posed by AI in education are significant. The way AI processes and presents information can influence how students construct knowledge. For instance, recommendation algorithms may create informational bubbles, limiting students' exposure to diverse perspectives and potentially undermining their critical thinking development. It is essential for educators and technology developers to consider how AI tools shape learning experiences. They should aim to promote balanced approaches that foster intellectual curiosity and critical thinking rather than merely providing ready-made answers (Machado, & Souza, 2023; Paiva, 2023).

The implementation of AI in education also raises concerns about equity in access to technology. Disparities in access to technological resources may exacerbate existing inequalities among different social groups. Consequently, educational policies must address these disparities to ensure that all students have equal opportunities to benefit from technological innovations.

Addressing the ethical and epistemological challenges of AI should become a core component of teacher training programs. Educators must be equipped to navigate an increasingly technology-mediated educational landscape. This preparation includes understanding the implications of AI for pedagogy and adopting strategies to mitigate potential risks while maximizing its benefits (Duque et al., 2023; Machado, & Souza, 2023). By fostering a critical and reflective approach to AI integration in education, institutions can enhance learning outcomes while upholding ethical standards and promoting equitable access to technological advancements.

FINAL CONSIDERATIONS

The present chapter aimed to explore the foundations and possibilities of integrating Artificial Intelligence (AI) in science education, with an emphasis on interdisciplinary approaches and the ethical and epistemological challenges associated with this transformation. The research achieved its objectives by providing a detailed analysis of the basic concepts and principles of AI, its potential in science education, and the challenges that arise within the educational context. The qualitative approach, through a literature review, was fundamental in understanding the complex interactions between these two fields, allowing for an in-depth discussion of the pedagogical and ethical implications of this integration.

The research revealed that AI, combined with the theme of renewable energies, can be a powerful tool for transforming science education, particularly by promoting a more personalized and interactive learning experience that fosters interdisciplinarity and the development of critical competencies among students. However, it also became evident that implementing these themes in scientific education involves significant challenges, such as the need to ensure equity, transparency, and data privacy, as well as epistemological issues related to redefining knowledge and the role of educators. In this regard, the chapter demonstrated that while the addressed themes offer transformative potential, their application in the educational context must be accompanied by critical reflection on their impacts.

For future research, it is recommended to deepen the analysis of the real impacts of AI in the daily practices of science classrooms through empirical studies involving teachers and students. Furthermore, it is essential to investigate continuous professional development strategies for teachers regarding the pedagogical use of AI to ensure that the implementation of this technology is conducted ethically and efficiently. Research exploring the application of AI in specific contexts, such as inclusive education or science teaching at different educational levels, is also highly relevant for understanding how these technologies can be utilized more effectively and accessibly.

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EFFECT OF DIFFERENT ACIDITY CONDITIONS ON THE STRUCTURAL PROPERTIES OF ZIRCONIA CERAMICS

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ABSTRACT

In this study, two groups of dental ceramics exposed to acidic conditions were evaluated: Group 5Y-TZP (Zirconia stabilized by 5mol% Y2O3 and obtained experimentally by chemical synthesis), and Ceramill® Zirconia Group, commercially acquired. Both materials were compacted in the form of pellets, using a mold with a diameter of 6 mm and a hydraulic press, applying a uniaxial load of 3 tons for 60 seconds. After the pressing stage, the pellets were sintered at 1500ºC for 2 hours. All the tablets produced (N=30) were weighed on an analytical scale and then divided according to the acid immersion solutions into 4 media: SA (artificial saliva), SL (orange juice), CC (cola [Coca-Cola] and C (coffee). The tablets were stored in an oven at 37ºC for 72 hours and after the end of this time they were washed in water and dried on absorbent paper. Their masses were again measured in order to evaluate the possible loss of mass during storage. The effect of the acid medium on the crystallinity of the ceramics was evaluated by X-ray diffraction (XRD) analysis, while the chemical bonds were evaluated by Infrared Vibrational Spectroscopy (FTIR). The XRD analyses indicated that, regardless of the acidic medium, none of the ceramic groups observed a change in the crystallinity pattern. The FTIR spectra indicated the presence of new absorption bands, possibly due to the permeability of the acid solutions on the surface of the ceramic samples.

Keywords: Zirconia. Bioceramics. Acid degradation. Crystallinity.

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INTRODUCTION

Dental aesthetics has become increasingly important in contemporary society (MOTRO *et al*., 2012; WRIGHT *et al*., 2004). The demand for ceramic restorations has increased due to their improved aesthetics and greater durability when compared to other restorative materials (dos SANTOS *et al*., 2016; DELLA BONA, 2009; SARAC *et al*., 2006). However, the development of restorations that allow mimicking the natural appearance of teeth is still one of the greatest clinical challenges in dentistry (NOGUEIRA *et al*., 2013; SON *et al*., 2010; BREWER *et al*., 2004). Thus, ceramics must reproduce the natural characteristics of the teeth, including color, surface texture, and translucency, to achieve aesthetic levels that accurately correspond to the natural structure of the tooth (NOGUEIRA *et al*., 2013; SON *et al*., 2010; HARIANAWALA *et al*., 2014).

Due to their superior mechanical properties, biocompatibility with human tissues, and improved optical properties, yttria-stabilized tetragonal zirconia (Y-TZP) ceramics have become increasingly important in recent decades as biomaterials for restorations, being widely used commercially in the manufacture of crowns, fixed dental prostheses, and dental implants (MIYAZAKI *et al*., 2013; CAMPOSILVAN; TORRENTS; ANGLADA, 2014; DENRY and KELLY, 2014; PRESENDA *et al*., 2015; TONG *et al*., 2016; ZHAO; ZHU; LUO, 2016). Recently, Y-TZP ceramics have undergone microstructure and composition modifications to improve translucency, however, without causing damage to mechanical properties (ZHANG *et al*., 2018; MATSUZAKI *et al*., 2015).

Regarding the properties of ceramic materials, it is known that the chemical composition of the materials, the manufacturing technique, the application method, among other factors affect the properties (DELLA BONA, 2009). The properties can also be affected when the ceramic is subjected to a process of surface degradation, which occurs when the surface is exposed to aqueous solutions and/or changes in pH (ESQUIVEL-UPSHAW *et al*., 2013; KUKIATTRAKOON *et al*., 2010; KUKIATTRAKOON *et al*., 2009; SWAIN, 2014; CCAHUANA *et al*., 2010). In addition, this process can be intensified by temperature variations (ESQUIVEL-UPSHAW *et al*., 2013; KUKIATTRAKOON *et al*., 2009) and has undesirable consequences for restoration, for example the accumulation of biofilm and restorations with changes in color and appearance (KUKIATTRAKOON *et al*., 2010; MINAMI *et al*., 2007).

Many *in vitro* studies have shown that commonly used beverages such as coffee, tea, red wine, cola soft drinks, and fruit juice can cause significant changes in the color of restorative materials (REN *et al*., 2012; GULER *et al*., 2005; FUJITA *et al*., 2006; ASHCROFT *et al*., 2008; TUNC *et al*., 2009; FONTES *et al*., 2009). However, studies

evaluating the influence of acidic diets on the crystal structure of ceramics are scarce. In view of the above, this *in vitro* study evaluated the alterations of the crystal structure and chemical bonds in ceramics of 5Y-TZP (Zirconia stabilized by 5mol% of Y2O3, obtained experimentally by chemical synthesis process) and Ceramill® zirconia, commercially acquired, when exposed to potentially acidic solutions. The null hypothesis was that the proposed acid solutions would not be able to alter the properties of the evaluated ceramics.

MATERIALS AND METHODS

CHEMICAL SYNTHESIS OF EXPERIMENTAL 5Y-TZP CERAMICS

The chemical synthesis process was initiated by weighing, on an analytical scale, the masses of zirconium butoxide and yttrium nitrate hexahydrate necessary for the reaction. Separately, citric acid was dissolved in distilled water and kept under stirring and heating at 60°C for 30 min. The citric acid solution was added to the vial containing the reagents and the mixture was kept in stirring and heating at 90°C for 1 h. Only then was ethylene glycol added, the temperature being raised to 130°C and the resulting solution kept in stirring for 1 h at this temperature.

Then, the solution was preheated in a muffle furnace at 350°C for 3 h, followed by heat treatment at 800°C for 6 h in order to promote the formation of the crystalline phases.

SELECTION OF COMMERCIAL CERAMIC SYSTEM

In this study, the pre-sintered ceramic block of the commercial system Ceramill® zirconia (Amanngirrbach, Koblach – Austria) introduced in the Dental market was used for the manufacture of infrastructures by CAD/CAM (*Computer Aided Design / Computer Aided Manufecturing*).

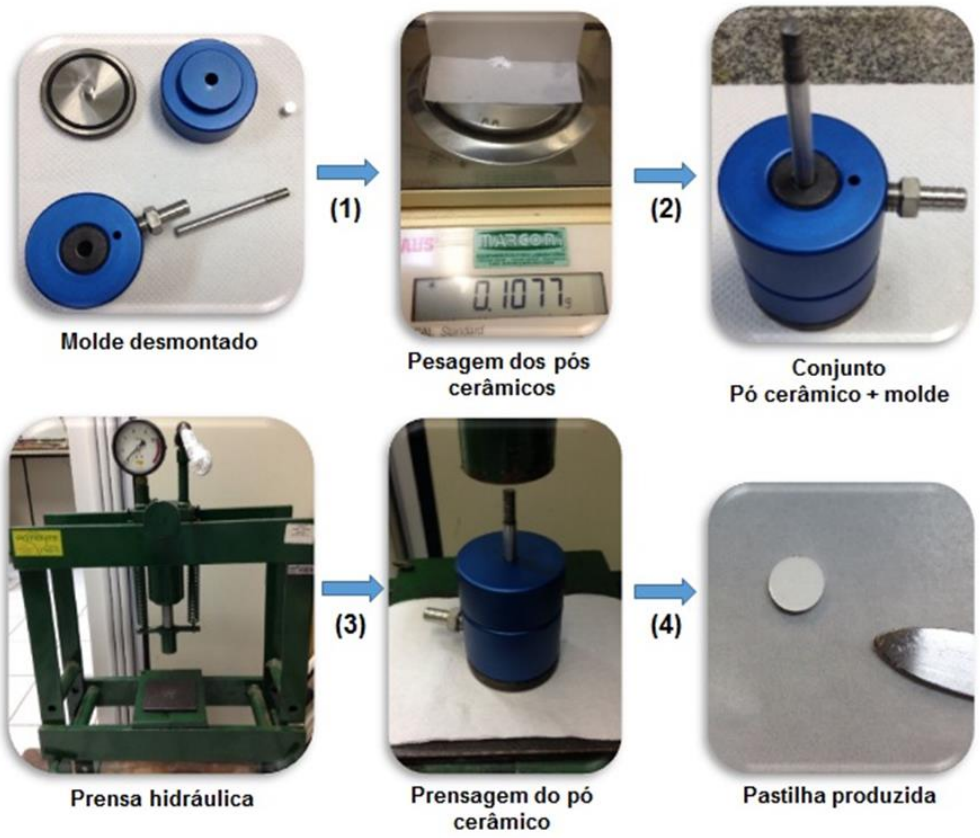
The product Ceramill® zirconia is described as a super-high translucency zirconium oxide. Indicated for monolithic or anatomically reduced restorations in the anterior region, as well as bridges of up to 3 elements in the molar area. This ceramic combines the excellent processing properties of zirconium oxide with a translucency comparable to that known so far only in lithium disilicate. The result is a highly aesthetic dental prosthesis of long-lasting strength and stability.

The pre-sintered Ceramill® zirconia block was cut with a diamond blade coupled to a precision cutter with a cutting speed of 400 rpm under abundant water cooling, in order to obtain bar-shaped specimens. The sectioned specimens were disaggregated with the aid of a mortar and pistil.

UNIAXIAL PRESSING OF CERAMIC MATERIALS AND SINTERING

The powders of the experimental ceramics 5Y-TZP and commercial ceramics Ceramill® zirconia were pressed uniaxially in a stainless steel mold for the manufacture of pellets. The inserts were pressed according to the conditions: applied load of 3 tons and load application time equal to 60 seconds. From the pressing, pellets of 6 mm in diameter by 1.45 mm in height were obtained, and approximately 0.10 g in mass. Figure 1 illustrates the sequence of steps in the manufacture of the tablets.

Figure 1 - Sequence of steps for making ceramic tiles.



Source: Authored by the author.

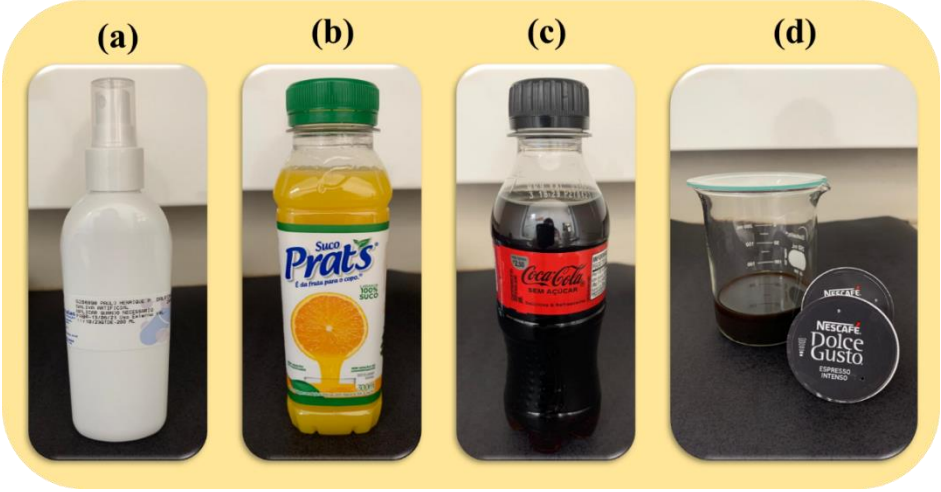
The pellets produced (N = 30) were taken to an Amanngirrbach furnace, model Ceramill® therm 3 following the guidelines indicated by the furnace manufacturer: sintering temperature 1500°C and dwell time of 2 h. After the sintering stage, the pellets were weighed on an analytical scale.

STUDY OF EXPOSURE TO DIFFERENT PH CONDITIONS

After weighing the tablets, the samples of each of the systems, 5Y-TZP and Ceramill® zirconia, were divided according to the immersion solutions into 5 groups (n = 3): group GC (Control), group SA (artificial saliva), group SL (orange juice), group CC (cola

[Coca-Cola]) and group C (coffee). Figure 2 illustrates the image of the solutions used in this study.

Figure 2 - Solutions used in the acid degradation test: (a) Artificial saliva (Bauru Formulas Laboratory); (b) Whole orange juice without sugar and preservatives (Prat's); (c) Coca-Cola sugar-free soft drink (FEMSA); (d) Dolce Gusto intense espresso (Nescafé).



Source: Authored by the author.

The samples of the GC group were stored in a falcon tube, in the absence of liquid medium, in an incubator at 37°C for 72 hours. In turn, the samples of the SA, SL, CC and C groups were immersed in a volume of 5 mL of their respective solutions and, likewise, were stored in falcon tubes and kept in an incubator at 37°C for 72 hours.

The description of the groups studied is summarized in Table 1.

Table 1 - Groups submitted to the acid degradation test in an oven at 37°C and a stay of 72 h.

Group	Description
5Y-TZP_GC	Experimental 5Y-TZP wafers stored in absence of solution
5Y-TZP_SA	Experimental 5Y-TZP pellets stored in artificial saliva
5Y-TZP_SL	Experimental 5Y-TZP lozenges stored in orange juice
5Y-TZP_CC	Experimental 5Y-TZP pellets stored in Coca-Cola
5Y-TZP_C	Experimental 5Y-TZP pellets stored in coffee
Ceramill_GC	Ceramill zirconia wafers® stored in the absence of solution
Ceramill_SA	Ceramill® zirconia tablets stored in artificial saliva
Ceramill_SL	Ceramill zirconia lozenges® stored in orange juice
Ceramill_CC	Ceramill zirconia lozenges® stored in Coca-Cola
Ceramill_C	Ceramill® zirconia tablets stored in coffee

Source: Authored by the author.

After the end of the storage time, the samples were washed in distilled water, dried on absorbent filter paper and taken to drying in an oven at 37°C for 5 h. Their masses were again determined on an analytical scale in order to evaluate the possible loss of mass during the acid degradation process. Then, the wafers were characterized for changes in the crystal structure and chemical bonds.

CHARACTERIZATIONS

Determination of pH

The solutions used in the acid degradation test, i.e., artificial saliva, orange juice, Coca-Cola soft drink and coffee were evaluated for their pH (hydrogen potential).

pH determination was performed using a pH meter (pH meter) (Akso, model AK95) previously calibrated with known pH buffer solutions (pH = 4, pH = 7 and pH = 10). The analysis is based on the measurement of the potential difference between two suitable electrodes, immersed in the solution under examination. One of these electrodes is sensitive to hydrogen ions and the other is the reference electrode, with constant potential. The measurement was carried out in a room with a controlled temperature of 22°C. The measurements were performed in triplicate.

Mass Loss

The mass of each pellet was determined before and after the acid degradation test in order to determine the possible mass loss that occurs in the process. Thus, the percentage of mass loss (%Δm) was calculated using equation (1), where *mi* corresponds to the mass before the degradation test and *mf* to the mass after degradation.

$$\%\Delta m = \frac{m_i - m_f}{m_i} \qquad (1)$$

X-ray diffraction

The wafers were examined by X-ray diffraction (XRD) using a Rigaku DMAX Ultima+ X-ray diffractometer. The experimental conditions were: interval from 20º to 80º with increment $\Delta 2\theta$ = 0.02º, scanning speed of 2°/min, CuK radiationα, wavelength 1.54 Å, power 40 kV, current 20 mA. The data obtained from XRD were processed by *software* using the ICDD (*International Centre for Diffraction Data*) database.

Fourier Transform Infrared Spectroscopy

The samples were examined by Fourier Transform Infrared Spectroscopy (FTIR) using a Bruker Fourier Spectrophotometer, model Vertex-70. The analyzed range was 4000-400 $^{cm-1}$, 64 accumulation scans, and 4 $^{cm-1\ resolution}$. The position of the main absorption bands was indicated in the spectra in order to facilitate the attribution of the identified chemical bonds.

RESULTS AND DISCUSSION

PH DETERMINATION

Table 2 summarizes the pH data of the solutions used in the degradation study.

Table 2 - pH data of the solutions analyzed in the acid degradation study.

Group	ph
Saliva artificial	5.04 ± 0.01
Whole Orange Juice	3.61 ± 0.02
Sugar-free Coca-Cola soda	3.18 ± 0.01
Intense espresso café	5.29 ± 0.00

Source: Authored by the author.

The pH or hydrogen potential of a solution is represented on a scale ranging from 0 to 14 and this scale measures the acidity or basicity of a solution. Thus, if the pH value is equal to 7 (pH of water), the medium of the solution (or liquid) will be neutral, while if the pH is less than 7, it will be acidic, and if it is greater than 7, basic (ATKINS, 2011). In view of the above, the characterization of the pH values of the solutions involved in the degradation study aimed to evaluate the erosive potential of the solutions.

To facilitate the discussion of the results obtained, the pH data were classified as: potentially erosive (solutions with pH lower than 5.5) and potentially non-erosive (solutions with pH equal to or greater than 5.5), following the attribution made by LIMA *et al.* (2005) which considers that the dissolution of tooth enamel begins when the pH on the tooth surface reaches values below 5.5 (PRISTA, 2015). Thus, according to the data presented in Table 2, the pH values of the solutions ranged from 3.18 (Coca-Cola) to 5.29 (Coffee) and, therefore, all the solutions used in the study were classified as potentially erosive.

MASS LOSS

In view of the pH data obtained, it was decided to evaluate the possible loss of mass (%Δm) of the ceramic tiles associated with the acid degradation process. The data on mass loss are presented in Table 3.

It was found that all the pellets submitted to the degradation test showed a loss of mass. However, the highest values of mass loss correspond to the groups of ceramic tablets stored in Coca-Cola Soda medium, i.e., groups 5Y-TZP_CC and Ceramill_CC, with losses of 0.43% and 1.50%, respectively.

According to DRUMMOND *et al.* (2019), Coca-Cola Soft Drink has in its composition the phosphoric acid content (H3PO4) of 0.059 g/ 100 mL of soft drink. Considering the acid force, that is, the force that determines the degree of ease with which acids ionize in water and other solvents, phosphoric acid is defined as a moderate or semi-strong acid, while

citric acid (C6H8O7), present in orange juice, is considered a weak acid (ATKINS, 2011). Thus, it is believed that the property related to acid strength justifies the fact that orange juice, which presented pH = 3.61, did not prove to be potentially erosive in relation to Coca-Cola Soft Drink.

Table 3 - Percentage of mass loss after acid degradation.

Group	%δm
5Y-TZP_GC	0.00 ± 0.00
5Y-TZP_SA	0.05 ± 0.02
5Y-TZP_SL	0.06 ± 0.03
5Y-TZP_CC	0.43 ± 0.14
5Y-TZP_C	0.05 ± 0.03
Ceramill_GC	0.01 ± 0.01
Ceramill_SA	0.06 ± 0.02
Ceramill_SL	0.09 ± 0.05
Ceramill_CC	1.50 ± 0.10
Ceramill_C	0.08 ± 0.05

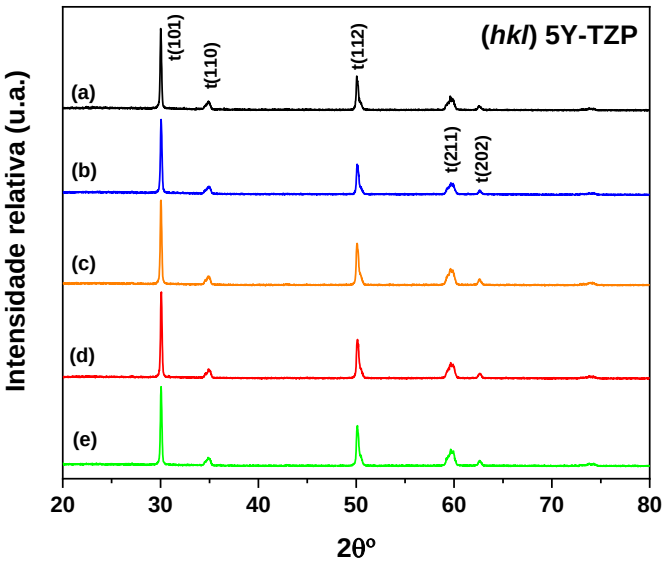
Source: Authored by the author.

X-RAY DIFFRACTION

The XRD characterization made it possible to identify the crystalline phases formed, as well as the effect of acid degradation on the crystallinity of zirconia ceramics. Figure 3 illustrates the XRD patterns of the 5Y-TZP groups studied, while Figure 4 illustrates the patterns of the Ceramill® zirconia groups.

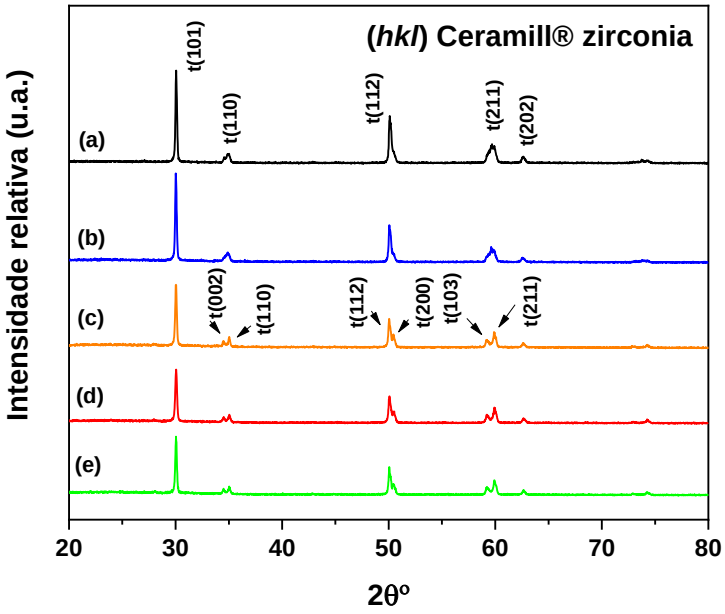
The analysis of the crystalline phases, as well as the indication of the crystallographic planes (*hkl*) in Figures 3 and 4 was performed using as reference the crystallographic file 79-1769 of the PCPDFWIN database of the *International Centre for Diffraction Data* (ICDD), illustrated in Figure 5. The crystallographic record was chosen based on the crystal structure of zirconia (ZrO2) evidenced in the diffraction patterns obtained. According to this factsheet, the pattern represents the tetragonal cell of ZrO2.

Figure 3- Diphratograms of roots X two groups 5Y-TZP subjected to acid degradation: (a) 5Y-TZP_GC; (b) 5Y-TZP_SA; (c) 5Y-TZP_SL; (d) 5Y-TZP_CC; (e) 5Y-TZP_C.



Source: Authored by the author.

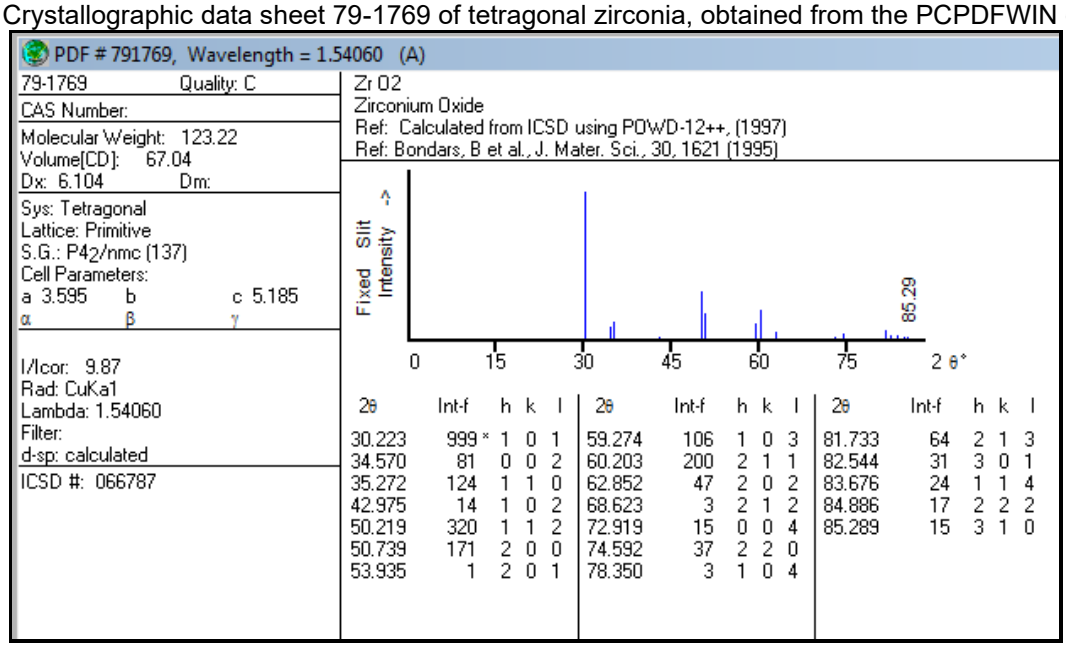
Figure 4- X-ray diffractograms of Ceramill® zirconia groups subjected to acid degradation: (a) Ceramill_GC; (b) Ceramill_SA; (c) Ceramill_SL; (d) Ceramill_CC; (e) Ceramill_C.



Source: Authored by the author.

The XRD data indicated that both control groups, 5Y-TZP_GC and Ceramill_GC, which were not exposed to the acidic environment, showed diffraction peaks associated with the tetragonal crystalline phase of zirconia. In addition, it was found that regardless of the acid solutions used in this study, they did not promote the change in the crystallinity pattern of the ceramics.

Figure 5- Crystallographic data sheet 79-1769 of tetragonal zirconia, obtained from the PCPDFWIN database.

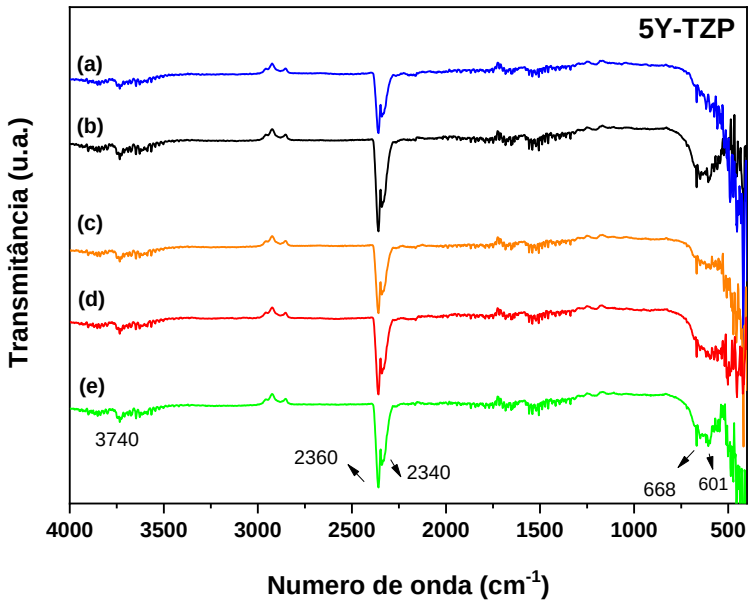


Source: Authored by the author.

FOURIER TRANSFORM INFRARED SPECTROSCOPY

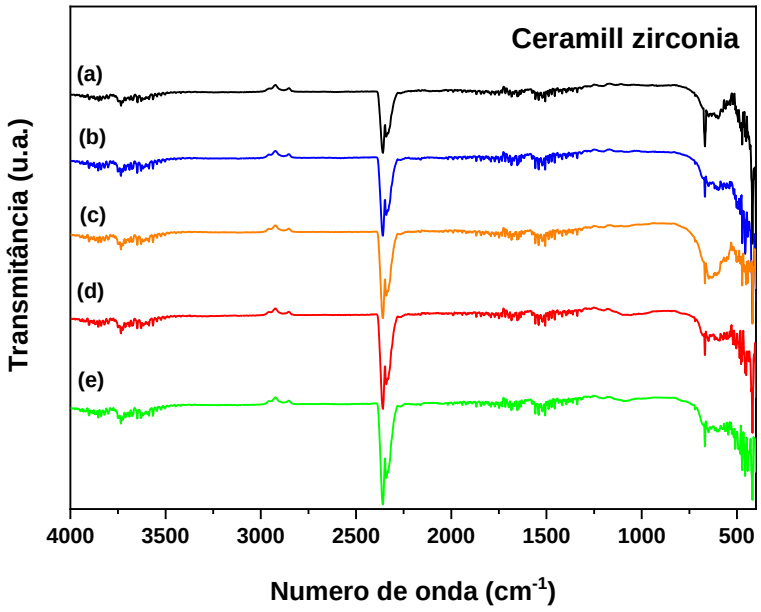
The results obtained by FTIR from the analysis of the chemical bonds present in zirconia, 5Y-TZP and Ceramill® zirconia ceramics, after the acid degradation test are illustrated in Figures 6 and 7, respectively.

Figure 6- FTIR spectra of two groups of 5Y-TZP subjected to acid degradation: (a) 5Y-TZP_GC; (b) 5Y-TZP_SA; (c) 5Y-TZP_SL; (d) 5Y-TZP_CC; (e) 5Y-TZP_C.



Source: Authored by the author.

Figure 7- FTIR spectra of Ceramill zirconia groups subjected to acid degradation: (a) Ceramill_GC; (b) Ceramill_SA; (c) Ceramill_SL; (d) Ceramill_CC; (e) Ceramill_C.



Source: Authored by the author.

Table 4 summarizes the attributions of the chemical bonds identified in the zirconia ceramics studied.

Table 4 - Data obtained by FTIR for the groups of zirconia ceramics submitted to the degradation test. Abbreviations: ν, bond stretch, and δ, angular deformation.

Wavenumber ($^{cm-1}$)										Connection
5Y-TZP					Ceramill zirconia					
GC	HIS	SL	CC	C	GC	HIS	SL	CC	C	
3741	3741	3741	3738	3740	3734	3736	3736	3736	3736	ν(OH)
2360	2360	2360	2360	2360	2360	2360	2360	2360	2360	νCO2
2341	2341	2341	2341	2340	2340	2340	2340	2340	2340	νCO2
667	668	668	668	668	668	668	668	668	668	ν(M-O)
-	605	-	-	601	-	-	601	-	-	δ(C-H)

Source: Authored by the author.

The FTIR spectra revealed that all the evaluated groups indicated the presence of the hydroxyl band (O-H) in the region of 3740 $^{cm-1}$, which can be attributed to water molecules adsorbed on the surface of the pellets during the execution of the analyses. Similarly, the bands at 2360 $^{cm-1}$ and 2340 $^{cm-1}$ can be attributed to the presence of carbon dioxide (CO2) in the environment during the tests. As expected, all spectra presented the band at 668 $^{cm-1}$ associated with M-O (metal-oxygen) bonds. However, in some of the spectra, bands in the region of 600 cm-1 were identified, attributed to C-H (carbon-hydrogen) bonds. According to the data already discussed on the percentage of mass loss, which confirmed the degradation of the ceramic tiles, it is believed that the erosive character of the solutions used may have caused porosity in the tiles. In turn, erosion may have

promoted the permeability of the acid solutions on the surface of the ceramic samples, which justifies the C-H bonds identified in the spectra.

CONCLUSIONS

Under the experimental conditions evaluated, the acid degradation study carried out confirmed that all the acid solutions used, i.e., artificial saliva, orange juice, Coca-Cola soft drink and coffee, promoted the wear of the 5Y-TZP ceramics.

All the acid solutions used presented pH values considered potentially erosive and, therefore, may represent a risk to dentin enamel demineralization.

Coca-Cola soft drink was responsible for the greatest loss of mass in the tablets, possibly due to the presence of phosphoric acid in its composition. The erosive wear of the inserts may have caused greater porosity of the surface of the ceramics, which justifies the chemical bonds C-H identified by FTIR. On the other hand, it was found that acid degradation had no effect on the crystallinity of the 5Y-TZP ceramics evaluated.

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INTERFACE OF CONTROLLERSHIP ARTIFACTS AND THE LIFE CYCLE IN FAMILY BUSINESSES

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ABSTRACT

The study analyzes whether family businesses are in harmony with the use of controllership artifacts, according to the study by Miller and Friesen (1984), with regard to the evolution of the life cycle linked to succession. The research is identified as a multiple, descriptive and qualitative case study. The sample is composed of two family businesses in the State of Santa Catarina, one in the food industry, located in the municipality of São Lourenço do Oeste - SC and the other in the trade activity - Supermarkets, located in Chapecó - SC, both operating in the market for more than 30 years. Data collection was directed to the person responsible for the controllership of the companies under study, through a questionnaire, which was sent by e-mail. The results show that controllership artifacts are part of the reality of the companies studied, and that they emphasize controllership as an important tool for managers' decision-making. It is possible to verify that both organizations are in the maturity phase, with regard to the stage of the life cycle.

Keywords: Controllership. Life cycle stages. Family Businesses.

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INTRODUCTION

Family businesses have been growing over the years, becoming the basis of social and economic growth in the world (MOREIRA AND FREZATTI, 2019). Family organizations have a mixture of corporate governance linked to management with family relationships and emotional issues, which makes them complex and peculiar (LOBÃO, 2019).

In fact, the most important thing for most people is family and work, so it is a positive point for family businesses, as they unite work and family, along with their beliefs and values, that make them powerful. However, such feelings, as well as intimacy, can get in the way of authority, in addition to influencing family relationships, thus circumventing negative points (LANSBERG, GERSICK and HAMPTON, 2017).

The world is increasingly globalized, through the rapid development of science and technology, so companies need to keep up with these changes to remain in the competitive market based on the imposed challenges that require strategies to act differently (ORO AND LAVARDA, 2019). Therefore, the planning of the succession process is important for the continuity of the institution, inserted in technological advances, along with strategic managerial controls (ROTH, TISSOT AND GONÇALVES, 2017).

According to Bernhoft (2018), the successor's challenge will be how to deal with the balance between the legacy of the past, which must be preserved, and the generation of new skills for the company's future. In this way, the dynamic process that determines the evolution of the entities, linked to the management accounting practices they use, will be analyzed through the emphasis on the life cycle of these organizations (GREINER, 1998; LESTER et al., 2003).

Based on the studies of Miller and Friesen (1984), which analyzes the evolution of the entity, from birth to its decline, thus verifying how the evolution within this model intervenes in the use of management accounting artifacts. The present study aims to analyze the use of controllership artifacts under the aspects of the organizational life cycle in family businesses, observing the impact that succession causes in this process.

In this context, the following research problem arises: **Are family businesses in harmony with the use of controllership artifacts, according to the evolution of the life cycle recommended by Miller and Friesen (1984), linked to succession?** The objective is to identify the stage of the life cycle that the family businesses under study are in, confronting the use of controllership artifacts, as the evolution of organizations and succession increases.

This study is justified by the importance that family businesses have in the world in the generation of jobs and participation in the GDP. However, Hiebl (2012) points out that

few companies pass to the second generation and most do not survive the third generation. Succession is identified as a relevant moment in the life of the family business and implies changes in its management, due to the impact on activities, due to the change of command (ROTH, TISSOT AND GONÇALVES, 2017).

The research aims to assist in the continuity and growth of family businesses. Thus, it begins with this introduction, then there is the theoretical structuring of organizational life cycles and controllership artifacts. Afterwards, the methodological procedures used are demonstrated, then the results are shown and the conclusions of the study are closed.

THEORETICAL FOUNDATION

ORGANIZATIONAL LIFE CYCLE

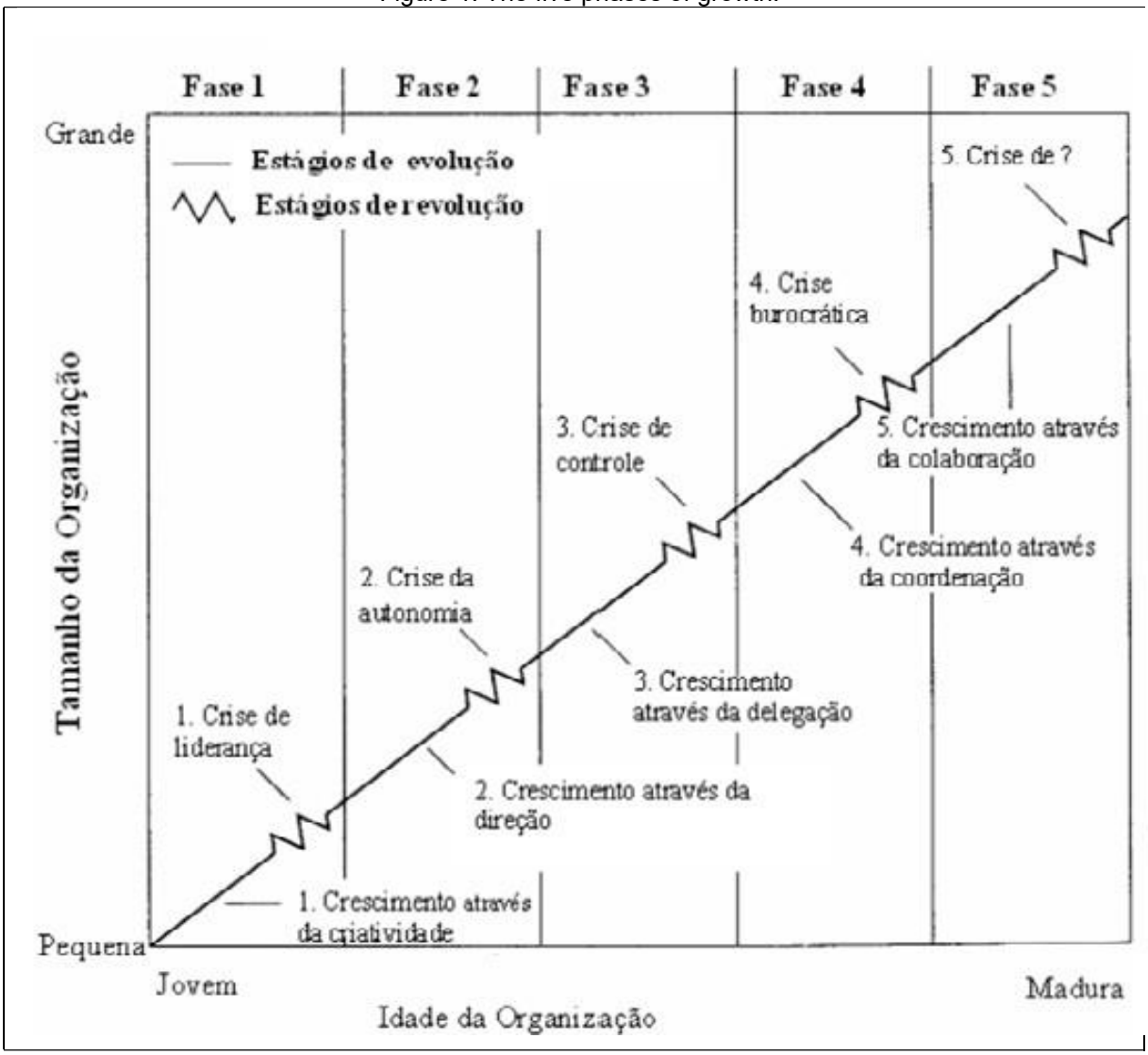
Life cycle studies began in the area of biophysiological sciences and, due to its scope, it has been applied in other areas, such as in the social sciences, in development and growth issues (QUINN; CAMERON, 1983; MILLER; FRIESEN, 1984; HANKS; CHANDLER, 1994). In the accounting area, the precursor of research on the life cycle was Chandler (1962), the same one who dealt with the changes in the structure of organizations and their similarity with the strategic variations of the business.

Greiner (1972, republished in 1998) was one of the first authors to develop an organizational life cycle model, through his own bases of experiences and observations, thus, he found that companies go through five phases, from creation to maturity. Greiner (1972) found that in the growth phase there are two cycles: revolution and evolution. These phases alternate with each other, so that the cycle of evolution is periods of stable growth, while in the cycle of revolution organizational conflicts occur.

According to Greiner (1972), this study helps managers to understand the organizational cycle of the company, since it provides the anticipation or prevention of the next crises, through the phases of development, which, influenced by the management model, it is possible to determine whether the next phase will be evolutionary or revolutionary. Also Greiner (1972), for the development of organizations it is necessary to take into account five elements: 1) age of the organization; 2) size of the organization; 3) stages of evolution; 4) stages of revolution; and 5) growth rate of the industry.

Greiner (1972) also differentiated five phases for evolution and revolution. The evolution phase is composed of the data: 1) creativity; 2) direction; 3) delegation; 4) coordination and 5) collaboration. The phase of revolution, on the other hand, is constituted by the elements: 1) leadership, 2) autonomy; 3) control; 4) bureaucracy and 5) psychological saturation. Figure 1 explains the five phases.

Figure 1: The five phases of growth.



Fonte: Greiner (1972).

Each phase is a cause-effect for the next phase. In other words, in Phase 2, the evolutionary element is direction and was demanded by the leadership crisis (Phase 1). In phase 3, the evolutionary element is the delegation and constituted of the process influenced by the crisis of autonomy (phase 2) and so on (GREINER, 1972).

After the work of Greiner (1972), several studies on the evolution of the operational cycle of organizations were raised, following the order, Quinn and Cameron (1983) carried out a comparative study of nine life cycle models and originated their own typology, called the summary life cycle model. The models studied highlight several factors that demonstrate the change in the characteristics of organizations over time, classifying them into different stages of development, as illustrated in Chart 1.

Table 1: Summary model by Quinn and Cameron (1983)

Estágio empreendedor	Estágio de coletividade	Estágio de formalização e controle	Estágio de formação de estrutura
• Organização de recursos • Muitas ideias • Atividades Empreendedoras • Pouco planejamento e coordenação • Formação de nicho • Importância de ser o primeiro a chegar ao mercado	• Comunicação e estruturas informais • Senso de coletividade • Muitas horas trabalhadas • Senso de missão • Inovação contínua • Alto comprometimento	• Formalização das regras • Estrutura estável • Foco na eficiência • Conservadorismo • Instituição de processos	• Elaboração da estrutura • Descentralização • Expansão do domínio • Adaptação • Renovação

Source: Adapted from Quinn and Cameron (1983, p. 34-40).

It is noted that the summary model does not have the phases of decline of organizations. Thus, Quinn and Cameron (1983), in a longitudinal study, deal with the relationship between the development of the organizational life cycle and operational effectiveness, because, according to the authors, external forces affect organizations all the time, leading them to internal adaptation to achieve goals.

In addition to the typologies already discussed, still in the 80s, Miller and Friesen (1983, 1984) presented a life cycle model that covers the decline phase of organizations. Through a longitudinal approach, the authors' goal was to form a theory that, when used, would identify differences in environmental and organizational characteristics at different stages of development.

Miller and Friesen (1983, 1984) carried out empirical tests with a longitudinal approach, thus identifying particularities of different organizations at different stages of life, at the same historical moment, such as strategy, structure, decision-making and environmental and organizational factors. Through the results, the authors defined five stages of development identified as: birth, growth, maturity, renewal and decline, as described in chart 2.

Chart 2: Miller and Friesen's Organizational Life Cycle Model (1984)

Stages of development	Structure	Strategies/decision-making
Birth: Company up to 10 years old. Young and small in relation to competitors. Organization characterized by a simple structure and centralized in the power and decision of the owners.	Informal structure. Simple administrative activities with few formal controls and use of archaic methods of information processing.	It seeks business viability. Proactivity in the development of products and services. It takes excessive risks. Decisions based on intuition, without detailed analysis and few opinions are taken into account in decision-making.
Growth: Medium-sized company that already has stability in the market and demonstrates business potential, in a more complex and competitive environment.	A more specialized and decentralized structure, as the owner's influence is reduced. Greater formalization in the collection and processing of information, for better monitoring and control.	Product line with more diversification and innovation. Constant growth and market expansion. More analytical and integrated decision-making, since more managers are involved in decisions, reducing the willingness to risk.
Maturity: Organizations Larger and older than in previous phases. They have a competitive advantage over competitors. Inclusion of political arrangements to conserve the stability of the environment.	Structure with greater professionalization, formalization and bureaucratization. Greater control of costs, use of budget and performance indicators.	Greater aversion to risk and innovation, more conservative, focus on cost control, and profit margins. The level of analysis is similar to that of the previous phase. However, there is greater emphasis on the analysis of alternatives for productivity and efficiency.
Renewal: Large companies, with a more complex, dynamic and hostile environment. It is concerned with establishing strategies to guide the future path of the organization.	Divisionalized structure, with greater operational autonomy by divisions. Sophisticated systems to monitor room performance. Greater processing of information, beyond that used in the previous phase.	Focus on innovation, diversification and expansion of products and markets, with a high willingness to risk. Decision-making in a reflective, analytical and participatory way, addressing the analysis of the environment in relation to opportunities and Threats.
Decline: Stagnation, without a defined strategy. Crisis management concentrates all the time, affecting the analysis of other relevant data. Hostile environment.	Size can be similar to maturity, yet simple and centered. Lack of formal controls and information processing mechanisms less sophisticated.	Decision-making with conservative characteristics, without the use of information and analysis of the environment, focus on the short term. Lack of strategic planning.

Source: Adapted from Miller and Friesen (1983; 1984).

In the model structured by Miller and Friesen (1983; 1984) it is possible to verify that in each phase of the life cycle of organizations there are several characteristics. Thus, there is no single and determining sequence and the cycle time of organizations in each phase is not the same. However, for Miller (1987, p. 698), for each stage of an organization's life cycle there is an element that exerts a preponderant influence.

Several other life cycle patterns were created over time, but the organizational life cycle model of Miller and Friesen (1984) was elaborated from a longitudinal study in 36 companies with at least 20 years in the market and the basis of the study was through historical reports taken from books, annual reports and journal articles, as well as the

information analyzed in the questionnaire responses sent to senior executives of corporations, both current and former. Of the 36 companies evaluated, it was possible to identify 161 phases of the life cycle, 12 of which were periods of birth, 61 of growth, 45 of maturity, 27 of rebirth and 16 of decline. Due to these analyses and the fact that the two companies considered in this study also have more than 20 years in the market, this research was elaborated by a particular model, that of Miller and Friesen (1984).

Still on the life cycle, it is relevant to analyze the correlated studies carried out, which are linked to numerous factors that help the correct decision-making and longevity of organizations. Reis et. al. (2018), analyzed the elements that help maintain the longevity of companies, through a questionnaire sent to partners and owners of establishments located in the Northern Mesoregion of Minas Gerais. This research sought to analyze the importance of the management tool to diagnose the stages of the entrepreneurial process and to promote the longevity of organizations, based on the life cycle model proposed by Bygrave (2010).

Among the relevant researches, the study by Garcia; Junior and Lucena (2020), which aimed to present the trajectory of the Kodak company, in the light of the Life Cycle Theory, seeking to relate the business characteristics arising from the changes that have occurred over time with each of the stages of the life cycle of an organization, addressed in the model created by Miller and Friesen (1983; 1984).

Another related study, as a planning and control instrument, Hillen and Lavarda (2019), carried out a case study in a family business, located in the State of Paraná, which operates in the supermarket retail segment. In this research, it was analyzed how the need for budget is idealized, which is also an artifact of management accounting, connected to the relevance of succession as part of the life cycle in family businesses and the interconnection with the *management control system* (MCS).

In this sense, it is verified that Management Accounting is the branch of Accounting that deals with the information needs of managers, as well as all internal users of organizations (NECYK; FREZATTI, 2010). Therefore, the artifacts of Management Accounting are important for the improvement of the decision-making process of institutions.

ARTIFACTS OF THE CONTROLLERSHIP

Controllership is known as a basic tool for the effectiveness of business management and aims to contribute to the continuity of the company, generation of resources, employment and income (SALUSTIANO; ARAÚJO; JABUR; & PIRES, 2024). Frezatti,

(2005) reports that controllership artifacts are structures, models and systems implemented that help in the control and development of companies.

In a study by Soutes and Guerreiro (2007), it was concluded that 57% of larger companies resort to accounting artifacts, such as ABC Costing, kaizen, strategic planning, activity-based management (ABM), EVA (Economic Value Added), simulation, Balanced Scorecard.

It is important for companies to use the methods and tools that help in the decision process, through Controllership it is possible to create this scenario to meet the needs and objectives of companies, as cited by the authors Bauren, Scroeder and Stédile (2010). Mosimann and Fisch (1999, p. 89) state that:

> [...] The Comptroller's Office must strive to ensure the fulfillment of the mission and the continuity of the organization. Its fundamental role in this regard is to coordinate efforts to achieve a synergistic global result, that is, greater than the sum of the results of each area.

Controllership can be observed from the perspective of an administrative body, as dissemination of knowledge, modeling and implementation of information systems, with mission, functions and principles engaged in the company's management model, Almeida et. al (2001). Analyzing from the perspective of the area of human knowledge through the principles, concepts and methods defined by other theories have the responsibility of establishing the conceptual basis.

Almeida et. al (2001) and Garcia (2003) understand that controllership is supported by the theory of accounting, theoretical bases necessary to model, build management systems and methods meeting the decision-making needs of managers, establishing through the disciplines the conceptual basis for acting in the processes and applications of management in organizations.

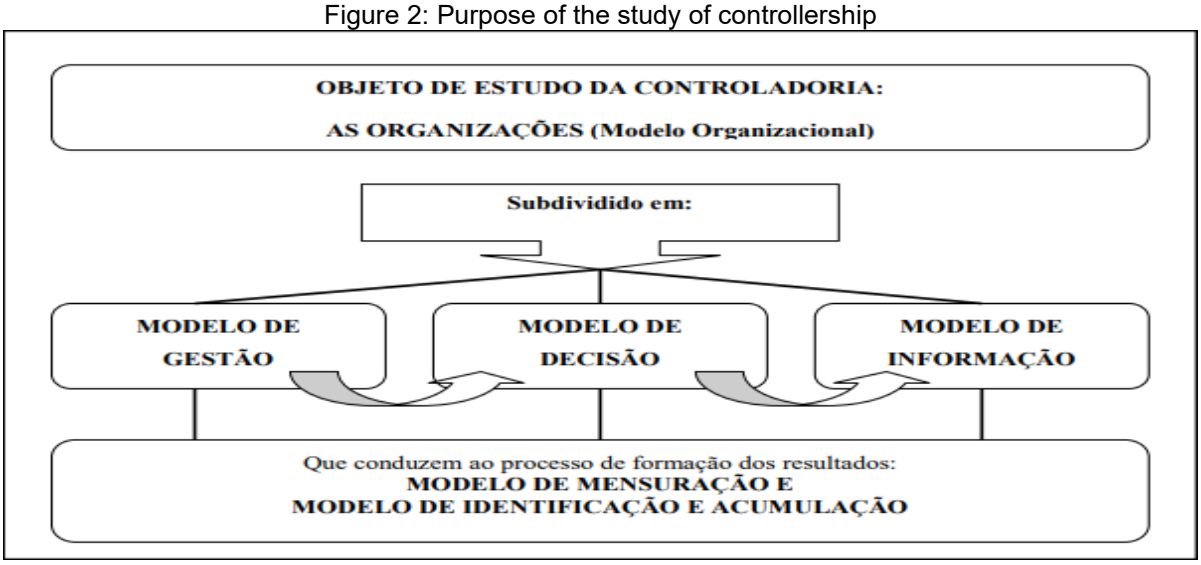
On the one hand, Mosimann and Fisch (1999) interpret controllership as an economic management that aims to guide and direct organizations through principles, methods, originating from Economics, Administration, Psychology, Statistics and Accounting itself. On the other hand, Peters (2004) understands that controllership is introduced as modern models in organizations. Borinelli (2006), on the other hand, explains controllership as a control of business management processes constituted by economic, operational, financial and patrimonial theories.

Vatter (1950) understands that the controller is extremely fundamental to contribute to the processes of the Controllership. For Regel (2003), controllership must be accessible to external and internal users. The objects of study of the Controllership have the scope,

formation of results, measurement, communication, identification, decisions to economic factors, planning, controls and management processes, (FERNANDES, 2000).

From Figure 2, it is possible to verify the objects of study of controllership presented in the model proposed by (BORINELLI, 2006).

Figure 2: Purpose of the study of controllership



Fonte: Adapted from Borinelli (2006).

The management process is related to operational, economic, financial and asset management. In the decision and information model, the need for information for decision making is evidenced, as mentioned by Borinelli (2006). For Ansoff (1984), the strategy management process has the function of Controllership, necessary to support and direct these processes so that companies can survive and remain profitable.

In the line of strategic management, the studies carried out by Longo and Sakata (2018) can be considered, which analyzed the Total Cost of Ownership (TCO), especially for the management of investments in Information Technology (IT). The indicators were collected in medium and large organizations, which increasingly understand the benefits associated with the use and investment in technology, which induces a drop in costs, making IT more accessible and available.

In the study by Nascimento et al. (2016), the objective was to demonstrate the formal structure and instruments that are used by controllership in family businesses that seek to implement good corporate governance practices. It is a descriptive research, with a quantitative approach, and the data were collected through a questionnaire sent to the controller or the person responsible for the controllership department of the companies indicated by the IBGC, located in the State of São Paulo. The results show that the family culture can interfere in the management process of family businesses, and the

controllership department is an internal mechanism that has elements that can contribute positively to the implementation of better governance practices, because in addition to interacting with governance agents, its mission is common to the basic principles of corporate governance.

Another related study, presented by Leite, Reif and Lavarda (2018), with the objective of analyzing the functions of controllership in a large civil construction organization. The research was carried out through a semi-structured interview with the person in charge of this department, which resulted in the identification of several aspects related to the controllership department and the controller's profile. It was possible to verify that controllership, in addition to control, has its area focused on results, therefore, it is important to participate in the operational and administrative process, knowing the operational flows, monitoring changes in the environment that may interfere with the competitiveness and mission of organizations.

As already commented in this research, the constant technological changes and the various external and internal factors have made the business environment even more complex. Thus, for Leite, Reif and Lavarda (2018), controllership is increasingly comprehensive, as it establishes a differentiated function, with the objective of effective managerial control, which assumes the role of the main support of the management process in organizations and in assisting in decision-making.

METHODOLOGY

In this section, the methodological processes adopted to carry out applied research are addressed. According to Marconi and Lakatos (2007, p. 39), "method is the way of proceeding along a path", that is, the scientific method is an ordered set of procedures for obtaining knowledge on a given subject.

Regarding the research design, it is a multiple case study, since it has been used for its comprehensive research strategy, in order to explore real-life situations, as well as to explain the causal variables of a given event in complex situations (PRODANOV AND FREITAS, 2013). Another relevant fact, Martins (2008) illustrates that the case study allows the researcher to "dive" into the social reality of the object of study, thus helping to emphasize the objective of the study.

As for the objective of the research, it is classified as descriptive, according to Gil (2002, p.42), these studies study the characteristics of a population, analyzing the relationships between the variables. The collected data are analyzed through the samples,

without manipulation, presenting conclusions about these phenomena (CERVO; BERVIAN, 2002).

The approach to the research problem is classified as qualitative, because, from the point of view of Richardson (1999), this type of approach is not based on statistical data for the analysis of the data collected. Therefore, the data collected cannot be translated into numbers (SILVA; MENEZES, 2001).

Data collection was carried out in August 2020, through a questionnaire sent by email to the person responsible for the controllership of the companies under study, with multiple-choice and descriptive questions about the organizational process, controllership artifacts and management processes, which was based on the Borinelli (2006) questionnaire. Taking into account that, "what we tried to do was to categorize the data collected in order to transform them into information that would allow us to find answers to the questions asked". (BORINELLI, 2006, p. 227.).

The companies under study were chosen for their accessibility, availability of information, structure and size. In order that, (YIN, 2015) the use of multiple cases allows for greater learning from the observed phenomena. The questionnaire was applied in two family businesses in the State of Santa Catarina, one in the food industry, located in the municipality of São Lourenço do Oeste - SC and the other in the trade activity - Supermarkets, located in Chapecó - SC, both operating in the market for more than 30 years.

PRESENTATION AND ANALYSIS OF DATA

The questionnaire was applied to two medium-sized companies, with annual revenues of no more than 360 million. The organizations preferred not to be identified, so for the purposes of this study they were named as company A and company B. Both operate in the food industry, company A operates in the supermarket industry and B in the food industry. In company A, the questionnaire was answered by the controllership manager and in company B, by the HR Manager and a Controllership Specialist who works in the costs and budgets department. In company A, in order to be successful in the answers, it was necessary to contact the controllership manager by telephone, who requested permission from the board to answer the questionnaire, while in company B, it was necessary to have the first contact with HR, responsible for the contact between the professional and the applied research. The profile of the respondents is presented, as shown in Chart 3.

Chart 3: Respondent profile

Respondent profile	Company A	B Corp	B Corp
Gender	Female	Male	Male
Age	45 years	33 years old	30 years
Position	Controllership Manager	Controller	HR Manager
Length of experience in the company	20 years and 2 months	3 years	5 years
Length of service in the current position	10 years	10 months	3 years
Education	Bachelor's Degree in Accounting Sciences and Post-Graduation in Business Management, Controllership and Costs	Degree in Accounting Sciences and specialization in Accounting and Financial Management.	Bachelor's Degree in Business Administration and Graduate Studies -Degree in Labor Calculations

Source: Survey data (2020).

It is identified in chart 3 that both in companies A and B, those responsible for the controllership area and in the case of company B, also the HR manager are qualified for the position, as well as have been in the organizations for some time, especially in company A, which demonstrates the importance of these sectors in the view of the directors, demonstrating, as well as being indispensable to the proper development of the company.

In Table 4, it is possible to analyze the characteristics of the companies under study. Through the identification of the organizations in the sample, it is possible to verify the permanence in the market in large steps, which corroborates Pestana, Gomes and Lopes (2020) that family businesses with traces of stability and growth expectations are essential for the development of the economy.

Table 4: Identification of the company

Company identification	Company A	B Corp
Company Branch	Supermarkets	Food Industry
Legal format of the company	S.A. Privately Held	S.A Capital Closed
Total Employees	580	626
Administrative Employees	40	42
Employees Operational Sector	500	434
Date Foundation	1953	01/09/1988
It operates in other countries	No	Uruguay, Paraguay, Argentina, South Africa, Portugal, Bolivia, Colombia, Panama and Suriname
Acquires products from other countries (imports), which:	Italy, Spain, Argentina, Portugal and others	Italy - Equipment Only
Revenue 2019	Midsize	Midsize

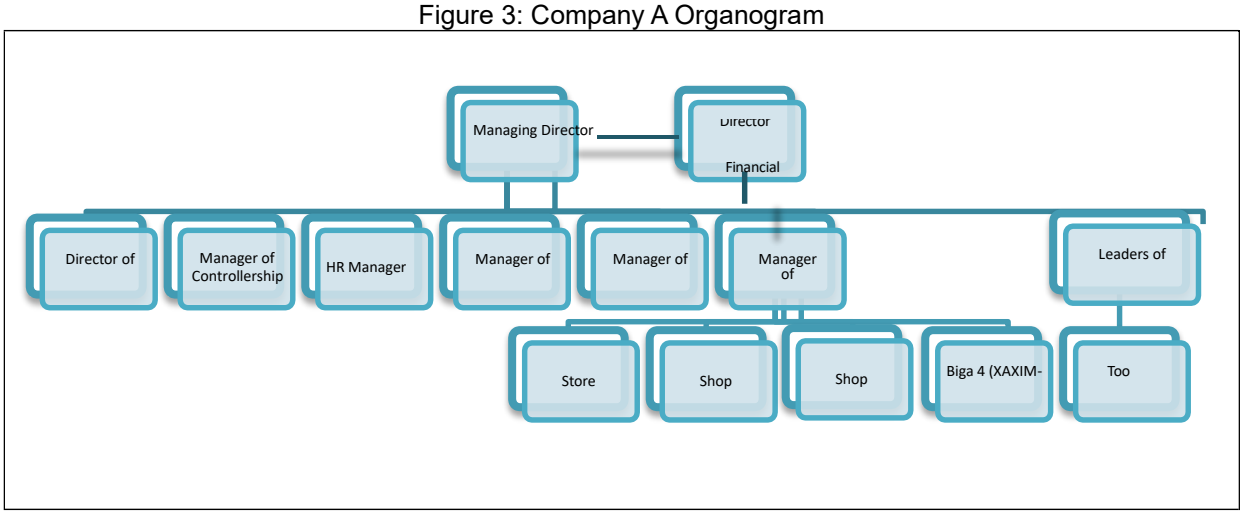
Source: Survey data (2020).

In addition to the fact that the companies are framed in food, even as resale and the other as a manufacturer, both have similar characteristics in the company's identity, such as legal format, number of employees and size. Company A has been active in the market for more than six decades and company B half of that period.

It is also verified that company B exports to other countries, with the objective of leveraging the goals, and only imports the machinery from Italy, a country that is recognized worldwide for the quality of the product industrialized in that company. Company A, on the other hand, does not export, as it is not compatible with the branch of activity – supermarkets, however, it imports in order to maintain the demand for products supplied to customers and also the best price/benefit.

The organizational chart represents the structure of the organization. According to Daychouw (2007), organizational charts demonstrate how the company is organized according to the organs or sectors, hierarchy and communication relations between them. In Figures 3 and 4, sequentially, the structure of the companies analyzed is presented, as detailed by the respondents.

Figure 3: Company A Organogram



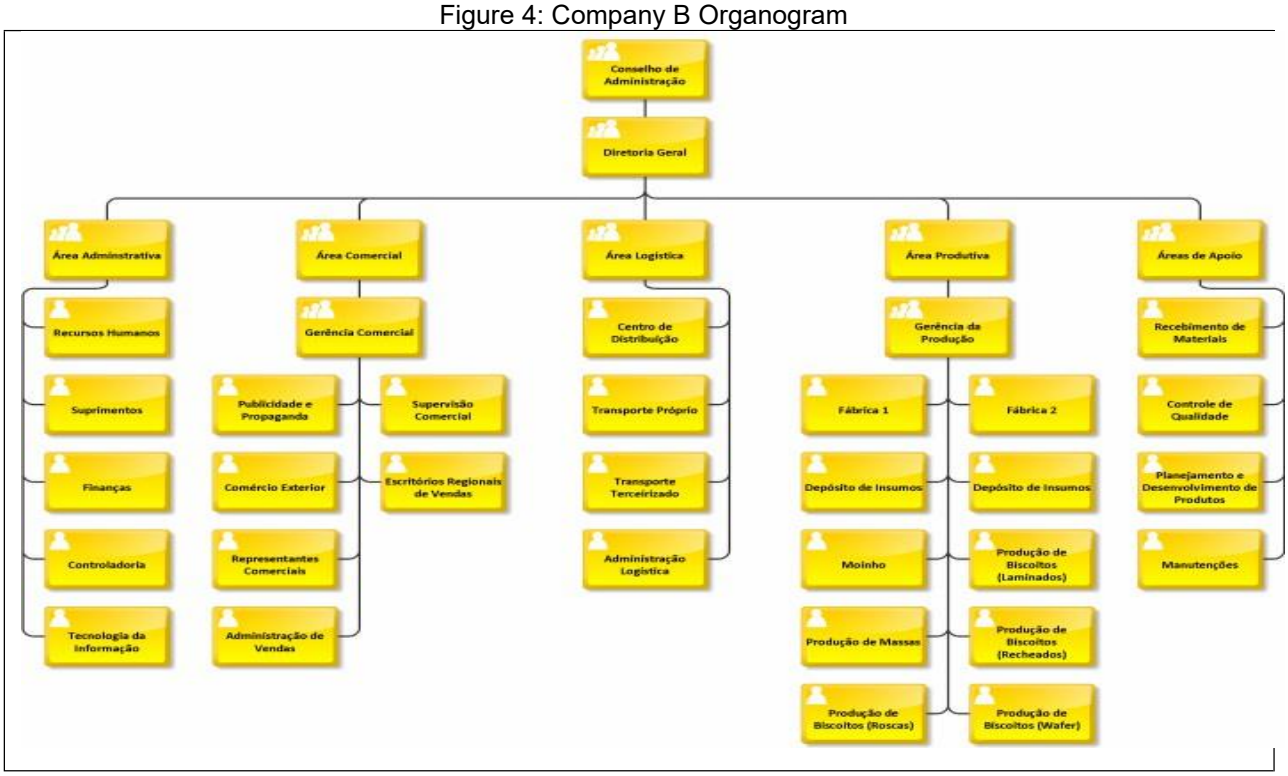
Source: Survey Data (2020).

Based on the organizational chart, company A is composed of the general and financial director, followed by the director of operations, controllership, HR, Purchasing and Operation manager, and, with the exception of the position of general and financial director, occupied by successors, the other management positions are occupied by professionals. Following the flow, it is verified that in each supermarket, so far 4, headquarters and two branches located in Chapecó-SC and a branch in Xaxim-SC, there is a manager in each store. Soon after, in the structure, the department leaders and other employees.

According to the interviewee of company A, succession is a subject addressed in the management of the company, and to take over the organization, the heirs need to be prepared, through knowledge in the field, to present characteristics of leadership and entrepreneurship, only then can they take over the company as successor, because the participation of the directors is active within the organization, both in the monitoring and control of the company, as well as in decision-making. Company A is now in the 3rd generation occupied by the founder's grandchildren. The management is professional, the successors occupy deliberative positions, and the positions of General and Financial Director are held by family members.

Through the structures described by the researched organizations, it was possible to verify that both companies A and B have their functions and frameworks defined according to their field of activity. Both operate in the food segment and are considered family businesses. Below is the organizational chart of company B:

Figure 4: Company B Organogram



Source: made available by the company (2020).

In company B, the organizational chart is more complex, depending on the activity. The board of directors and the general board are occupied by successors, the other positions are occupied by professionals. The structure is distributed by areas, such as the administrative area, composed of HR, supplies, finance, controllership and information technology, while the commercial area consists of the commercial manager, accompanied by advertising and advertising, foreign trade, commercial representatives, sales administration, commercial supervision and regional sales offices. There is also the logistics area, consisting of the distribution center, own transportation, outsourced transportation, and logistics management.

The production area is composed of the production management, which manages the two factories, factory 1 produces dough and doughnut biscuits, while factory 2 produces laminated, filled and wafer biscuits. Then the support area, formed by the receipt of materials, quality control, product planning and development and maintenance.

In company B, the interviewees also perceive that succession is a subject discussed, however, regarding the characteristics of the managers and successors and the criteria for choosing the successor, they preferred not to comment. Company B is in the second generation, management at the board and board of directors level is carried out by the children, who are the founder's successors.

As for the management process, companies have integrated systems in relation to managerial, operational, fiscal and accounting control, which facilitates the capture of

information and processes that take place within companies. For Oliveira et al. (2002), the Controllership is an organizational unit capable of elaborating, structuring and implementing the integrated system of the entities.

Therefore, Chart 5 presents the answers of the companies regarding the management process, according to the questionnaire applied.

Table 5: Management Process

Questions	Company A	B Corp
Accounting?	External	Internal
Are the systems used integrated?	Yes	Yes
Methods adopted for the company's strategic management?	In addition to following trends in the areas, we participate in several support groups in the segment, we also have advice for various areas and legal advice.	NDA.
Reports most used in information management and decision-making?	For each area, different information is used, such as sales targets, losses, customer analysis, offers, financial	Management reports; Analysis, financial statements; Business analytics.
Is the analysis monthly, biweekly? How does the discussion of the information take place...	There are weekly and monthly analyses. It occurs through meetings with managers from each department analyzing the data.	Monthly Analysis (Management Meeting/Results); Biweekly analyses (Commercial meetings/Monitoring); Weekly analysis (Commercial x production meetings); Punctual analyses (Miscellaneous).
What are the main indicators used in the day-to-day management?	Sales, mark-up, losses, expenses	NDA
Does the company have elaborate/structured strategic planning?	We are in the implementation phase	NDA.
Which unit exercises strategic planning?		
Do these strategic objectives have indicators and are they monitored?		
Is strategic planning evaluated and considered by successors?		
Is there a target established for the indicator of strategic objectives?		
When goals are not achieved, what are the actions taken?		
How often is strategic planning reviewed?		
How often is strategic planning reviewed?		

Source: Survey data (2020).

It is verified that the methods adopted as strategic of company A are recognized as a basis of support for the growth and development of the company, as well as the prevention against some risks, since they have legal advice.

The reports used by the companies under study for decision making are targeted. In organization B, information from the departments is used individually, in order to analyze by departmentalization and individual decision-making in each department. In the case of company A, the reports are unified by looking at the company as a whole and its results together with all departments. The analysis of these results is done according to the objective of each area, the management analyzes the results monthly, during the month meetings are held with the commercial department in order to outline the goals and objectives for sales.

It is possible to verify that the Controllership is recognized as an important department within these organizations. Regarding the management information and the structure of the Controllership, the information acquired with the questionnaires is shown in Chart 6.

Table 6: Structure of the controllership

Questions	Company A	B Corp
Does the company have a formal controllership structure, such as a specific sector in the company or does it act as support through other sectors?	It has a sector	It has a formal structure.
Which sector or board is it linked to?		Board of directors
Does the company have a professional in the Controllership?	Controller	The company has an external consultant who responds as a manager of the sector. In the company, the sector is divided into the accounting area, the tax area and the managerial area, costs and budgets.
What is the main objective of the Controllership in your organization?	Analyze, validate the indicators and seek strategies to improve them	Its purpose is to provide adequate information to the decision-making process, certifying, validating and guaranteeing it; Creation, maintenance and verification of the correct follow-up of the procedures adopted/executed by the various sectors of the company;
Does it have a defined mission?	Yes	NDA
Are the procedures adopted in the Comptroller's Office standardized? How was this standardization done, based on which methods, models or system?	The procedures are mixed, but suitable for our business	Yes, they are standardized. They follow good controllership practices and are constantly evolving.
In his perception of the activities/functions performed by the Comptroller's Office:	Corporate/Financial/Tax/Cost Accounting. Protection of the company's Assets. Support to financial decisions. Management Accounting. Service to internal and external users. Planning and Control	Corporate/Financial/Tax/Cost Accounting. Protection of the company's Assets. Support to financial decisions. Management Accounting. Service to internal and external users. Planning and Control

Source: Survey data (2020).

It is identified that company A has its own Controllership where the Controller is responsible, who was selected for the interview and reported that "the *main objective of the controllership is to analyze, validate the indicators and seek strategies to improve them*".

In company B, the Controllership is made up of a team divided into sectors: accounting, tax, managerial, costs and budgets, there is also an external advisor responsible for guiding these departments. The interviewee mentioned that "*The objective is to provide adequate information to the decision process, certifying, validating and guaranteeing it; Creation, maintenance and verification of the correct follow-up of the procedures adopted/executed by the various sectors of the company".*

In company A, controllership is adequate according to the needs of the company and its business. In company B, controllership follows the standards of good practices. Therefore, both companies have in common the same perception of the functions assigned to the Controllership. Thus, chart 7 shows the responses of the companies regarding the information on the controllership artifacts and the management control processes.

Table 7: Controllership artifacts

Questions	Company A	B Corp
Methods, criteria and costing systems	Average cost	Costing system: absorption; Inventory control: average cost
Measurement and evaluation methods, and performance measures		NDA.
Philosophies and management models		Monthly projected budget; Budgeted x actual monitoring.
What are the managerial controls used by the company?	We use departmentalized indicators, as if it were several companies within a single one.	Budgeted x actual monitoring (Revenues, expenses, fixed and variable costs, production and sales planning).
How are these management controls analyzed? (Monthly, quarterly?)	Monthly	Monthly, quarterly and punctual analyses.
Do managers use information from controllership to develop the organization's strategies?	Yes	Yes, the information is widely used by managers.
What type of information or indicators are most used?	Growth and EBITDA	Monthly follow-ups (budgeted x actual); Spot (specific) analyses
This information is generated automatically, or manipulation is necessary to meet the expectations of managers.	They are generated automatically, but the compilation of this data is interventional, that is, it is done by a professional	The vast majority of data is extracted in the system, but it is necessary to tabulate the data to generate synthesized/specific information.
How do you realize the importance of information in the management of the company.	Without this information, I believe that it is not possible to have efficient and safe management.	They are essential. Without information, the decision-making process becomes subjective (flawed).

Source: Survey data (2020).

In the analysis of controllership artifacts, company A presents inventory and cost control, through the average cost. The measurement and evaluation methods, as well as performance measures, are carried out by the method of pricing, cash flow and balance sheet. Management controls are carried out monthly, by indicators separated by department, that is, the analysis of the departments is done individually. On the other hand, the costing methods and criteria require from company B, due to its activity, a more detailed cost control with several criteria, so the company adopted the absorption costing system and the average cost for its manufactured products.

According to Brewer (2008, p. 36), controllership is based on four pillars, which are: leadership, strategic management, operational alignment, continuous improvement and learning; and, "ultimately, the responsibility of controllers is to generate value for shareholders." Chart 8 shows the answers of the companies regarding the role of controllership, (1 being for little important, or indifferent and 5 for very important, very useful).

Table 8: Role of the controllership

Company A	B Corp
(5) In the process of preparing the organization's Strategic Planning; (5) In the process of controlling the organization's Strategic Planning; (5) In the process of preparing the organization's Tactical Planning; (5) In the process of controlling the organization's Tactical Planning; (5) In the Performance Evaluation process, of the organization as a whole, as well as of each of the areas of the organization; (3) In the process of defining the sale price; (4) In the process of preparing the organization's Tax Planning. (5) In the decision-making process by managers.	(5) In the process of preparing the organization's Strategic Planning; (5) In the process of controlling the organization's Strategic Planning; (5) In the process of preparing the organization's Tactical Planning; (5) In the process of controlling the organization's Tactical Planning; (5) In the Performance Evaluation process, of the organization as a whole, as well as of each of the areas of the organization; (5) In the process of defining the sales price; (5) In the process of preparing the organization's Tax Planning. (5) In the decision-making process by managers.

Source: Survey data (2020).

The role of Controllership is cited as very important in all processes of managerial, strategic, commercial, and tax planning controls Only the process of preparing the Tax Planning was evaluated, by company A, with a score of 4, being considered important, while in the process of defining the sale price in the view of the controller, it was evaluated as 3 (reasonable).

The management controls adopted by the companies interviewed here are analyzed in different ways, although they are similar, the first analyzes the company as its individualized departments, while the second controls the company in general and with a

focus on projected x realized budgets, both work with standardized systems capable of generating information for automatic management reports, however, they make use of the interference of professionals in the Controllership area to adapt the data generated in order to provide managers with synthesized and specific information, this also proves the understanding and importance that both companies demonstrate for the Controllership and its entire management process.

Roehl-Anderson and Bragg (1996) understand that the Controllership leads the directors and managers to manage the companies, planning the strategies and directions, through the consistent information of the Controllership, so that they are productive. Organizations have accounting integrated with management systems, which facilitates the capture of information and processes that take place within companies.

FINAL CONSIDERATIONS

The research aims to identify the stage of the life cycle that the family businesses under study are in, confronting the use of controllership artifacts, as the evolution of organizations is also linked to successions. The questionnaire was directed to professionals in the controllership department, both with academic training in Accounting Sciences and specialization in the area they currently work. Common characteristics were identified among the companies in the management processes, management controls and direction to successors, both family businesses and structured with individualized departments.

The companies analyzed use integrated systems capable of generating customized reports that are appropriate to the company's reality, as well as used for management controls. They have monitoring of management processes and controls, through meetings to discuss and analyze improvements, results and specific issues.

Company A emphasized the use of some indicators and the implementation process of the elaborated/structured strategic planning project, while company B keeps this data and information confidential, not exposing the use of indicators and strategic planning within the management process.

It is understood that the family businesses analyzed have a structured controllership department, although they act in different ways and with specific objectives within the reality and market of each organization, both benefit from Controllership as a basis for decision-making for their managers and have the perception that the functions of controllership are linked to accounting in general, to managerial and commercial processes and controls, serving both its internal and external users, that is, it is perceived that the Controllership is totally directed and in constant evolution and harmony for the growth and development of

companies, strengthening the life cycle and boosting succession, considering that managers evaluate and make their decisions through the detailed information of the Controllership.

Controllership artifacts are part of the reality of the companies under study, although they have explained little about the use of these artifacts and maintained some restrictions on their use. It is possible to conclude that the use of these instruments is daily in companies, such as inventory control and costing methods, which in the case of company B, due to its industrial activity, has a costing system by absorption and makes its inventory control by average cost.

The interviewees expose their point of view regarding the importance of Controllership in the management of the company, "*Without this information, I think it is not possible to have an efficient and safe management",* quotes the Controller of company A*, and "It is essential. Without information, the decision process becomes subjective (flawed),* mentions the Controllership specialist of company B "and they also conclude by evaluating as very important the role of controllership in the control processes, elaboration of strategic and tactical planning, performance evaluation, emphasizing as an important tool for decision making, that is, there is a very clear vision of these professionals in relation to controllership artifacts as essential for the growth of companies.

It is concluded that both companies A and B are in the maturity phase, with regard to the stage of the life cycle, based on the model of Miller and Friesen (1984). They are medium-sized organizations with several years in the market, they have gone through the birth and growth phases, as well as having a competitive advantage over competitors. Decision-making with an analytical and integrated bias, since more managers are involved in decisions, reducing the willingness to take risks. Greater aversion to risk and innovation, more conservative, focus on cost control, and profit margins.

The study delimits the fact that the interviewed companies have not implemented strategic planning in the management process, however, company B is in the process of implementation, which shows that this process was pointed out as an important tool to assist in decision making. For future research, it is suggested to extend the sample size of family businesses, as well as the sectors of activity.

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ETHNIC AND CULTURAL DIVERSITY IN A VOCATIONAL EDUCATIONAL INSTITUTION

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ABSTRACT

Current Brazilian Education needs transformations in the search for improvements, as it suffers from the lack of investments and the lack of preparation of professionals to mediate fundamental knowledge for the development of a fair, inclusive, collaborative and transformative society. With the development of the educational team, especially in the continuous training of educators, such needs will become a reality, as long as School Management is democratic, facilitating and encouraging, implementing the theme of ethnic and cultural diversity. The main objective of this study was to analyze how the theme of ethnic and cultural diversity has been implemented in a professional education institution in the interior of the state of São Paulo, and as specific objectives, to describe the importance of the theme of ethnic and cultural diversity in the school environment, including the methodological teaching proposals for the fulfillment of Law 11.645/08 and to investigate how the actions pertinent to the ethnic and cultural diversity. Methodologically, this work is qualitative of the Case Study type. For data collection, interviews were conducted with managers and teachers, making a total of 18 research subjects. The interviews provided us with enough materials to realize the importance and need to work on this theme in schools, with all education professionals, so that they feel safe and able to approach the theme with tranquility, lightness and enough knowledge to demystify taboos and prejudices that permeate our society, generators of suffering and violence. Because we believe that education is capable of transforming suffering into conflict resolution, even suffering rooted for centuries, bringing peace, unity and justice with respect and enriching exchanges, especially from a people as miscegenated and culturally rich as Brazilians.

Keywords: Multiculturalism. Vocational Education. Law 11.645/08. Continuing Education.

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INTRODUCTION

Currently, about eight billion people make up the human species, and, except for monozygotic twins, each individual has unique characteristics, including biochemical and digital identity, with no racial hierarchy in the variations (Azevêdo, 1987). Azevêdo reports that, in the eighteenth century, Linnaeus classified man into four races, but today, through genetics, it is known that it is impossible to biologically delimit races due to the continuity of variations.

Diversity, defined by Houaiss (2004), characterizes everything that is varied. Freire (2001) divides the differences between intercultural and ideological, linked to power and resistance, stating that a loving education transforms the world. Anca and Aragón (2018) describe diversity in demographic, experiential and cognitive. According to Sacristan (2002), diversity, as normal as life, requires coexistence and acceptance. Ferreira (2020) emphasizes the importance of considering ethnic-racial needs from childhood.

The Universal Declaration of Human Rights (UN, 1948) and the Brazilian Constitution of 1988 guarantee human rights and respect for diversity, but, in practice, inequality is still a major problem in Brazil.

RACE AND ETHNICITY

According to Giddens and Sutton (2017), race refers to biological characteristics, but the modern concept of race, which began in the sixteenth century, has always been linked to classifications. Azevedo (1987) reports racial discrimination since 2000 B.C., which has been intensified by science and philosophy. Racial tests and craniometry dehumanized black people, associating physical traits with subservience (Pinheiro, 2023). Almeida (2019) concludes that race operates biologically and culturally, but racial identification in Brazil is complex due to the ideal of whitening (Munanga, 2004).

Ethnicity is a sociological concept that designates groups with a similar culture. Giddens and Sutton (2017) explain that members of ethnic groups share a common cultural identity. Before the arrival of Europeans, there was a great indigenous diversity in Brazil, disregarded by the colonizers (Urquiza, 2016). Anthropology criticizes the hierarchization of cultures, as they all have their unique values.

RACISM

Racial discrimination is a systematic, power-based practice that has persisted for millennia (Almeida, 2019; Azevêdo, 1987). During European modernity, the belief in racial superiority was used to justify institutional racism, such as apartheid in Africa. Silva (2021)

comments that, even after slavery, black people continued to suffer from racism and lack of access to rights. Sodré (2023) defines modern racism as the result of deep emotional reactions, while Volp (2022) highlights the inequality suffered by black men.

Racism is systematic, affecting racialized groups in various spheres. Discrimination occurs directly or indirectly, creating social stratification (Almeida, 2019). Colorism highlights the additional prejudice against darker-skinned black people (Devulsky, 2021). Ferreira (2015) defends critical racial literacy as an essential practice for social justice, and Santos (2015) addresses the suffering of blacks due to the lack of access and the desire for whitening.

Black women face invisibility and stereotypes, often limiting themselves to underemployment. Its historical representation reinforces the myth of the black mother, exploited to meet the needs of whites (Azevedo, Silva, Conceição, 2019).

CULTURAL DIVERSITY

Respect for cultural diversity is guaranteed by the Brazilian Constitution (Brasil, 2016), and is essential for the identity of society. Brazil has a large indigenous population, whose cultural knowledge is transmitted orally (Paiva, 2016). The search for indigenous and Afro-Brazilian identity is an ongoing process (Krenak, 2015), and ethnic-racial diversity must be considered in public and private administration to promote social responsibility (Silva, 2019).

MULTICULTURALISM

Multiculturalism emerged in France in the 1960s, as a public policy in Brazil in 1996, focusing on the racial issue (Frederico, 2016). Weissmann (2018) describes multiculturalism as the contact between different cultures without mixing them, while McLaren (1997) relates multiculturalism to oppression and social injustices, especially racial ones.

DIVERSITY IN EDUCATION

The 1988 Constitution establishes education as a right for all, promoting respect for cultural diversity. The BNCC includes diversity as an essential competence (Brasil, 1996), encouraging a historical and cultural understanding for an inclusive educational process. UNESCO (2022) reinforces the importance of diversity to shape the future, proposing pedagogies based on cooperation and solidarity. However, education in Brazil has historically reinforced racism, with the support of academic institutions (Almeida, 2019).

Diversity management is a technique that aims at an inclusive environment, promoting the development of everyone's potential. These studies highlight the importance of inclusion to combat discrimination and promote respect for ethnic and cultural diversity in Brazil.

METHOD

Methodologically, this work is qualitative of the Case Study type, and according to this method, it must develop naturally and be rich in descriptive data, having an open and flexible plan focusing on reality in a complex and contextualized way. Ludke and André (1986)

Data collection was carried out through interviews with the perception of the respondents, the two programs in a professional institution in the interior of the state of São Paulo. This institution has two programs that probably dialogue with issues involving non-violence in the school environment and outside it, respect for ethnic and cultural diversity, among other themes. They are: 'Culture of Peace Program' and 'Diversity and Inclusion Program'.

Semi-structured interviews were conducted with 07 managers, and 11 professors, totaling 18 subjects, mostly postgraduates and from the same educational institution. These instruments aimed to understand how ethnic and cultural diversity are planned and developed in the institution, already mentioned, reaching compliance with law 11.645/08.

SAMPLE CHARACTERISTICS

The participants of the interviews were chosen in a diversified way in order to aggregate information both from professionals with more time in the job and other colleagues who had recently joined the institution. They are all aged between 28 and 56 years old, most with an undergraduate degree and only one does not have a specialization, and one does not have a degree. Most specializations are in the area of expertise. Both in management and teaching, the majority is composed of women, totaling 14 females, 2 males and 2 non-binary transgender people. Regarding race, 4 participants are black, 13 participants are white and no participant is indigenous.

Tables 1 and 2 below show the information of the interviewees.

Table 1 – Characteristics of the sample - Managers

IDENTIFICAÇÃO	GÊNERO	IDADE	FORMAÇÃO	RAÇA	TEMPO DE INSTUIÇÃO	TEMPO NA FUNÇÃO
Gestor A	Feminino	34 anos	Graduação em Pedagogia e Letras; Mestre em Educação Especial; Pós-graduada em Educação Profissional; Especialização em Linguística e Gestão Escolar.	Branca	13 anos e 9 meses	Atuou 12 anos e 6 meses como docente e está como gestor há 1 ano e 4 meses.
Gestor B	Feminino	47 anos	Biblioteconomia; Pós-graduação em educação.	Negra	12 anos	12 anos.
Gestor C	Masculino	37 anos	Bacharel em Turismo, MBA em Gestão de Pessoas, MBA em Gestão Estratégica, Especialização em Alfabetização e Letramento.	Branca	13 anos.	Atuou 2 anos como Supervisor de Atendimento, 10 anos como docente e está há 1 ano como gestor educacional.
Gestor D	Feminino	42 anos	Graduação e Pós-graduação em Administração.	Branca	20 anos.	20 anos.
Gestor E	Feminino	28 anos	Graduação em Administração, Pós-Graduação em Gestão de Pessoas e Coaching.	Negra	9 meses	4 meses como assistente no atendimento e 5 meses como gestora.
Gestor F	Feminino	42 anos	Graduação em Pedagogia, Pós-Graduação em Gestão Escolar, Pós-Graduação em Pedagogia Empresarial e Educação Corporativa.	Branca	6 anos	Atuou 6 anos como docente e está como gestora há 3 meses.
Gestor G	Feminino	35 anos	Ensino médio completo	Negra	7 meses	Recém contratada para função de gestora do setor de limpeza.

Chart 2 – Characteristics of the sample - Teachers

IDENTIFICAÇÃO	GÊNERO	IDADE	FORMAÇÃO	RAÇA	TEMPO DE INSTITUIÇÃO	TEMPO NA FUNÇÃO
Docente 1	Feminino	49 anos	Graduação em Educação Física, Especialização em Natação, Especialização em Acupuntura e Especialização em Docência Profissional.	Branca	17 anos	17 anos.
Docente 2	Feminino	32 anos	Engenharia de Segurança do Trabalho.	Branca	10 meses	10 meses
Docente 3	Não binário	32 anos	Arquitetura e Urbanismo e Design de Interiores.	Branca	1ano e 3 meses.	1 ano e 3 meses.
Docente 4	Feminino	44 anos	Graduação em Psicologia e Especialização em Gestão de Pessoas.	Branca	10 anos.	10 anos.
Docente 5	Feminino	51 anos	Graduação em Pedagogia, Pós-Graduação em Gestão de Pessoas.	Branca	11 anos.	11 anos.
Docente 6	Feminino	35 anos	Graduação em Administração, Pós-Graduação em Finanças e Controladoria, Pós-Graduação em Gestão Estratégica de Finanças e Gestão Estratégica de Pessoas.	Branca	11 anos	Atuou 2 anos como assistente administrativo e atua como docente há 9 anos.
Docente 7	Feminino	38 anos	Graduação em Nutrição, Mestre e Doutoranda em envelhecimento.	Branca	5 anos e 5 meses	5 anos e 5 meses.
Docente 8	Não binário	33 anos	Arquitetura e Urbanismo, Pós-Graduação em Educação.	Branca	5 anos.	5 anos.
Docente 9	Masculino	56 anos	Enfermagem há 24 anos com especialização em urgência e emergência.	Branca	4 meses	4 meses.
Docente 10	Feminino	35 anos.	Bacharel em Moda	Branca	11 anos	11 anos.
Docente 11	Feminino	39 anos	Administradora de empresas com licenciatura em matemática e especialização em acupuntura.	Negra	1 ano e 4 meses	1 ano e 4 meses.

We used the methodology of content analysis of , which defines content analysis as the search for understanding something beyond immediate meanings, and which aims to overcome uncertainty and enrich reading (Bardin, 1996, p. 17). The author also adds the desire for rigor and the need to discover, to guess, going beyond appearances, having the heuristic function that enriches the exploratory attempt, and the function of administering evidence, confirming and affirming through content analysis. For the organization of the

analysis, the webQDA® software was used Bardin (1996) [5], which is a collaborative web tool to support the qualitative analysis of data. (Souza; Pedro Costa; Moreira, 2011)

RESULTS

The case study analyses are presented below, considering the description of the 18 interviews conducted with managers and teachers of the vocational education institution located in the interior of São Paulo.

The transcription of the interviews, organized in files in the ".doc" format, were transferred to the webQDA software.

In figure 1, we have a word cloud formed from the texts of the 11 teachers' interviews. The 200 most spoken words with a minimum of 5 characters were requested, thinking that the words "negro", "negra", "preto", "preta", among others, could appear in the discourses. However, due to the difficulties that society faces in understanding the characteristics of these words, they did not appear among the 200 most cited in interviews with teachers.

Figure 1 – Cloud of most frequent words - interview teachers

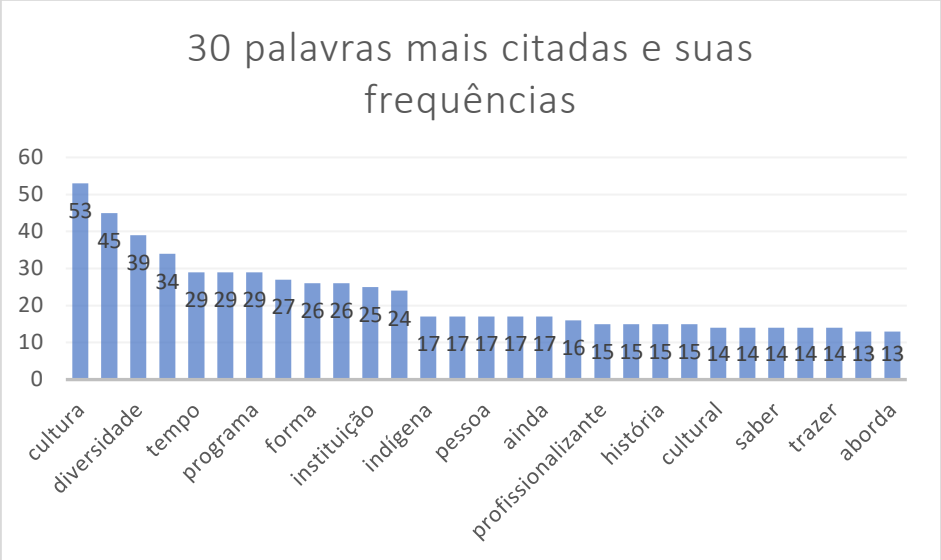


It is possible to see in the word cloud that the most present terms were "Culture", "People", "Teaching" and "Diversity", which was already expected from the content of the theme and the interview questions. We even see the word indigenous, with 16 references, the word ethnic with 11 references, however among the 20 most cited words, the issue of black people and other issues of diversity do not appear, something that alerts us and signals the difficulties of dealing with and understanding the theme. The word prejudice

[5] https://www.webqda.net

appears very discreetly, which may point to the difficulty of talking about the topic, even knowing that in practice various forms of racism and other behaviors of social exclusion of certain subjects may occur. Figure 2 shows the 20 most cited words and their frequencies.

Figure 2 – 30 words most cited by teachers and frequencies



Now the word cloud and graph with frequencies of the interviewed managers will be presented.

Figure 3 – Most frequent word cloud – interview managers



In the interviews with the managers, the scenario changed a little, perhaps because of their technical knowledge, or even because of the role they currently play in the educational institution. The most frequent words in this group were "Diversity", "People", "Culture" and "Ethnic", two of which were the same as in the group of teachers, but with different frequencies. In this group, the word "ethnic" appears in third place, and among

teachers it was much less frequent. The 30 most cited words with their frequencies are in figure 4.

Another fact that drew attention in this exercise was that in the interviews with the managers, the words "negro", "negras", "preto", appeared among the 200 most cited, but still with few repetitions, signaling the difficulty in dealing with and understanding the characteristics of these words.

Figure 4 – 30 words most cited by managers and frequency

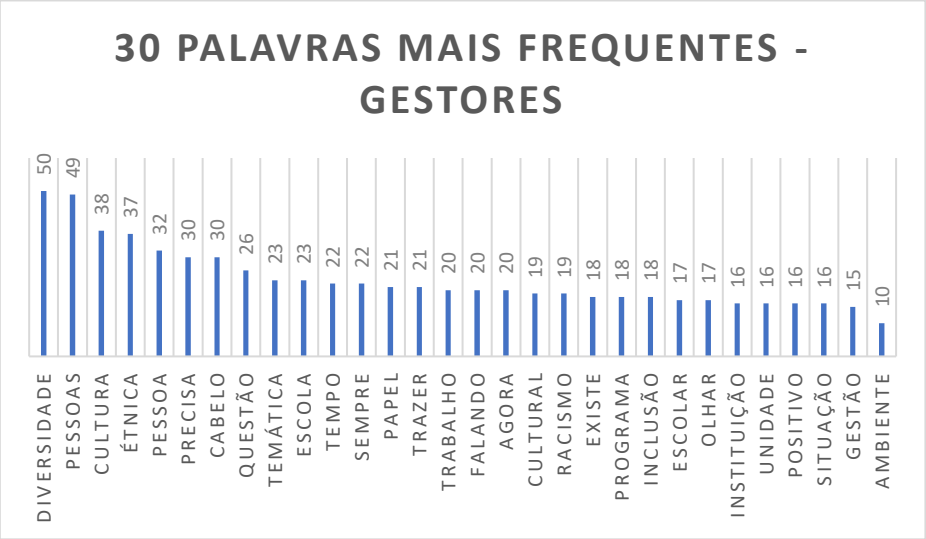
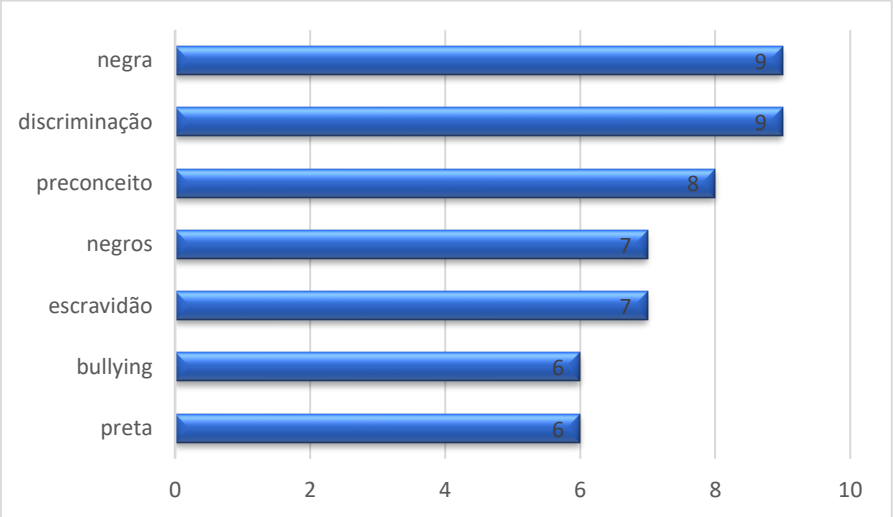


Figure 5 – words related to race and prejudice



The words in figure 5 were the most repeated and are related to race, with the words "black" and "discrimination" with 9 references, the word "prejudice" with 8 references, the words "blacks" and "slavery" with 7 references, followed by "bullying" and "black" with 6 references.

Although the word cloud is quite illustrative, and the graph with the frequencies of the 30 most cited words, the main objective of content analysis is to find the categories present in the interviewees' statements.

In the first analysis, verifying the answers that the teachers gave at the time of the interviews, the first categorizations emerged. *From the analysis of the narratives about the questions asked, the following categories emerged in figure 6.*

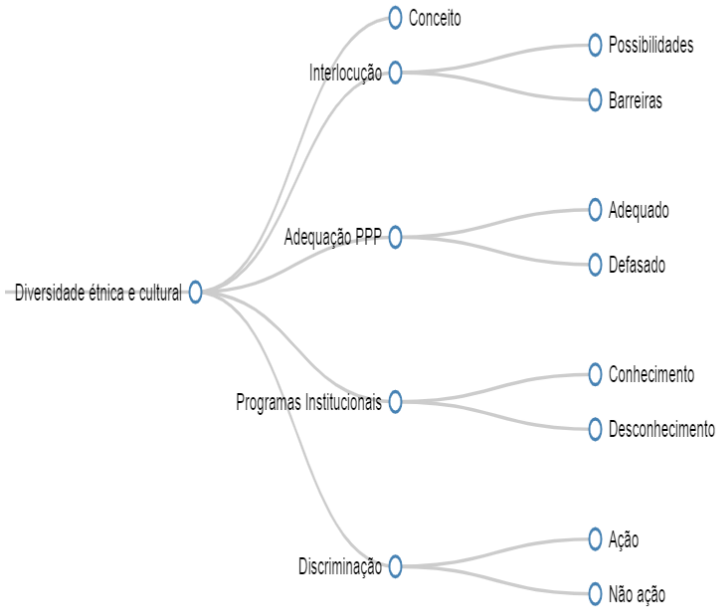
Figure 6 – Categories and subcategories from the interviews with the teachers



Source: webQDA software

In the managers' answers, 5 categories emerged, pointed out in figure 7, which will be analyzed later with the formation of the matrices and analysis of the interviewees' statements.

Figure 7 – Categories and subcategories from the interviews with managers



Source: webQDA software

As the content of the interviews was a little different between teachers and managers, it is expected that the categories will be a little different as well. The categories were created based on the content of questions and answers. The frequencies of each category will also be presented in this chapter, as well as the analysis matrices.

The following tables refer to the statements highlighted according to the categories previously separated by the WebQDA program, which can be seen in figures 8 and figure 9 presented above. The first table refers to the statements highlighted from the interviews with the professors and the second table refers to the statements highlighted from the interviews with the managers.

Chart 3 – Categories and statements highlighted from the interviews with teachers:

Categories	Highlights of the interviews (teachers)
Actions - Barriers and Possibilities	"Because I don't feel so safe to speak both indigenous and African." "Whenever I talk about quotas, I expose the need for reparation due to the suffering caused, something that students do not agree with, so I try not to emphasize."
PPP and Programs - Knowledge of the law	"No. Indigenous culture does not. Just a few dyeing techniques and Afro prints, there is only an unconscious approach, supporting a student who addressed the theme in a project because she works with the theme "Brazilianness"." "Very little, in health I address little. The case of the Yanomami I usually cite as an example, due to the lack of assistance and care, because it is a human being, we talk about indigenous culture." "Here, I need to put my blame, right? Because I still address it in a very small way, still very much the way I just spoke, because that's it, I assume that I came from this teaching that does not deal with the subject." "The dialogue about racism is linked to classes, and was inserted due to the African influence that contributed to the current culture and food."

	"Creating a welcoming space for the subject to be exposed without weight or discrimination."
PPP and Programs - Knowledge of the PPP	"I know it, right? I have been part of a culture of peace, I have participated, for a while, in a much more active way for a period." "Whoever needs it, asks for my help. So, as well as a culture of peace, I help in this way there too. When they need my help." "I know the Culture of Peace that works on respect and non-violent communication. Diversity and inclusion seeks to work with the inclusion tip of PWD and movements of the programs that have strength and are active in the institution." "Yes, I know and I confess that I really wanted to participate, especially in the diversity of inclusion."
Law 11645/08 - Ignorance of the Law	"So within my area I'm going to tell you that I don't approach it." "I don't address it. Maybe I need to get more information for my classes." "I don't usually address it in curricular units and courses." "I confess that I don't address much. I wish I had more ownership to address a lot more." "I never approached." "I don't approach it because of the nature of the course."
PPP and Programs - Ignorance of the PPP and Culture of Peace Program	"I read a little to participate in the Emergency Room, I know there is, but I can't specify each theme." "I don't know the culture of peace in depth." "The culture of peace, I know superficially the idea of what the program does now." "I know. I am not part of the Culture of Peace or Diversity and Inclusion. I know the PPP, but I can't say anything about it, I need to make it more real in my daily life." "I've never heard of PPP and I don't know what it means." "Yes, I know the programs, he doesn't use the documents to create his classes." "Many themes need to be better worked on for teachers, such as a turban workshop, a dive into Afro and indigenous culture. An Afro-descendant friend who is a militant root, who even ate his daughter's placenta, is something that brought me closer to culture. To know our reality and diversity, to learn from us."
Management and Diversity - Discrimination	"We are not doing vocational education for everyone." "Much like whiteness achieves, which is always trimming, showing what it wants and not showing the truth, what sometimes hurts, what sometimes hurts, but it's what made me look today and assume my half guilt and put as a commitment that I go after." "But that's it, we don't celebrate even one indigenous day, you know? We don't even have that." "The less we work on this, the more black people, people with disabilities, LGBT people are suffering." "A non-trans person will have it, simply because I don't have space, or a bathroom. So, I still don't have a base, I need the basics, you know it's having the right to be at the event, just like anyone else can be there." "Unfortunately, we find many prejudices there." "Mainly." "For me, my color is my color. I've always valued it and I have a younger sister who is white, it's white." "Importance is to avoid prejudice and bullying."
Management and Diversity - Ethnic and cultural diversity	"It's no use if you don't have empathy and know how to lead with diversity." "We are talking about the racial issue all the time. But he brought it in such a light, beautiful way. And yes, and then I'll bring you here a point of mine, I always say like this, wow, didn't I go through this pain?" "Of course I raise the black flag, I'm a black woman, I'm very proud of my color, right?"

Management and Diversity - Inclusion	"The staff has changed, it is more diverse." "Let's include these people here, let's include people who weren't heard, knowledge that isn't included to think at the time." "More and more we are occupying spaces that we didn't occupy, right?" "Of course I raise the black flag, I'm a black woman, I'm very proud of my color, right?" "We have to raise the flag like this, right? Will the pains happen? It has to be treated, it has to be resolved. But I think the message can be that way." "We don't need to want to change the world. If we start by changing our place here, we are already doing a lot, because we are little seeds, right?" "Because this way the prejudice, discrimination and violence generated by all this, through knowledge, has decreased." "The greater the diversity, the greater the innovation." "There is an Afro-Brazilian movement, but there is no movement of indigenous culture." "Reduce prejudice and give light to our culture, increasing our repertoire. Many students are not willing, little by little they are breaking prejudices."
Actions – Possibilities	"The staff has changed, it is more diverse." "I can see from Senac's policy and motto, something that circulates and coexists peacefully, there is always an area making a reference on the themes, including social responsibility." "Very important since applied with awareness, plurality, respecting the space of each person, enabling a respectful and welcoming environment." "It's not because it's difficult for us to put ourselves in the shoes of an ethnic group that we don't live in that we don't have to know each one, we always have to know, being open to dialogue is extremely important to me." "It is very much about embracing all causes and ethnic pluralities." "Many themes need to be better worked on for teachers, such as a turban workshop, a dive into Afro and indigenous culture. An Afro-descendant friend who is a militant root, who even ate his daughter's placenta, is something that brought me closer to culture. To know our reality and diversity, to learn from us."

Chart 4 – Categories and highlighted statements from the interviews with managers:

Categories	Highlighted statements from the interviews (managers)
Discrimination – Action	"Why today if I see that I am suffering racism too? I'm going to talk. In the past, we used to be quiet, right? Sometimes he listened, he was ashamed, he kept quiet. And no. And I'm one, if I realize. That's it, crime is crime. And you have to have these groups, yes, to guide, you know? I'm very surprised, because every day I learn something new."
Interlocution - Barriers	"Negative points, I believe that we, in totality, are not prepared for certain situations, are they?" "No, we don't talk much about race, no, sometimes we talk about the issue of gender, gender diversity, sometimes yes." "... And the teacher told me to tell my mother that she needs to comb her hair. So, he tells his mother to comb his hair. And I had the braids in my hair. So today I see Fabiana in a braid, I think it's beautiful, but I don't wear braids. No, I'm not going to wear braids. I think that stuck with me. It felt like I was going to school anyway. So it was up to me. Today I understand what happened, it was marked. I can't work with my hair down." "One day she told my other daughter, who said, her mother is not black. Then she started talking, because I'm the only black woman in the house. I'm going to say it like this, my daughter is white, husband is blonde, you understood then, the only black woman is me. I won't be able to explain this, why am I black?" "A lot, even because of the structural issue, right? So phrases, routine words that are always linked, especially when we bring a country with 54% blacks, right? So, where are the blacks? No, they are."

	"I looked at the pool, there were only 3 blacks. Where are the blacks at Sesc? I'm talking about a place that isn't paid monthly, it's not a private club. Even if it was also the look, it would have to be the same. However, in that environment where you pay 10 reais for the exam, where are the blacks? But in the service there was, in the cleaning, there was, so you keep thinking, why? So it's something that bothers me a lot." "I think that in the strategic meetings we had never dealt with this." "What a struggle, then, when it comes from a colleague who was already supposed to be on the same page, work in the same partnership, and then you find the rules. But when it's not like that, when the colleague who doesn't want to talk about it, tells us that I don't want to grow up, because he doesn't believe that this is important, my class is more important. What is that? It takes away all this importance, this appreciation that, in fact, we also need to talk about it."
Ethnic and cultural diversity - Concept	"I think that we think about school, right, to cover all, any and all ethnicities and. Culture, especially regional." "He comes from a place, right, that had and worked with the quilombolas, that worked with other cultures, right? With the indigenous people. So, he also brings this very strong to us. During the past year we talked a lot about the public, vulnerability, PSG and we ended up trying to reach people and we were faced with some issues, for example, when I went to the rural area to partner, right?" "It's thinking about the context of Brazil, I already have in mind the issue of miscegenation, you know, the diversity of peoples. So, in my opinion, this issue of ethnic-cultural diversity has to do with this mixture of races, you know, of peoples, of peoples, of languages, in short, it is very related to this." "We are in Brazil, black people, the first thing that comes to me are black people, and at the same time, I also think of other ethnicities, Portuguese, Japanese, Chinese." "A space with people of various races, several different places, with several different cultures." "So all the peoples of all countries, all the colors." "Ethnic, I think it's about races, it's what comes the most, just race. When we talk about race, we encompass everything, people who generally, when we talk about ethnic, we go only for a certain theme, relating ethics, ethnic, racial. Black skin. But we have the indigenous ethnicity. We have the oriental ethnicity. So, I think that when we talk about this racial ethnicity, we are talking about races, we are not talking about color, we are talking about ethnic."
Institutional Programs - Knowledge	"Culture of peace I think encompasses what I commented, I think I could be more active on the issue of the contribution of teachers." "The inclusion program is there to monitor, especially the employees, it gives such assistance, but it is really inclusion in fact, and not that we make the program welfare." "We welcome them, right? We understand, we try to understand the parts. Whether mediation is appropriate or not, which is often something that has already been." "So, they are disregarding teachers, they are disregarding the coordinator." "But in practice we don't do it." "I really believe in the 2 programs, I think the 2 are super connected and make a lot of sense. Once again, considering our values, considering our own pedagogical proposal." "The culture of peace as it is based on a perspective of non-violent communication and emotional intelligence, it is exactly to treat all the remnants that this subject brings, because it is not an easy subject. From the person who obviously suffers, because then the dimension of pain is totally surreal, because I have no way of measuring it." "Yes, I know when I worked here in 2019, I saw the groups, the meetings happening more effectively. I even participated in a pedagogical meeting, where the groups divided and talked about how I was able to have this experience, which was very valid." "There are 2 programs that I admire a lot, I'm in the culture of peace, but I'm not doing anything for the culture of peace." "I think that the 2 projects clearly, you can walk like this, hand in hand. All the time, all the time. You already know that little colleague who. I think that a culture of peace and inclusion and diversity, including diversity, should have joint actions, so we could eliminate so much conflict, rework."

PPP Adequacy - Lagging	"So I'm going to bring you the reality that I had there and it was even talked about a lot on the network at the time, because, I don't know if you know, there in Santos was the last unit to do the PPP. So, an absurdity, but it happened due to several situations, changes of managers, looks, anyway. So, the new units already had the PPP ready and we didn't have them yet." "I've been here for 1 year and I hadn't seen it, she passed me the other day, I haven't been able to see it yet." "So the PPP is not just ours, the school community is all involved and we reach cities that do not always have the same proposal as our same culture." "The inclusion program is there to monitor, especially the employees, it gives such assistance, but it is really inclusion in fact, and not that we make the program welfare." "So, they are disregarding teachers, they are disregarding the coordinator." "We are a little outdated. But I think that within the PPP, this has to be a priority." "But in practice we don't do it." "I think we don't leave the place either." "The culture of peace as it is based on a perspective of non-violent communication and emotional intelligence, it is exactly to treat all the remnants that this subject brings, because it is not an easy subject. From the person who obviously suffers, because then the dimension of pain is totally surreal, because I have no way of measuring it." "Currently I see that these groups, they are, they exist, but they are making a little, a little less noise." "We want to say it like that, right? They are more shy, working more punctually, right? But I see total connection, importance and it is, for example, a culture of peace." "The PPP is the pedagogical political project, wow we haven't thought about this issue for a long time, it rose from the ashes, right. I think we need to rethink the PPP because it's been a long time since we've looked at it." "The unit's political-pedagogical project is a little outdated."
Institutional Programs - Lack of Knowledge	"I don't know what PPP is."
Ethnic and cultural diversity - Discrimination	"Ah, but I'm not to blame for what happened about racism! I don't know how many years ago, in the time of slavery, what do I have to do with it? But I suffer the consequences of this, you understand? You have nothing to do with it, I wasn't there, I wasn't there either, only with the consequences I suffer you don't, you understand?" "Today it is even easier to deal with, can't you study the history of slavery? Of wanting to know what he did with people. I went to find out what a nightstand was recently, for me it was always that headboard, it was on the side of the bed that wasn't, and that. It's just the right name. It's headboard, right? It is a side table. But I was raised talking about dumb servants, you get the idea. I think black work, I think it's a blackness what you're doing." "I as a black woman, I as a black woman, I'm still learning, I'm 35 years old, I've learned a lot of things now, because at school I didn't say that, I was the little black girl with the hard hair, you'll just repeat the hair. I also straightened my hair." "We took it kind of in stride, but it was still bullying, racism." "And the teacher told me to tell my mother that she needs to comb her hair. So, he tells his mother to comb his hair. And I had the braids in my hair. So today I see Fabiana in a braid, I think it's beautiful, but I don't wear braids. No, I'm not going to wear braids. I think that stuck with me. It felt like I was going to school anyway. So it was up to me. Today I understand what happened, it was marked. I can't work with my hair down." "They don't know that sometimes the person was sold for the tooth, for the shin, that he didn't have the strongest shin, that he had the slave, that he was a breeder, you know? He was treated, like an animal. He was punished, put on the trunk, whipped. He was treated like an animal, right?"
Ethnic and cultural diversity - Interlocution	"He comes from a place, right, that had and worked with the quilombolas, that worked with other cultures, right? With the indigenous people. So, he also brings this very strong to us. During the past year we talked a lot about the public, vulnerability, PSG and we ended up trying to reach people and we were faced with some issues, for example, when I went to the rural area to partner, right?"

	"I think this issue of inclusion is really positive, right? Of you considering, of you bringing equity to situations, because you can't wait culturally speaking." "So, considering this last year, I've been talking a lot more." "But people still have this issue of bringing this look to the table, because they don't want to analyze slavery, right? That there is no way to pay for this."
Discrimination - Non-action	"No, we don't talk much about race, no, sometimes we talk about the issue of gender, gender diversity, sometimes yes." "I as a black woman, I as a black woman, I'm still learning, I'm 35 years old, I've learned a lot of things now, because at school I didn't say that, I was the little black girl with the hard hair, you'll just repeat the hair. I also straightened my hair."
Interlocution - Possibilities	"I think this issue of inclusion is really positive, right? Of you considering, of you bringing equity to situations, because you can't wait culturally speaking." "So it's something cool, but that's it, we'll always have to talk because our audience is large, more than 1500 people passing through here a day, but they change, right? Tomorrow there are another 1500, a very high turnover, it's something we'll always have to talk about. So, it's no use saying that we said once or did an action that will make sense and that's it. I think that if you can collaborate, since you are with this study you will be rich, always welcome." "If I started talking about these things at an early age, I think that the new generation will already grow up different from the one that passed." "And you have to have these groups, yes, to guide, you know? I'm very surprised, because every day I learn something new." "So, considering this last year, I've been talking a lot more." "So, talking about it is increasingly necessary." "But people still have this issue of bringing this look to the table, because they don't want to analyze slavery, right? That there is no way to pay for this." "We have to see people bringing this look, see people bringing this speech, sometimes even with the conviction that it doesn't exist, that there is no need for this, that it is that and without analyzing this historical issue, without analyzing facts, without analyzing all this concreteness." "Look, we had an educator about anti-racism, and then I started to be able to talk about this subject, especially with the led, because then I see that they feel safe, especially for me to be black." "This part of ethnicity we end up talking a lot about our daily lives." "When the unit, it has the quotas already reached, we can start hiring people with cultural diversities giving priority, so, between a person during an evaluation in a process that we identify a person as an equal, it is for us to give priority to hiring this person, right? That of the culture. From another race or culture, this is the orientation." "I think that the library has a fundamental role within the unit, the library is not just a space for reading, knowledge or bringing knowledge from books to students."

As presented in Charts 3 and 4, complementing the information from the results of the interviews, the answers to the interviews follow with semi-structured questions carried out with the managers, whose theme was related to ethnic and cultural diversity in educational institutions, where the interviewees are asked to report what comes to their mind when the term "Ethnic and Cultural Diversity" is mentioned. *All 7 interviewees mentioned that the term refers to the diversity of ethnicities that our Brazilian society is inserted in, full of colors, cultures, especially black culture, very present in our society. Of the 7 people interviewed, only 1 person referred to indigenous culture, to our native peoples.*

Continuing with the same theme, the second question was related to the dedication of dialogues on the theme among the members of the led teams, where most mentioned

that such themes have recently been part of the strategic meetings, where two participants signaled that it is due to the experiences of the manager of the educational unit, with contacts with the indigenous and quilombola community. It was also evidenced that the theme started to have strength due to the guidance of the Headquarters that guides all units, signaling that we have quotas for hiring people who fit all the Ethnic and Cultural Diversity to be met, and an anti-racism course facilitated the approach of the topic with its subordinates.

In question three, where it was requested to highlight positive and negative points in dealing with this theme, the managers were unanimous in pointing out that dealing with the theme favors inclusion, the learning of fundamental concepts for understanding and the reduction of racism and prejudice. Three managers pointed out that we are all educators and to deal with the topic we need to understand, update ourselves and be prepared, and it needs to come from us, from our daily experiences the learning that we want to disseminate to our students, because as two managers pointed out it is motivating to work in an environment where we can solve our doubts and foster inclusion.

Moving on to the theme related to the responsibilities of management in the face of ethnic and cultural diversity, in view of the question of how they can use the PPP as a tool in this dealing, all the managers interviewed were unanimous in reporting that currently the PPP of the educational unit is not active and therefore not effective, it needs to be revitalized according to the current needs of all those involved. It is a topic that is on the agenda to happen as soon as possible, but which is currently not helping especially in ethnic and cultural diversity.

Regarding the relationship between management and the institutional programs Culture of Peace and Inclusion and Diversity, one manager believes that the programs could be more active and count on the contribution of teachers, demonstrating the directive of the themes to teachers. Four managers point out that the programs are fundamental for the development of inclusion and respect for diversity, capable of offering tools for understanding concepts and improving coexistence inside and outside the institution, but that they are currently more stopped, without many actions and this is necessary to disseminate the proposed themes. And when this happens, the lack of knowledge and experiences capable of transforming behaviors and attitudes favorable to inclusion prevails.

On the issue related to decision-making in the face of discrimination, all managers were unanimous in resolving it based on dialogue, the welcoming of all those involved, it is important not to neglect it. One manager pointed out that they are instructed to expose to the victim their legal rights to report. Three managers said that if it occurs in the classroom,

it is necessary to present the documents that permeate everyone, such as the school regiment that deals with the rights and duties of everyone in the school community.

DISCUSSION

Barbara Carine Pinheiro (2023) points out that educating is a social act of exchanges that contribute to the entire educational process, so education is the act of socializing with the new generations the knowledge historically produced. To this end, we need educators who are willing to put the educational act into practice in a planned way, with the systematization of the contents to be socialized, following a curriculum with intentionalities.

In the planning of actions and participatory functions of managers, including in action plans, time is not included for work directed to the theme of ethnic and cultural diversity, including in Institutional Programs such as the PPP, Culture of Peace and Inclusion and Diversity, something that needs to be reviewed, because it is perceived that it is something that compromises results and effectiveness. Because without the assiduous participation of managers in the actions, other employees do not feel supported, in addition to the lack of direction of actions on the subject. Some managers report their concern with the lack of dedication to this theme and to the Programs, such as Manager D, in the following excerpt:

> "I wanted to dedicate at least 1 hour a week to the projects, to the program. Even so, among all the projects of ..., the culture of peace is the one that stands out the most, it is the one that has the most proposals. This is discussed with technicians and managers. The culture of peace and inclusion and diversity, which we have done some actions, the others are really very still, needing someone to be at the forefront." (Manager D).

Other managers believe that the participation and responsibility of the actions of the Institutional Programs should be more active on the part of the professors.

The management team interviewed believes that the educational environment is conducive to discussions and learning about ethnic and cultural diversity, favoring what is recommended by the principles of the LDB, which indicates that teaching should take place considering the pluralism of ideas and pedagogical conceptions and the link between school education, work and social practices.

The lack of knowledge of Law 11.645/08 was specifically evidenced in the reports of the teachers interviewed, demonstrating the lack of understanding of the current Educational Laws, including the Law of Guidelines and Bases (1996) that establishes the teaching of Diversity in Education as one of the general competencies of basic education throughout the national territory, which is even more worrying, in fact, it is symptomatic of the training of many teachers.

Suffering from racism is not far from educational units, for a long time the disqualification of professionals who traumatize since childhood has been seen, as we can see in the reports cited in the interview with Manager G, described below:

> "Some memories, it seems that the understanding began to come, because I talk about the old days, that girls had straight hair, just like my mother. I told her, I saw my mother's hair when my mother was on her deathbed. I only saw what my mother's hair was like, that my mother was always that person who straightened her hair, she always had to have straight hair, she never had curly hair that she was, why? Because it was what society accepted. And when she got sick, which I went to see, then I cut her hair, cut it, short her hair. Then I saw the way her hair was just like mine. Then I was like, wow, but I told my daughter, wow, her hair is just like mine and I had never seen it, can you believe it? So I believe that my mother must have suffered a lot in this matter, yes. I've suffered, but they never let me talk about it. So the person says like this, ah, but I'm not to blame for what happened about racism! I don't know how many years ago, in the time of slavery, what do I have to do with it? But I suffer the consequences of this, you understand? You have nothing to do with it, I wasn't there, I wasn't there either, only with the consequences I suffer you don't, you understand? That's kind of what I heard. I kept quiet because sometimes I say, I'm not going to start talking, because at some point I might lose my argument, so it's better not to start." (Manager G).

Racism is capable of devastating the self-esteem of people who suffer daily from various forms of prejudice and discrimination, something evidenced in the following report:

"It looks like I have my hair unkempt, but it's mine, that's it. It seems that I have my hair unkempt and in them I think it's beautiful. I think their hair is beautiful, but mine I can't let it loose, even defining the curls." (Teacher G)

FINAL CONSIDERATIONS

Considering that the theme of this work sought to analyze how ethnic and cultural diversity is implemented in a professional education institution in the interior of the state of São Paulo, it was possible to observe that there are promising movements fostering actions and considering people in a significant way, in the search to explain the importance of understanding historical facts against prejudice and discrimination. However, from the statements of the interviewees, it was clear that they do not have racial literacy and some even showed racist thoughts - possibly originating from structural racism - in their speech, such as that one should dispense with Afro and indigenous culture and approach oriental culture, more "pertinent" to the area of the course. In addition, the lack of knowledge about mandatory topics, such as the concept of PPP and the mandatory teaching of diversity, does not reflect something simple, but is an oversight, even if involuntary.

When writing about this theme, the importance of knowledge and discussions about ethnic and cultural diversity in a vocational education institution is raised, being an important part of the world of work, because vocational education institutions, in addition to

the development of professional technical skills, help in the development of attitudes that add pertinent and necessary information for a healthy coexistence in the professional environment. To this end, there is a need for the constant dedication of the entire educational team, especially the management team with its responsibility to direct and support its subordinates, and the teachers who are the educators who mediate and encourage the search for knowledge in a constant and transformative way.

All managers, in view of their answers in the interviews, said that they believe that working on the theme of ethnic and cultural diversity is important, because by adding such information, everyone will have more chances to obtain more knowledge, and thus, they will have subsidies to abolish prejudice and the violence generated, increasing respect for diversity. As a demonstration of the need for these new thoughts and possible forms of help to solve such problems, they requested the sharing of this research, as they believe that they can obtain new understandings and new ways of dealing with ethnic and cultural diversity in the vocational educational environment.

One way to help understand the importance of this theme would be to propose specific workshops on Law 11.645/08 and on Critical Racial Literacy, as they will be facilitators of how we can add it to our curriculum and daily planning in the most different courses, with creativity and in a facilitating way to the learning process about the history of indigenous and Afro-Brazilian culture, using methodological and didactic resources that favor understanding and considering the objectives of the course and its indicators.

The proposal of conversation circles about ethnic and cultural diversity can also favor the exchange of experiences and the understanding of life stories, where people from the school community who suffer from prejudice and discrimination in their daily lives, can teach how we can act without prejudice, without violating rights and disrespecting historical facts, considering differences in a respectful way, and empowering people to live together Thus, when dealing with these topics with students, it will be easier, as there will be the experience of living, and the chance to deal with the subject safely and calmly, as we will have a support base to solve our doubts and difficulties.

Another facilitating way to solve our doubts would be the creation of a free application that could be consulted in case of simple doubts, with an example of terms that should not be used for their racist, discriminatory or prejudiced connotation, to more serious cases that can be considered crimes such as racist, discriminatory and prejudiced speeches and opinions. The application could also offer a database with curiosities and pertinent information about Afro-Brazilian culture and indigenous culture and all native peoples, such as languages, typical foods, beliefs, derived words, works of art, handicrafts,

health and wellness tips, fashion and beauty tips, revering all the beauty of the ethnic-cultural diversity existing in our culture.

The vocational education institution could create a committee for the joint elaboration of a booklet on how to apply Law 11.645/08 in its courses in an aggregating way, fostering the exchange of experiences between professionals from all over the State of São Paulo on this theme, so we could obtain a facilitating material that can be consulted and easily applied in all vocational educational units, where educators will feel safe in addressing the topic and working on the difficulties of their students in a calm way. The dissemination of this booklet, which can be physical and digital, can be carried out through corporate education and directed to all educators and professionals of the institution in partnership with the library and the institutional publisher.

Another way to promote the importance of ethnic and cultural diversity and the implementation of Law 11.645/08 is the inclusion of this theme as a priority in the Pedagogical Political Projects (PPP) and in the actions promoted by institutional programs such as the Culture of Peace Program and the Inclusion and Diversity Program, where the participants, after understanding the importance of the development of this theme, will prioritize their insertion in the actions that will make up the annual calendar, in a planned way, making the theme common and simple throughout the educational calendar. Thus, the understanding of the methodological proposals will be necessary, as it will be a facilitator in the entire educational process, and the planning routine will be assertive considering all the development needs of the entire school community.

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PHYSIOTHERAPEUTIC PERFORMANCE IN PALLIATIVE CARE: AN INTEGRATIVE REVIEW ON THE EXISTENCE OF PHYSIOTHERAPEUTIC PROTOCOLS FOR PALLIATIVE CARE

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ABSTRACT

Physiotherapy is a fundamental part of the multiprofessional team to promote quality of life and comfort to patients in palliative care, acting in the assessment, prevention and treatment of the dysfunctions presented, being essential to provide physical, emotional and functional comfort to patients. The present study is characterized as an integrative review guided by the following question: "In view of scientific publications, is it possible to establish a physical therapy protocol for palliative patients?". Thus, the objective of the study is to research the scientific productions about the physiotherapeutic techniques used in palliative care in the face of a multiprofessional work. An integrative literature review was performed in the PubMed (National Library of Medicine and National Institutes of Health), VHL (Virtual Health Library), PEDro (Physiotherapy Evidence Database) and SciELO (*Scientific Electronic Library Online*) databases, using the following descriptors: *("physiotherapy" AND "palliative care" AND "oncology" AND "neoplasm").* Including in the study only the journals 2017 to 2023 as publication date limits. Through the studies analyzed, it was observed that physical therapy acts actively in the face of the main complications reported by patients in palliative care, using techniques such as kinesiotherapy, aerobic exercises, resistance exercises, respiratory physical therapy techniques, neurofunctional physical therapy, TENS, therapeutic massage, compressive bandaging and myofascial release. It was possible to observe, through analyses and studies, that the intervention of physiotherapy plays a crucial role in palliative care, being considered an essential and complementary part within the multidisciplinary context of treatment. The physiotherapy approach in this scenario aims not only to relieve physical symptoms, such as pain and fatigue, but also to promote quality of life and emotional well-being for patients. However, when considering the development of specific protocols for certain conditions presented by patients in palliative care, we are faced with significant challenges, where the scarcity of well-founded studies in this area is notable, which makes the definition of evidence-based guidelines and practices a complex task. The diversity of cases and the individuality of each patient also contribute to the difficulty in establishing standardized protocols.

Keywords: Physical therapy. Quality of life. Interventions. Studies. Terminality.

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INTRODUCTION

Palliative care refers to a series of multidisciplinary conducts aimed at patients with incurable diseases, aiming to improve the quality of life of these patients, promoting the prevention and relief of pain complaints through the identification, evaluation and treatment of pain and symptoms that affect not only the patient's physique, but also the entire psychological and social context involved in the condition presented (WHO, 2002).

All individuals affected by life-threatening pathologies, whether acute, chronic, and at any age, are suitable for palliative care (INCA, 2022). According to PALMEIRA et. al. 2011, palliative care actions apply to any active, progressive disease or that threatens the continuity of life, that is, they extend to cases in which death can be constituted by a process of natural evolution in relation to illness, even if it lasts for years.

The patient's diagnosis is a determining factor for the allocation of palliative care to patients affected by an incurable disease. In view of the development of the present condition, establish a prognosis that helps in the adaptation of the affected patient to palliative care, where the need to carry out practices aimed at the patient's better quality of life was observed, in which the palliative approach aimed at the patient's better condition in its current time is expanded (INCA, 2022).

In view of the reported fact, it is necessary for patients with conditions beyond the possibility of cure to conduct themselves aimed at improving well-being, in which they provide these individuals with basic comfort aimed at daily comfort. Thus, palliative care is defined as approaches that promote the quality of life of patients and their families, who face diseases that threaten the continuity of life, through prevention and relief of suffering (WHO, 2017). These are approaches that require the comprehensiveness of knowledge inherent to the various specialties, enabling the performance of clinical and therapeutic conducts in various areas of knowledge in the health area, with physiotherapy as one of the components.

Physiotherapy is of paramount importance in palliative care, presenting a wide variety of resources for carrying out conducts aimed at the patient's quality of life (INCA, 2020). That said, physiotherapy is an essential component in the multidisciplinary team for the development of palliative care, covering numerous areas of action in which they enable the patient to improve the clinical condition and, consequently, the perspective of promoting their well-being.

Thus, it is necessary to understand the protocols exercised in the physical therapy practice in palliative care in order to establish the necessary knowledge for the formation of specific conducts based on the apparent situations in the care of patients with the presence

of non-curable diseases. Thus, the objective of the present study was to analyze scientific productions aimed at carrying out physiotherapeutic conducts aimed at symptom management in patients in palliative care situations.

METHODOLOGICAL PATH

CONTEXTUALIZATION OF THE OBJECT

This is an integrative review based on a literature search using the following descriptors: *physiotherapy, palliative care, oncology and neoplasm*, which aimed to search for physiotherapeutic methods used in palliative care.

CHARACTERIZATION OF THE STUDY

For the development of the study, steps were determined to guide the research, namely: determination of the guiding question; organization of keywords; inclusion and exclusion criteria; literature search; analysis of the studies included in the search patterns; identification of information pertinent to the research; interpretation of the results and conclusion of the synthesis of the knowledge produced.

The following standards were used as eligibility criteria: articles that included physiotherapeutic methods in palliative care in adults or children/adolescents, clinical trial articles, and systematic review articles, available in English, Portuguese, and Spanish, including articles from 2017 to 2023 as the publication date limit. The following exclusion criteria were determined: theses, dissertations, letter articles and case studies. The searches in the databases were carried out between September 2023 and January 2024, being carried out only by the author himself.

DATA COLLECTION INSTRUMENT

The searches were carried out in the following literary databases: PubMed (National Library of Medicine and National Institutes of Health), VHL (Virtual Health Library), PEDro (Physiotherapy Evidence Database) and SciELO (*Scientific Electronic Library Online*). To standardize the searches, the Boolean operator was used with the following scheme *("physiotherapy" AND "palliative care" AND "oncology" AND "neoplasm")*

The following information was collected in the studies: author, year, type of study, number of individuals/studies analyzed, age, and the therapy used in palliative care in adults and children/adolescents.

ANALYSIS OF THE RESULTS

The final result of the studies selected after selection in the databases totaled 12 scientific articles, where dissertations, theses, case reports and articles in which they were related to physiotherapeutic approaches in palliative care for adults or children/adolescents were considered as exclusion criteria: clinical trial studies and systematic reviews available in English, Portuguese and Spanish, covering the period from 2017 to 2023 as a publication limit. Taking into account the inclusion and exclusion criteria defined for the elaboration of the study, the articles were extracted directly from the aforementioned databases and evaluated for their eligibility to answer the study's guiding question, as shown in Figure 1.

Figure 1. Flowchart for eligibility of scientific articles.

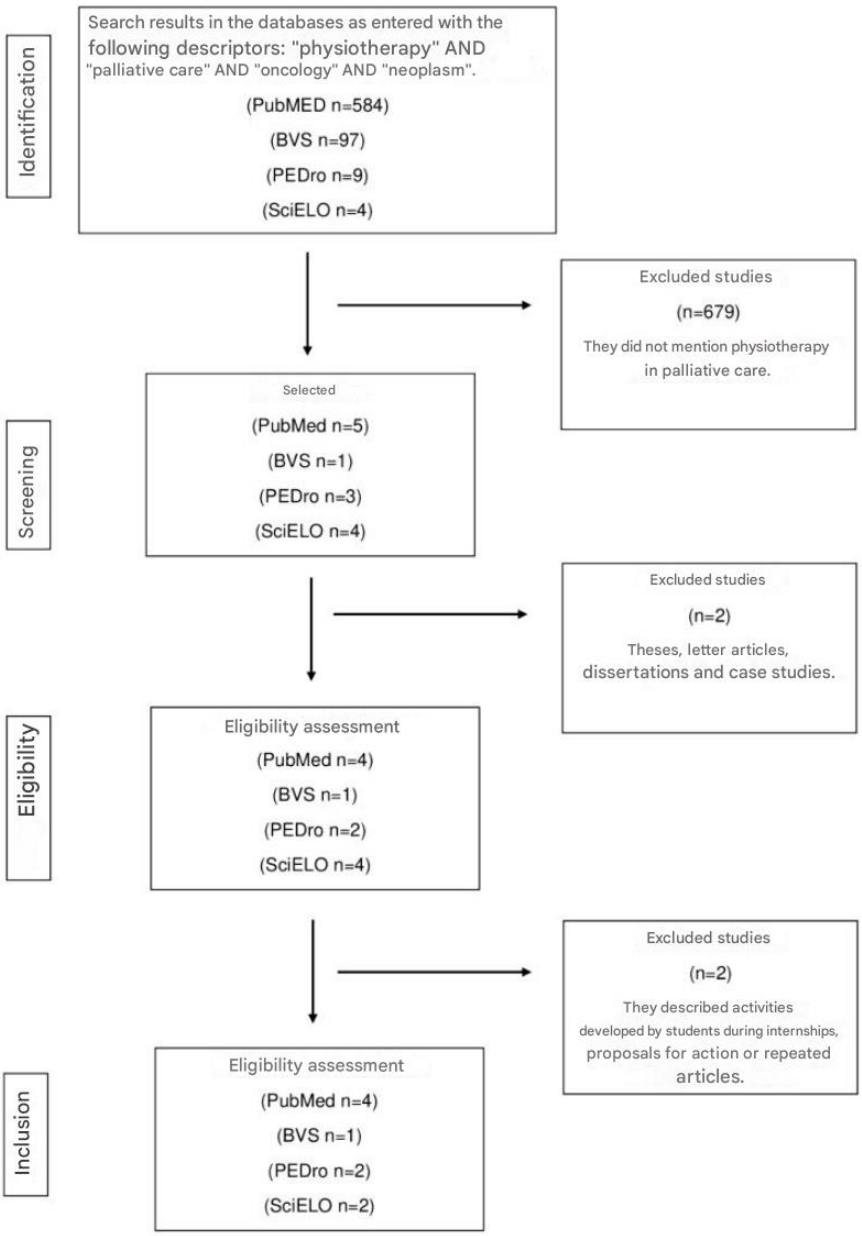

Table 1. Studies defined as literature reviews and conduct guides.

Author	Year	Type of study	Local	No.	Objective	Description of results
VIRA, et al.	2020	Systematic review	India	9	To review the role of physical therapy and its effects in palliative care of patients with advanced cancer.	It has been seen that a structured protocol of exercise, massage therapy, TENS, and compression bandages are helpful in relieving the symptoms experienced by advanced cancer patients in palliative care. However, the quality of the studies ranged from low to moderate.
CAMPOY, et. al	2021	Systematic review	Spain	7	To gather, analyse and critically evaluate the available scientific evidence on physiotherapy in children requiring palliative care through a systematic review of studies published in the last 10 years in the following databases: PubMed, Cochrane Library, PEDro, CINAHL and Scopus.	Its evidence was respiratory physiotherapy and techniques aimed at the control of neurological symptoms, such as the prevalent specialties in pediatric palliative care. A major weakness of the study was the difficulty in searching for scientific evidence that fit the established design.
BUSTOS, et. al	2020	Systematic review	Colombia	5	To identify the effects of physical therapy intervention on quality of life and symptom control of cancer patients in palliative care.	He stated that physical therapy intervention is effective in patients with advanced cancer and the impact on the quality of life of these patients, but he reports the low scientific evidence in the area, reporting that there is a need for more research in the area.
SILVA, et. al	2021	Integrative review	Brazil	12	To analyze the scientific productions regarding the performance of physiotherapy in palliative care in cancer patients.	The study evidenced the relevance of physiotherapy in palliative care, reporting its importance at all levels of health. The scarcity of studies in the area was reported, requiring a greater scope of research.
MOREIRA, et. al	2021	Integrative review	Brazil	12	We searched the literature for studies that use kinesiotherapy to treat, attenuate, and improve fatigue in cancer patients, in addition to identifying the best intervention for clinical practice with this group of patients.	He reported that the use of physical therapy with kinesiotherapeutic exercises is essential for the rehabilitation of these patients, making it necessary to further research with clinical trials, including the application of physical therapy with kinesiotherapeutic exercises.

n - Number of samples used to carry out the author's research.

Table 2. Studies defined as observational and experimental studies.

Author	Year	Type of study	Local	No.	Objective	Description of results
SCHUNK et. al.	2020	Accelerated pragmatic randomized controlled trial	Germany	160	The effectiveness of the Munich Breathlessness Service (MBS), which integrates palliative care, respiratory medicine and physiotherapy, was tested in the BreathEase trial in patients with chronic shortness of breath in advanced disease and their caregivers. Exercises and positions to facilitate breathing were performed by the physiotherapy team; breathing techniques; exercise plan and assessment of the need for medical help.	The results of the study highlighted the effectiveness of the Munich Breathlessness Service (MBS) in reducing the burden caused by chronic shortness of breath in advanced disease in a wide range of patients. However, it was seen that additional evaluation is needed in subgroups of patients and with a longitudinal perspective.
PYSZORA et. al.	2017	Randomized controlled trial	Poland	60	To evaluate the effect of a physical therapy program on cancer-related fatigue and other symptoms in patients with a diagnosis of advanced cancer.	The exercise program caused a significant reduction in fatigue in terms of fatigue severity and its impact on daily functioning. In addition, the physical therapy program improved the patients' overall well-being and reduced the intensity of coexisting symptoms, such as pain, drowsiness, lack of appetite, and depression.
POORT et. al.	2017	Randomized controlled trial	Holland	219	To evaluate the efficacy of graded exercise therapy and cognitive behavioral therapy compared to usual care in reducing fatigue in patients with incurable cancer.	It is concluded that gradual exercise and cognitive-behavioral interventions look promising in reducing the severity of fatigue based on their efficacy in disease-free cancer patients and in patients receiving cancer treatment with curative intent.
LONGARAY et. al.	2021	Quasi-experimental study	Brazil	11	To verify the effects of a physiotherapy protocol in individuals with hematological cancer.	The results showed that it is possible to use a physical therapy protocol that adapts to the hematological profile and clinical conditions of the patient in this area, with correlations between several functional variables evaluated, although more studies

						are needed. A predominant factor for this study is its low number of samples, directly implicating the effectiveness of the results.

Tables 1 and 2 show the objectives of the selected studies after filtering based on the criteria analyzed. From the results obtained, it is possible to analyze the physiotherapeutic performance in the midst of palliative care, outlining the effectiveness of the conducts aimed at resolving the main symptoms reported by the patients, in which it will be possible to establish a standard in the conducts and, finally, the effectiveness of the techniques used to control the symptoms of patients with terminal diseases.

The main objective of physiotherapy in this patient population is aimed at improving quality of life, so that it relieves symptoms, discomfort and difficulties that make it impossible for the individual to function at an optimal level (PYSZORA et al., 2017). Thus, it is seen the need to implement physical therapy in numerous situations presented by the patient, aiming at its improvement in a broader context, where it can provide the patient with the possibility of performing activities of daily living.

In order to direct palliative care in a given patient, it is first necessary to carry out a detailed assessment of the clinical condition and aspects that interfere with the patient's quality of life, where the main symptoms reported are analyzed and thus a direction of conduct. In the study by VIRA et al. (2020), the predominant symptoms in palliative patients who need physical therapy care are pain complaints, decreased physical function, fatigue, lymphedema, and sleep disorders related to shortness of breath, in which it is possible to evidence that there is a link in the appearance of the aforementioned conditions.

According to POORT et al. (2017), fatigue is one of the most commonly reported symptoms by patients with incurable cancer, in which they are suitable for palliative care. In view of the reported fact, the study by PYSZORA et al. (2017) observed the effectiveness of a physical therapy program to reduce fatigue, where active exercises for upper and lower limbs, myofascial release techniques and proprioceptive neuromuscular facilitation (PNF) techniques were performed over a period of two weeks, in which six sessions of individual therapy were performed for a time of thirty minutes.

Like PYSZORA et al. (2017), the study by POORT et al. (2017) established an exercise program to reduce fatigue in patients with cancer, the following cancers: breast, colorectal, prostate, renal cells, bladder, endometrium, ovarian, cervical, bone and soft tissue cancer, or melanoma. Interventions included resistance exercises and aerobic

training over a period of twelve weeks. It obtained significant results for the increase of the physical capacity of the patients and eventually the reduction of the fatigue condition, establishing the training load based on the patient's physical capacity, both in resistance training through the maximum repetition test (RM), and in aerobic training in the face of the heart rate reserve (HRR).

Allied to the concept of kinesiotherapy, MOREIRA et. al. (2021) defines that aerobic, active, resisted, and functional exercises applied to patients with oncological fatigue should be from short to long term, being at least three weeks to two years, with ten to thirty minutes, three to five days a week, with repetitions of eight to twelve, and sets of three, which develop a decrease in fatigue levels and also reduce coexisting symptoms, providing a better quality of life and functional capacity for these patients.

Highlighting pediatric palliative care, the study by CAMPOY, et al. (2021) saw the direction of physical therapy techniques aimed at acting on Cerebral Palsy, where it is concluded that respiratory physical therapy and techniques aimed at controlling neurological symptoms are the most prevalent specialties, evidencing techniques aimed at postural management due to the reduction of spasticity and deformities in the child, in addition to techniques aimed at neurodevelopment and sensory stimulation.

Considering the aspect of shortness of breath in palliative patients, MENDES et. al. (2020) relates the use of strategies for comfort and management of this symptom, such as: maintaining a quiet and ventilated environment, with windows open, cooling the patient's face using cold compresses, wearing comfortable clothing, postural adjustment, preferably with an elevated headboard, and relaxation techniques. In more complex clinical cases, it is evident that the use of respiratory physiotherapy techniques is indicated, in which it is necessary to evaluate the specificity of the case.

Still on respiratory treatment, SCHUNK, et. al. (2020) defined that a multidisciplinary protocol aimed at patients affected by shortness of breath during exertion or at rest resulting from any advanced, life-limiting and progressive disease is effective for improving the clinical condition. In this study, physical therapy was performed based on exercises and positions to facilitate breathing; breathing techniques; exercise plan and assessment of the need for medical help over a period of six weeks.

FINAL CONSIDERATIONS

Despite the positive results observed in the studies, it is important to recognize that the formalization and standardization of the techniques used in palliative care is unfeasible due to the low number of well-founded studies in the area.

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VIRTUAL LEARNING ENVIRONMENTS AND *SMART PAPERS* IN LARGE-SCALE ASSESSMENTS

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ABSTRACT

This article presents the results of the qualitative analysis of the literature on the use of Virtual Learning Environments and *Smart Paper* technology in large-scale evaluations in the Brazilian educational context. The research revealed that virtual learning environments offer tools to make assessments more efficient, although they face challenges such as the need for adequate infrastructure and equity in technological access. On the other hand, *Smart Paper* technology emerges as a promising solution to overcome access and cost obstacles, integrating digital resources into the paper format. It was concluded that these technologies can enrich evaluation practices and support more effective and inclusive educational policies.

Keywords: Large-Scale Evaluation. Virtual Learning Environments. Smart Paper.

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INTRODUCTION

Contemporary education faces challenges and opportunities, both fueled by rapid technological evolution and the need to adapt to increasingly digital learning environments. The information age has brought significant changes to teaching and learning processes, requiring educational systems to constantly reinvent themselves. In this dynamic context, two key elements stand out: large-scale assessments, which make it possible to map performance and identify learning gaps, and virtual learning environments (VLEs), which have the potential to transform the way teachers and students interact, collaborate and build knowledge.

Educational assessments, traditionally conducted in person and analog, have progressively migrated to the digital environment, which creates a fertile field for the use of advanced *learning analytics* tools. These tools allow for detailed analysis of the data collected, offering *insights* into learning patterns, individual and collective performance, as well as suggesting more effective pedagogical interventions. However, the digitization of assessments also poses significant challenges, such as ensuring academic integrity, combating fraud, and creating reliable assessment processes, even in virtualized environments.

However, the growing reliance on digital technologies in education exposes deep inequalities. The digital divide emerges as a critical problem, as unequal access to technology and lack of digital skills among learners can widen already existing educational disparities. More vulnerable regions, where devices, connectivity, and technological capabilities are scarce, face an even greater impact. For many students, the absence of basic resources turns the promise of innovation into another obstacle to educational inclusion.

In this scenario, hybrid solutions that unite elements of digital and traditional have gained prominence. Among these innovations, *Smart Paper* emerges as a promising technology, capable of mitigating part of the barriers imposed by the digital divide. This tool combines the familiarity of paper with the functionality of digital platforms, offering an accessible bridge for students who have difficulty accessing purely digital resources. In addition, *Smart Paper* allows the collection of data in real time, enabling instant analyses that can feed back pedagogical strategies and provide concrete subsidies for more equitable educational policies.

With the implementation of innovative technologies such as *Smart Paper*, there is an opportunity to promote a more inclusive education that meets the needs of different contexts and realities. These tools allow us to expand the scope of assessments and adapt them to

the specificities of each group of students, respecting their limitations and potential. In addition, by integrating emerging technologies into assessment practices, it is possible to prepare students to face the challenges of the future, equipping them with competencies that go beyond academic content and include digital skills and critical thinking.

This article aims to shed light on these possibilities by exploring how the convergence between large-scale assessments, virtual learning environments, and hybrid technologies can contribute to a more democratic and effective education. Through a careful analysis of the available tools and their applications, it is expected to open paths for the strategic use of the *insights* generated, which can support proactive, precise educational policies tailored to the specific demands of students in different areas and contexts, ensuring that no one is left behind in the learning process.

METHODOLOGY

The methodology used in this article is based on a qualitative methodological approach, through the analysis of existing literature to deepen the understanding of the implications of digitalization in education, with a specific focus on the convergence of large-scale evaluations and technologies of virtual learning environments and *Smart Paper*. This methodological approach was chosen for its effectiveness in providing a solid foundation for the topics under study, allowing critical analysis, essential for the advancement of educational research in the digital context.

LARGE-SCALE ASSESSMENTS AND VIRTUAL LEARNING ENVIRONMENTS

Education is one of the key elements of social development that reflects the well-being of the country's population and one of the quality of life indicators used to calculate the Human Development Index (HDI), one of the criteria for classifying developed, developing and underdeveloped countries.

Thus, the importance of large-scale evaluations to subsidize public policies in line with the social context, as well as with school practices that articulate curriculum, methodology, evaluation in favor of the quality of education, is emphasized.

Large-scale assessments refer to standardized assessments, whose primary objective is to report results beyond the individual level, aiming to measure the performance of a specific group or population in relation to predefined learning patterns or competencies. These assessments cover a wide range of items and are applied to many students, often on a regional, national, or international scale. They inform areas of improvement in the

education system and provide comparative data between different schools, regions or countries.

For Klein and Fontanive (1995, p.30):

> The objectives of the large-scale evaluation of the school system, proposed here, are to inform what populations and subpopulations of students in different grades know and are able to do, at a given time, and to monitor their evolution over the years. It is not your purpose to provide information about individual students or schools.

In these evaluations, it is possible to infer the results of educational progress, at the different levels to provide managers with subsidies for the formulation of educational policies with data that guide the establishment of quality goals, prioritization of actions and allocation of resources.

The Brazilian Constitution of 1988 conceives educational evaluation as a public demand of the State. The Basic Education Evaluation System (Saeb), Prova Brasil, the National High School Exam (Enem) and the National Higher Education Evaluation System (Sinaes) are responsible for different roles:

> 1) To gather information or evidence necessary for the formulation of educational policies, with the purpose of expanding and deepening knowledge about education systems so that the different spheres of government can define intervention priorities; and
> 2) induce changes or consolidate previously structured educational reforms for education systems. (MINHOTO, 2016, p. 78)

In addition to national assessments, there are other international monitoring studies, such as the *Programme for International Student Assessment* (PISA), coordinated and developed by the *Organisation for Economic Cooperation and Development* (OECD) and the Anísio Teixeira Institute for Educational Research (INEP). This world-class program primarily measures the reading, math, and science knowledge and skills of 15-year-old students, the approximate age range for completion of basic education in most participating countries.

In the 2018 edition (Brasil, 2020), the survey analyzed 79 countries, including Brazil, which ranked 57th. Brazil's PISA results (Schleicher, 2019, pp. 6-8), indicate a stagnation in the level of school performance of Brazilian students, with level 2 in reading, level 1 in mathematics and science, on a scale that goes up to 6. The minimum level considered adequate by the *Organisation for Economic Cooperation and Development* (OECD) is 2. In these three areas evaluated, Brazil achieved positions between "58th and 60th place in reading, between 66th and 68th in science, and between 72nd and 74th in mathematics" (Queiroz, 2021, p. 89).

From the analysis of the performance of South American countries in reading, mathematics and science (OECD, 2019, pp. 17-18), the challenging result for Brazil in the list of countries evaluated stands out. With a score of 384 in mathematics, Brazil is ahead only of Argentina (379) and shows a lower performance in relation to other countries, such as Colombia (391), Peru (400), Chile (417) and Uruguay (418), which obtained higher scores in this subject. In terms of reading performance, Brazil (413) is behind Chile (452), Uruguay (427), Colombia (412) and ahead only of Argentina (402) and Peru (401). Leading the group in science, Chile stood out with a score of 444, showing a significant difference between Brazil (404), Argentina (404), Peru (404), Colombia (413), Uruguay (426).

Brazil's performance in this assessment showed that the grades of students in Brazil were among the lowest in the world in the three areas evaluated. In addition, there is a significant disparity in student performance between public schools and private schools. Students enrolled in public schools tend to perform much lower compared to their peers in private schools.

> Internationally, students from private schools tend to perform better in PISA than those from public schools. The difference in performance found in Brazil is, however, particularly large. Public school students in Brazil score below level 2 in reading literacy four times more than private school students (57% versus 13%)3 (OECD, 2021).

This discrepancy can be attributed to a combination of factors, including financial resources available to private schools, more modern infrastructure, smaller class sizes, increased access to educational technology, up-to-date learning materials, and extracurricular programs.

In order to understand the Brazilian educational system in depth in order to direct public policies for the development of education, in 1990 the federal government instituted through Ordinance No. 931 (Brasil, 2005) the National System of Evaluation of Basic Education (SAEB) previously consisting of three large-scale evaluations: National Evaluation of Basic Education (Aneb); National Assessment of School Performance (Anresc), known as Prova Brasil; and National Literacy Assessment (ANA). However, as of 2019, they ceased to exist with this nomenclature, and all these external evaluations were identified as SAEB. Also in this year, the gradual transition to new matrices prepared in accordance with the National Common Curricular Base (BNCC) began, replacing the reference matrices used since 2001.

[3] Trecho Original: Internationally, students in private schools tend to perform better in PISA than those in public schools. The performance gap found in Brazil is however particularly large. Students from public schools in Brazil score below Level 2 on reading literacy over four times more often than students from private schools (57% as opposed to 13%).

The averages of the students' performance scores measured in the SAEB, together with the approval rates calculated in the School Census, make up the Basic Education Development Index (Ideb). This indicator was created in 2007 by the Brazilian federal government to assess the quality of education offered in the country's public schools. It offers subsidies for the elaboration of educational policies and for monitoring the quality goals of the Education Development Plan (PDE) for basic education. Also created in 2007, the PDE (Education Development Plan) is a set of actions and public policies created by the Brazilian federal government in 2007, with the objective of improving the quality of basic education in the country. It is composed of 20 goals that comprise various aspects of education, such as valuing teachers, access to early childhood education, improving school infrastructure, among others.

The Basic Education Evaluation System (Saeb) and the Basic Education Development Index (Ideb) are surveys organized by the National Institute of Educational Studies and Research Anísio Teixeira (Inep), which conducts and disseminates these studies every two years.

Portuguese Language and Mathematics tests are applied in a census form to students from urban and rural public schools in the 5th and 9th grades of Elementary School and 3rd grade of High School. By sampling, students in the 9th grade of Elementary School in some public schools also take tests in Natural Sciences and Human Sciences. Also by sampling, students from the 5th grade, 9th grade EF and 3rd grade of High School from some private schools take Portuguese Language and Mathematics tests and students from the 2nd year of Elementary School from some public and private schools take Portuguese Language and Mathematics tests.

In addition, questionnaires are applied to students, teachers, principals and municipal secretaries of education. These tests are prepared by a team of experts composed of multiple-choice and discursive items, which assess both the knowledge and skills and competencies of the students and use in their construction and application a methodology that allows the evaluation of education networks or systems, and not the students individually as the tests applied by the teachers.

For the analysis of standardized tests, the Item Response Theory (IRT) is used, a complex statistical approach that takes into account not only the number of correct answers, but also the characteristics of each question of the test, assuming that they have a difficulty and discrimination, which may vary according to the characteristics of the group of individuals being evaluated.

> IRT is a set of models where the probability of response to an item is modeled as a function of the student's proficiency (non-observable variable) and parameters (which express certain properties) of the item. The higher the proficiency, the greater the probability that the student will get the item right (KLEIN & FONTANIVE, 1995, p. 31).

Item Response Theory (IRT) is a more recent and advanced approach to the analysis of standardized tests in view of some limitations of Classical Test Theory (TCT), which has been widely used in the educational field, including school assessments and university admission tests. For Soares (2018, p. 38) "the main difference between these theories lies in the fact that the first offers an approach in which the total score of the test is investigated, while in the second, the properties of each item are investigated individually."

One of the main advantages of Classical Test Theory (TCT) is its simplicity to calculate and understand the result of an assessment, in addition to not requiring assumptions for its application in different contexts. However, in this theory, each constructed test has its own scale, as this theory is not able to provide a common scale to compare the performance of individuals in different forms of the test and between different classes of students, such as the Item Response Theory (IRT), unless the conditions of application and correction of the test are strictly standardized and controlled, which is difficult in practice.

Another major difference between the two theories is the ability to identify the students' occasional hits, that is, the kicks (Brasil, 2011). Classical Test Theory (TCT) cannot make this identification. The Item Response Theory (IRT) does not only consider the number of correct answers, but also the difficulty and discrimination of each item of the test (Soares, 2018). It is able to evaluate students fairly and objectively, considering the difficulty of the questions that they got wrong or got right, based on the coherence of their answer pattern, thus pointing out the candidate's real ability in each area of knowledge.

Increasingly used in large-scale international assessments such as the Program for International Student Assessment (PISA), and also in Brazil, such as the National High School Exam (ENEM) and the Basic Education Assessment System (SAEB) (Costa, 2022, p. 46), the Item Response Theory (IRT) has been arousing the interest of educational institutions to subsidize the necessary pedagogical interventions.

In this sense, it should be noted that large-scale assessments in education are taking the direction of computerization in the application of standardized tests, as can already be seen with the implementation of the National High School Exam (ENEM) in digital format, using the same format as traditional tests, but carried out on computers, with consolidation

expected by the year 2026, when the application of the printed test will be extinguished (Brasil, 2019, pp. 8-13).

Considering the various advances that this new application format will bring, the possibility of interactive questions of multiple file types and extensions stands out, as well as the possibility of increasing inclusion and accessibility with tests adapted to the needs of people with special needs.

There is already a wide range of technologies with a variety of *online* resources to help teachers and experts assess students according to needs. In this sense, many virtual learning environments are not yet able to assess the full spectrum of skills and competencies that are desired to be developed in students, but this technology can help make assessments more efficient, personalized, and accessible.

With the progress in psychometric research and the development of the capabilities of virtual learning environments, several platforms, including *Moodle*, *Canvas* and *Blackboard*, can also implement Item Response Theory (IRT) through computerized adaptive tests (TAC).

> The Computerized Adaptive Tests, known by the acronym TAC, are basically questionnaires that can be made available in digital media, where the items can be customized and adapted as the student answers them. The TAC make it possible to analyze the student's ability, after the completion of the questionnaire (ORTEGON, 2019, apud ADOLFO, 2021, p. 18)

Unlike traditional tests that are made up of the same questions for all students, adaptive tests are assessments that dynamically adapt to each student's performance during the test, according to their own estimated skill level. If the student answers one question correctly, the next question will be a little more difficult. If he answers incorrectly, the next question will be a little easier. Adaptive tests are common in standardized assessments, but they can also be used in summative and formative assessments.

These environments provide different tools and *plug-ins that allow the creation of IRT-based tests, such as the Adaptive Quiz plugin,* Adaptive Quiz in *Moodle* via R and the *Test Generator* for *Canvas*.

These virtual learning environment tools based on Item Response Theory (IRT) can be customized according to the specific needs of each subject and take into account individual student differences and the characteristics of test items to provide more accurate and equitable assessments.

Although incipient, a broad effort to integrate technology, psychometrics and educational theory has been gaining momentum in the arena of large-scale assessments. This effort seeks to develop more appropriate public policies, employing an evaluation

system that can effectively inform about the needs and performance of students, aiming to improve the quality and effectiveness of educational interventions.

VIRTUAL LEARNING ENVIRONMENT AND *LEARNING ANALYTICS TOOLS*

With the emergence of virtual learning environments (VLEs) and the possibility of these systems collecting large volumes of data (*big data*), which can be analyzed to reveal patterns and trends, researchers and education professionals have focused on the development and use of analytical methods to understand and improve learning experiences.

The term *big data* refers to extremely voluminous, complex, and varied data sets that are collected, stored, and processed in order to obtain *insights*, identify patterns, and support informed decision-making. The use of *big data* techniques and technologies makes it possible to analyze and interpret this data to identify trends, patterns, correlations, and *insights* in various areas, such as marketing, health, finance, logistics, science, security, among others.

In the educational context, this data can come from records of activities and performance in tests. The natural transition of this information to more structured practices has led to the development of the field of *Learning Analytics*, a practice centered on the learning process that involves the collection, processing, analysis, and interpretation of large data sets, using statistical and computational techniques of educational data mining and predictive modeling, to understand and improve the teaching and learning process.

The goal of *Learning Analytics* is to "provide data-driven evidence in order to assist teachers and students in improving teaching and learning processes" (Freitas et al., 2020, p. 73). This tool is designed as an extension of the evaluation process, as it allows the teacher to identify the subjects in which students are facing difficulties and based on this information, adjust the content or pace of the classes and provide personalized *feedback* to students.

Siemens and Baker (2012, as cited in Bassani & Cazella, 2021) point to the use of *Learning Analytics* "to provide personalized experiences and align pedagogical strategies in an assertive way for different student profiles". In this sense, this tool can also help identify which evaluative pedagogical practices are succeeding and which need to be adjusted or improved. The main applications of this tool include the identification of learning patterns, student behavior and possibilities for collaboration in the learning environment.

The data mining task can use descriptive, prescriptive, and predictive data modeling. Modeling education data is important because it helps to transform data into useful information that can be used to improve education.

The descriptive model assumes the discovery of interesting patterns or associations between existing data, to provide *insights* into students' performance, identify areas where they need more support, and understand the impact of specific interventions.

In the predictive model, it is possible to "discover patterns and capture relationships in historical and current data, allowing the future projection of a given event" (Filatro, 2021, p. 20). Through parameter-based predictive modeling, it is possible to "predict" the student's behavior (Biagiotti, 2021, p. 71) and performance; their engagement and participation in the evaluation activities; identifying subjects where students had the greatest difficulties and even identifying those who are involved in some type of risk and carrying out intervention to help them achieve success. Through predictive modeling, it is also possible to compare teaching practices to obtain a prediction about the favorable and unfavorable points of each approach.

Prescriptive data models are used to provide recommendations on actions that should be taken to improve student performance. They utilize data analysis to verify pedagogical best practices, as well as recommend interventions for students based on their performance and academic record.

Another field of data mining research is that of explanatory modeling, which seeks to identify interpretable causal relationships between structures that can be observed from collected educational data that could lead to improvements in learning outcomes.

Rosé et al. defendem que:

> [...] explanatory models of the learner, whose objective is to enable a knowledge-oriented use in technology-based education. Learner explanatory models not only provide an accurate prediction, but also offer actionable insights that can better advance both learning science and educational practice.4 (ROSÉ et al., 2019, p. 2944)

This model aims to identify the factors that influence the learning process and student performance. They are built on machine learning algorithms that manipulate data collected from student activity records in virtual environments.

It should be noted that these models must be used carefully and ethically, in order to ensure the security of the student's data.

[4] Trecho Original: explanatory learner models, the goal of which is to enable insight-driven use of such analytics in technology-enhanced education. Explanatory learner models do not just provide accurate prediction, but also offer actionable insights that may better advance both learning science and educational practice.

The way Learning Analytics data and information is presented can be done through *visual and interactive dashboards that can also be customized according to the needs of teachers and students to monitor their own performance.*

According to Filatro (2021, p. 58), "the construction of *dashboards* is not trivial: identifying what information is relevant and the way to present it so that it is really useful lacks not only technique, but also perception and experimentation very close to the end user."

Student-oriented dashboards are among the most prominent responses to improve their learning experience, encouraging reflection on the relationship between behavior and results obtained, thus contributing to self-regulated learning, allowing the student to take responsibility for their own learning.

AS FERRAMENTAS DE *LEARNING ANALYTICS*

Virtual learning environments can provide a variety of *Learning Analytics tools* to support the task of monitoring student performance and identifying the points that generate the greatest difficulty so that necessary adjustments can be made.

Learning success is not only revealed in students' grades, but also in their learning experiences. When the student uses a virtual learning environment, their actions are recorded, leaving traces that provide important information about the development of the student's learning.

With the information produced, it is possible to:

> [...] understand the progress of students throughout a program, course or discipline, and qualify their interaction with content, tools and people. From this data-based understanding, it is possible to build better pedagogical proposals, enable students to play a proactive role in their learning, identify students at risk, and evaluate factors that affect the completion and success of studies. (FILATRO, 2019, p. 4)

With *Learning Analytics* tools, the teacher can monitor the progress of the class and the student individually, personalize the learning process for each student, identifying their deficiencies and encouraging their improvement, identify in which content students have the most difficulties, enabling the adjustment or complementation of activities or even curricular changes.

Learning Analytics *tools* have some limitations, as information about learner behavior may not reflect an accurate representation of their engagement and learning.

This inference away from the real context can lead to inappropriate conclusions about their behavior and unnecessary interventions. Therefore, it is important that teachers seek to obtain more comprehensive information to understand student behavior in the

virtual learning environment. This information can be obtained in a variety of ways, such as direct observation, interactions, reflective activities, group discussions, learning journals, or even through open communications with parents or guardians. This information may include interests, extracurricular activities, life experiences, family issues, or significant events that may affect students' academic performance or emotional well-being.

Most of the reports come from log data on attendance, activity participation, social interactions, course progress, assessment results, resource usage, completion rates, and more.

Learning Analytics *tools* can broaden teachers' horizons for improving evaluation processes. Many still lack a user-friendly and understandable interface, but developers seem to be striving to make them more accessible by applying visualization techniques that may include, but are not limited to, statistical graphs and heat maps to achieve better results.

There are several *Learning Analytics* tools that can differ in terms of functionality and price, and it is necessary to evaluate the teacher's needs for a careful choice of each of them.

Some data analysis tools are already integrated into virtual learning environment platforms, others can be implemented through *plug-ins. In addition, there are still independent data analysis platforms, such as Tableau* and *Power BI,* that can be connected to external data sources. However, in some cases it is necessary to integrate them with the platform to analyze educational data.

Among the free tools available for virtual environment platforms, the following stand out:

- ***Moodle Learning Analytics***

Moodle Learning Analytics is a feature that enables the collection, analysis and interpretation of educational data within the *Moodle* platform, allowing teachers to make informed decisions about student performance in various types of activities and personalise teaching as needed for each student.

It is an open system that allows external developers to create applications and services through the Application Programming Interface (API), *software* that allows different applications to communicate and interact with each other.

As of version 3.4, *Moodle Learning Analytics* has become a native feature of *Moodle*, but it is not enabled by default in all installations, and it is necessary to configure it. In older versions it is necessary to install the *plug-in*.

- ***Quiz Analytics***

The *Quiz Analytics* tool allows the collection of data on students' performance in quizzes. The user can see different graphs depicting metrics such as the number of questions answered correctly and incorrectly, the number of attempts, the time students spend on each question, or the quiz completion rate.

Commercial tools include:

- Intellboard

IntelliBoard is designed to build advanced analytics and reporting on student activity on platforms such as *Moodle*, Canvas, Blackboard, and others.

IntelliBoard collects and interprets data to support the decisions of teachers, instructors, and administrators. It offers real-time monitoring on a single dashboard with graphical data visualizations, as well as report customization options that can track student and teacher activity and performance.

- LearnerScript

LearnerScript is a commercial learning analytics tool that generates various types of custom and interactive reports and charts. It provides access panels with different functionalities for teachers and students. Another important feature is instant communication with students directly from the report, where the teacher can send messages or alerts with *email notification* with important information, deadlines for the delivery of assignments or *personalized feedback*.

Considering the above, it is evident that *Learning Analytics tools, present in virtual learning environments, can contribute significantly to large-scale assessments. By analyzing large volumes of data generated, they provide insights*, facilitating a more detailed understanding of student performance and identifying systemic factors that affect learning. This wealth of information allows us to adopt a more personalized and adaptive approach to assessments, overcoming the limitations of traditional methods, which often fail to address the complexity of the learning process.

In this way, the application of *Learning Analytics* in large-scale assessments can help shape more efficient educational policies, by providing concrete evidence in different contexts and for different groups of students. This allows educators and policymakers to make more informed decisions in order to foster a more inclusive, personalized, and tailored educational environment

ACADEMIC INTEGRITY AND THE FIGHT AGAINST FRAUD IN VIRTUAL LEARNING ENVIRONMENTS

As we advance in the use of virtual learning environments in assessments, the need to address challenges related to academic integrity becomes even more pressing. This is because no system is totally free from fraud in the face of human action, despite continuous efforts to ensure security and fairness in evaluation systems.

Assessment activities in virtual learning environments are fundamentally characterized by a variety of potentially positive factors, but their use needs to be carefully monitored to mitigate risks associated with academic fraud.

While virtual learning environments offer convenience and flexibility to students, allowing them to take assessments at their own times and locations, this same flexibility can create opportunities for dishonest academic practices. The absence of direct oversight during *online assessments* can make it more difficult to detect and prevent fraudulent behavior, such as plagiarism, sharing responses, or unauthorized consultation with external resources.

Therefore, it is necessary to implement effective security and integrity measures in virtual learning environments. Among them, we can highlight real-time monitoring, capturing images and ambient audio to identify suspicious behavior; facial recognition or biometric authentication to ensure that the student is actually the one taking the assessment; access restrictions, blocking the student's access to other resources such as other browser tabs; anti-fraud software that detects suspicious patterns such as reduced time to answer a question or identical answers; randomization of responses among others that are still under development.

In addition, school computer labs can be used to apply online assessments , providing a controlled environment, where it is possible to ensure the security and integrity of the assessment process, minimizing the chances of fraud or misuse of information.

Also, it is important to educate students about the ethical principles of academic integrity and the consequences of dishonest practices, promoting a culture of accountability and honesty in assessments.

Virtual learning environments have control devices that allow auditing of the entire educational process. Auditing is a fundamental tool for maintaining this teaching modality, ensuring the transparency of the process and obtaining good results in its implementation. In addition to clear rules, the regulation should define who are responsible for auditing management authority and their responsibilities.

In this sense, it should be noted that basically audits in virtual learning environments are divided into technical and pedagogical. The technical auditor is responsible for the entire information system and its infrastructure. This role can be performed by a specialist or by a group of information technology (IT) specialists. The pedagogical auditor, on the other hand, is responsible for controlling the evaluation process.

SMART *PAPER TECHNOLOGY* IN LARGE-SCALE ASSESSMENTS.

The evolution of digital technology in large-scale educational assessment can optimize the efficiency of assessment processes by simplifying the administration, collection, and analysis of data on a broad and diverse scale. However, even in the face of these remarkable advances, a significant portion of the student population remains excluded from access to technological tools that are fundamental to the learning process. Traditionally, the introduction of digital technologies in the classroom can be accompanied by accessibility challenges, especially in disadvantaged or developing communities.

In the context of large-scale assessment, the digital divide emerges as a challenge, since some students could not take the tests due to lack of access to electronic devices and digital resources. This can have direct implications on the participation of these students, compromising the process, effectiveness and validity of these assessments.

The lack of essential digital resources can intensify the disparities already present in the education system, resulting in difficulties for students to keep up with the school curriculum and fully engage in educational activities. This gap in accessibility to technology not only harms the individual development of students, but can also have broader implications, such as a lack of data or results in certain areas, which in turn can hinder the development and implementation of effective public policies in the field of education.

Given this scenario, it is imperative to seek innovative and inclusive solutions that can overcome the barriers of digital exclusion and ensure that all students have equitable access to education. It is in this context that *Smart Paper technology* emerges as a promising alternative, offering a comprehensive and accessible approach that seeks to reconcile traditional paper assessment methods with the advantages of the digital world.

> Smart Paper impacts nearly 5 million students in the state of Rajasthan, India, by enabling the equitable collection of educational data in 65,000 public schools. The government uses Smart Paper to measure students' competency levels and enables around 300,000 teachers to personalise learning in their classrooms.5 (PATEL, n.d.)

[5] Trecho Original: Smart Paper impacts nearly 5 million students in India's Rajasthan state by enabling equitable educational data collection in 65,000 public schools. The government uses Smart Paper to measure the competency levels of the students and enables nearly 300,000 teachers to personalize learning in their classrooms.

A *Smart Paper* is a technological innovation that combines the traditional paper format with digital resources to provide a more dynamic educational experience. This technology allows the use of conventional equipment and materials without the need to purchase specific paper, printers or *scanners* .

Smart Paper is capable of communicating with electronic devices, such as *smartphones*, *tablets* or computers, through technologies such as *Radio Frequency Identification* (RFID), *Near Field Communication* (NFC), QR codes or specific printing technology. This enables direct interaction between paper and digital devices. Integration is made possible through a range of advanced technologies, including Application Programming Interfaces (APIs), which promote communication between *Smart Paper* and digital systems.

> Competency-based assessments in the state of Rajasthan, developed by Smart Paper, provide actionable data on each child's learning competencies. Paper-based assessments reach all children in grades 3-8 without infrastructure and technology limitations.6 (BRAND STORIES, 2024)

This technology enables an efficient and accurate evaluation of discursive questions. Using features such as handwriting recognition and natural language processing, it allows students to answer discursive questions directly on paper. This streamlines the correction process and expands the possibilities of large-scale educational assessment, making it more comprehensive, accurate, and tailored to the needs of students and educators.

In addition, *Smart Paper* offers the digital storage and sharing of information, which is especially relevant in the context of large-scale evaluation, allowing the results to be easily compiled, analyzed, and shared among those responsible for the evaluation, contributing to a more efficient and accurate management of evaluation data.

FINAL CONSIDERATIONS

The introduction of these innovations brings to light the growing permeability of technology in teaching and learning, offering new perspectives and approaches to large-scale assessment.

The adoption of virtual learning environments in these assessments makes it possible to collect and analyze data through *Learning Analytics* tools, revealing trends and gaps in the learning process. In addition, the application of techniques such as data mining

[6] Techo original: The competency-based assessments in Rajasthan state powered by Smart Paper provide actionable data about every child's learning competencies. Paper assessments reach every grade 3 to 8 child without limitations of infrastructure and technology.

and machine learning, offers the ability to track, measure, and analyze a wide range of aspects of human behavior and cognitive capabilities during assessments, allowing for a detailed analysis of how students interact with the assessment environment, including their behavior patterns, personality traits, attitudes, cognitive processes and diverse skills.

During an evaluation on these platforms, each click, response time to each question, navigation patterns on the platform, among other aspects of interactions are collected and analyzed. This data, when processed, reveals patterns and trends that can indicate, for example, which questions were more challenging, how different types of students approach problems in different ways, or even identify possible cases of academic dishonesty.

These *insights* enrich the understanding of students' performance and offer a more holistic and detailed view of their overall competencies, including problem-solving skills and the ability to cope with pressure. These analytics can help educators and developers of these environments to continuously improve teaching and assessment processes, customizing them to meet the specific needs of different student profiles and enhancing the interactivity and effectiveness of online learning platforms.

On the other hand, Item Response Theory (IRT) can be incorporated into these environments, transforming the creation and application of educational assessments. This integration facilitates the elaboration of tests that adjust the complexity of the questions in real time, adapting to the individual performance of the students. This proves particularly effective in Computerized Adaptive Testing (TAC), where the difficulty of the questions is automatically calibrated as the student's response progresses, optimizing the assessment experience.

It is important to highlight the importance of students having well-developed digital skills so that they can fully demonstrate their knowledge in large-scale assessments using virtual learning environments. Otherwise, they may face difficulties in using these platforms during the process, compromising the result of the evaluations. In this sense, it is essential that educational institutions incorporate education in digital skills into their curricula and pedagogical practices to overcome the challenges imposed by the digital age in educational assessments.

In addition, for large-scale evaluations in virtual environments to be successful and their integration into public educational policies to be effective, attention to challenges related to academic integrity and data security is necessary to preserve confidence in the evaluation process. The implementation of these technologies in regions without adequate technological infrastructure faces major challenges, since the lack of access to specific equipment and materials can make the use of these innovations unfeasible.

Recognizing the urgency of ensuring equity in education and the importance of providing accessible solutions to all students, regardless of their location or economic status, *Smart Paper* technology emerges as a way to democratize access to educational assessments in a way that does not rely on advanced technologies or complex infrastructure resources. Prioritizing simplicity and effectiveness, *Smart Paper* makes it easy to take assessments by employing basic features that are widely available, ensuring that every student, in any context, can be assessed fairly and accurately.

This solution, adaptable to the resources and tools already existing in schools and communities, facilitates the execution of large-scale evaluation processes and the realization of advanced educational activities. In this way, a range of possibilities is opened up for the significant expansion of data collection and analysis related to the learning process of students from remote or underdeveloped areas,

In this way, it is possible to obtain more accurate and representative educational measures of students' abilities, overcoming the geographical and infrastructure limitations that often compromise access and quality of education.

This democratization of access to rich and detailed educational data allows authorities to make evidence-based decisions about necessary interventions, resource allocation, and development of more effective strategies to improve educational outcomes.

In addition to being able to overcome geographical and infrastructure barriers, these technologies pave the way for the development of assessments for groups that have historically been forgotten or not properly assessed, such as those with some type of disability or learning disorder. This advance also facilitates the inclusion of a broader spectrum of learners, ensuring a fair and representative assessment of their skills and knowledge.

Another significant benefit of large-scale digital assessments lies in the ability to incorporate a variety of media, such as images, videos, and sounds, into their assessment formats. This multifunctionality enriches the assessment process, making it more engaging and interactive, finding direct resonance in the theory of learning styles, which recognizes the diversity in the ways individuals absorb and process information, as well as ensuring that students can demonstrate their knowledge and skills in the most appropriate way.

As technology is progressively integrated into the educational process, there is a transformation not only in the methods of content delivery, but also in the modalities of interaction between students and between them and the didactic material. As a result of this integration, there is a need to evolve evaluation methods, in order to incorporate, in addition to the measurement of conventional knowledge, the evaluation of digital skills, collaboration

skills in online environments, and the ability to solve problems within virtual contexts. In this context, it becomes essential and imperative to train teachers, who need to be prepared to use these new tools and incorporate them into their pedagogical practices.

By reflecting on the current landscape and potential future trajectories of education, the integration of technologies in large-scale assessments marks an important step towards building a more equitable, effective, and adaptive education system. The transition to digital assessment practices is not only a response to the demands of an increasingly digitized world, but also an opportunity to rethink and revitalize educational processes, making them more relevant to the needs and challenges of the twenty-first century. This change paves the way for exploring new learning perspectives, enabling each student to fully develop their potential in an ever-changing world.

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DENGUE IN PREGNANT WOMEN: A POTENTIAL THREAT TO MATERNAL-FETAL OUTCOMES?

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ABSTRACT

INTRODUCTION: Dengue is an acute febrile disease caused by the DENV virus and transmitted mainly by the Aedes mosquito. It is an endemic disease mainly in countries in Asia and America. The clinical course is usually divided into three phases: febrile, critical and recovery, with fever being the initial symptom, sometimes accompanied by anorexia, vomiting, diarrhea and maculopapular rash. The critical phase is characterized by increased capillary permeability, which results in hemorrhage, shock and organ dysfunction due to fluid accumulation, gradually reabsorbed in the recovery phase. The diagnosis of dengue is made based on the detection of the NS1 antigen; the genome, by RT-PCR; or IgM or IgG antibodies. Treatment is only symptomatic. During pregnancy, studies suggest that there is an increase in adverse maternal-fetal outcomes due to DENV infection, in addition to the challenging diagnosis, due to the physiological adaptations of pregnancy. In this context, this systematic review aims to analyze how dengue behaves in pregnant women and the outcome of the infection. METHOD: searches were performed in PubMed, using the keywords “dengue pregnancy”, in LILACS, using “dengue pregnancy” and “dengue embarazo”, and in Scielo, using “dengue pregnancy”. A total of 188, 18, 21 and 1 results were obtained, respectively, and after exclusion by title and abstract, and by full text, 32 articles were included. RESULT: of the maternal outcomes, severe thrombocytopenia and death were the most cited in the articles, followed by postpartum hemorrhage, more severe forms of the disease, need for cesarean section and preeclampsia. The most prevalent fetal repercussion was prematurity, in addition to stillbirths, neonatal deaths, low birth weight and oligohydramnios. DISCUSSION: The articles analyzed suggest that dengue during pregnancy increases the risk of severe forms of the disease, postpartum hemorrhage, maternal death, miscarriage, stillbirths, fetal growth restriction, prematurity, and oligohydramnios, especially in cases of infections acquired in the third trimester of pregnancy. Vertical transmission also increases at the end of pregnancy. CONCLUSION: This review highlights that dengue is especially relevant during pregnancy, with a significant negative impact on maternal and fetal outcomes. However, further studies are still needed for greater depth, since there is no consensus.

Keywords: Dengue. Pregnancy. Arbovirus disease. Fever.

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INTRODUCTION

DEFINITION

Dengue is an acute infectious disease caused by an arbovirus and transmitted by arthropods, especially by the mosquito of the genus Aedes, mainly the species Ae. aegypti. The disease presents a systemic and dynamic picture, with a wide spectrum of clinical manifestations, which vary from uncomplicated cases with mild, spontaneous or induced presentations, such as thrombocytopenia, to complicated forms such as dengue hemorrhagic fever and dengue shock syndrome [1]. Furthermore, dengue can be considered a global public health problem, both due to its occurrence throughout the globe, in an endemic, sporadic or epidemic form, but also due to its significant epidemiological and economic impact [1, 2,3]. The dengue virus, DENV, belongs to the Flaviviridae family and the Flavivirus genus, and has four different serotypes (DENV 1-4), each with distinct genotypes and lineages [1, 2, 3].

Furthermore, the dengue virus is characterized by being enveloped with icosahedral symmetry, a diameter of approximately 50 nm, and having its genome composed of a single strand of positive-polarity RNA [3]. This RNA encodes a single polyprotein that is cleaved into the structural proteins of the capsid (C), membrane (M), and envelope (E), in addition to eight nonstructural proteins (NS). In this context, the structural glycoprotein E is related to cellular recognition and promotion of entry, while the NS proteins assist in the replication of the viral genome [3].

EPIDEMIOLOGY

Dengue is one of the main vector-borne diseases, representing a major public health problem worldwide, with approximately half of the world's population at risk of becoming infected with the virus, with estimates of 100 to 400 million new cases per year, according to WHO data from 2021 [3,4]. In 2019, the same institution mentioned declared dengue as one of the “top ten threats to global health” that year, which reiterates its relevance, seriousness, and potential impact on health [3]. Furthermore, dengue is considered endemic in more than 100 countries, predominantly in tropical and subtropical areas, such as Africa, the Americas, the Eastern Mediterranean, Southwest Asia, and the Eastern Pacific; of these, the Americas are one of the most severely affected and Asia accounts for approximately 70% of the global burden of the disease. [4]

In the global context, the incidence of dengue virus infection has grown significantly across the globe in recent decades, with an increase from 505,430 cases reported to the WHO in 2000 to 5.2 million in 2019. This increase in the number of cases and the worldwide

spread is related to rapid urbanization with the growth of urban and semi-urban areas, combined with inadequate infrastructure planning, which favors the mosquito's life cycle and makes it difficult to combat it, in addition to the large number of trips between continents, which favors the disease being transmitted to new environments. [3]

Regarding the most recent data, 2023 was the year with the highest number of dengue cases recorded in the Americas, with a total of 4,565,911 cases and 2,340 deaths [5]. This situation continued until 2024, when data from epidemiological weeks 1 to 5 showed a 157% increase in the number of cases compared to the same period in 2023 and a 225% increase compared to the average of the last 5 years [5]. Until epidemiological week 12, the trend of increasing cases in 2024 compared to the same period in 2023 continued [6].

Also in 2024, up to the time of this study, there were 2,573,293 probable cases of dengue, 1,456 deaths under investigation and 923 confirmed deaths. Regarding gender, the disease is more prevalent in women, who represent 55.4% of probable cases, while men total 44.6%. In terms of race, mixed race people account for 39.8% of cases, followed by white people (36.7%), no information (16.3%) and black people (5.7%). In terms of age, the infection is more common in the 20 to 29 age group, in both sexes, and more serious in the age group from 80 years old. Finally, the most affected states are the Federal District, Minas Gerais, Espirito Santo, Paraná and Goiás.. [6]

PATHOPHYSIOLOGY

An individual becomes infected with DENV through the bite of the Aedes aegypti mosquito, and from then on, the virus begins its life cycle within the human body, with viral entry and fixation, going through several stages until the release of mature DENV particles.

In its mature form, the virus can circulate freely in the plasma or inside monocytes/macrophages, cells for which DENV has tropism and are the largest sites of viral replication, as well as in striated muscle cells, smooth muscle cells, fibroblasts and local lymph nodes. In this scenario, general symptoms such as fever and malaise coincide with the period of viremia, a time when serum cytokine levels are high. High serum levels of interleukins, tumor necrosis factor, interferons and platelet activating factor are also observed. [7]

Regarding the immune response to dengue virus infection, dendritic cells are the connectors between the innate and adaptive immune responses during the invasion of viral particles. These cells present the target antigen to T cells, especially TCD8 and TCD4, as the starting point of the innate immune response [8].

In addition, the complement system is of great importance in blocking infection by the

virus in the initial phase of the innate immune response. However, the immune evasion of DENV can be facilitated by NS1, when it interacts with the respective complement components in different pathways of their activation. As a consequence, this alters the functionality of the complement components and generates inhibition of their response. Another mechanism involved is the production of interferons, which control viral replication in its initial phase, as the first line of defense. [8]

There is also a paradoxical immune response mechanism, which harms the infected individual and is responsible for the immunopathology of hemorrhagic dengue. This occurs after sequential infections by DENV, in which the antibodies previously produced by infection by another viral type do not neutralize the second infecting virus and amplify the infection, facilitating the penetration of macrophages by the new infecting type. This is the phenomenon of facilitation by antibodies of viral penetration into macrophages, which leads to their activation by lymphocytes and aggression by cytotoxic cells, resulting in the release of thromboplastin, initiating coagulation phenomena and the release of complement-activating proteases, causing cell lysis and shock [7].

In summary, hemorrhagic dengue is caused by an anomalous immune response, which involves leukocytes, cytokines and immune complexes, leading to increased permeability due to poor vascular endothelial function, without destruction of the endothelium, with extravasation of fluids into the interstitium, causing a drop in blood pressure and hemorrhagic manifestations, associated with thrombocytopenia [7].

Regarding antibody production, structural protein E defines the production of antibodies specific to the viral type through its epitopes, in addition to being vital for the binding of the virus to the membrane receptor and having the most important antigenic domains. Antibodies produced against NS1 promote viral lysis by fixing the complement; however, they are not capable of neutralizing viral particles, acting as mediators of cytotoxicity phenomena by lymphocytes, through their receptors for the Fc portion of immunoglobulins. Furthermore, the humoral response produced by plasma cells resulting from the activation of B lymphocytes is usually vigorous [7]. Finally, susceptibility to DENV is universal, that is, when an infection by the virus occurs, acquired immunity is permanent and long-lasting for a specific serotype (homologous). Furthermore, through the mechanism of cross-immunity (heterologous), the individual also acquires partial protection against infection caused by the other three DENV serotypes, but this lasts only two or three months after the first infection. This is because the NS1 protein shares its similar sequence in up to 70% of dengue serotypes and also shows similarities ranging from 40-50% with other flaviviruses [2, 3].

LIFE CYCLE

The main form of transmission of dengue to humans, in the urban cycle, is through the vector route, through the bite of infected female Ae. aegypti, in the human-vector-human cycle [2]. This begins when a mosquito bites a person infected with the virus, which initially generates an infestation of the epithelial cells of the mosquito's midgut, followed by rapid viral dissemination within the arthropod, reaching the salivary glands and other tissues, thus making the mosquito capable of transmitting DENV to uninfected humans through its bite, closing the human-vector-human cycle [9].

Also in relation to Ae. aegypti, it is a mosquito with opportunistic habits, which lives close to humans, mainly in urban areas and in regions with high population density, especially those with disorderly occupation that provide more breeding sites for females to lay eggs. In this context, the main breeding sites are water tanks, gallons and barrels, but also small reservoirs such as plant pots, clogged gutters, bottles, open-air garbage, among others. It is in these places, associated with clean, still water, that the female mosquito can lay her eggs, on the walls of the breeding sites, very close to the surface of the water [10].

Regarding mosquito activity, it is most active in the early morning and at dusk, which are the periods of greatest risk for bites and consequent transmission of the disease [5]. In general, females feed every 3-4 days, with hematophagy being important for the complete development of the eggs and their maturation in the ovaries [5, 10].

CLINICAL PICTURE

Dengue is, by definition, an acute, systemic and dynamic febrile disease, with a broad clinical spectrum. [1] There may be asymptomatic patients, but in general, it is a debilitating and self-limiting pathology, with a benign evolution in most cases. However, some may evolve into severe forms or even death. [2]

The evolution usually occurs in three clinical phases: febrile, critical and recovery. In the febrile phase, the first symptom is generally a fever above 38ºC, but this can vary from 39 to 40ºC, with an abrupt onset and duration of two to seven days. There may also be associated anorexia, nausea, vomiting and diarrhea, in addition to maculopapular rash, mainly on the face, trunk and limbs. After the febrile phase, most patients recover gradually. [2]

The critical phase begins with the decline of fever, between the third and seventh day. The warning signs, resulting from increased capillary permeability, can evolve into shock due to plasma leakage, severe hemorrhages and severe organ dysfunction. Some of the warning signs are: severe abdominal pain (reported or on physical examination),

continuous vomiting, fluid accumulation (ascites, pleural effusion, pericardial effusion), postural hypotension and/or fainting, lethargy and/or irritability, hepatomegaly greater than 2 cm below the costal margin, mucosal bleeding and progressive increase in hematocrit [2]. Thinking about the early identification of warning signs, it is essential to perform the snare test, even if dengue is suspected.

Thus, as mentioned above, without adequate management of the critical phase, patients progress to severe forms of dengue, marked by shock, fluid accumulation resulting from plasma extravasation, respiratory distress, severe bleeding and signs of organ dysfunction in the heart, lungs, kidneys, liver and central nervous system. Dengue shock syndrome (DSS) occurs when a critical volume of plasma is lost due to extravasation, generally between the 4th and 5th day of illness. Shock sets in quickly and lasts for a short time, so that the patient may die within 12 to 24 hours.

The third characteristic period of dengue fever is called the “recovery phase” and occurs 24 to 48 hours after the critical phase, with the gradual reabsorption of the fluid that had leaked into the extravascular compartment, and this process persists for the next 48 to 72 hours. This leads to an improvement in the general condition and appetite, a decrease in gastrointestinal symptoms, hemodynamic stabilization, and an improvement in urinary output. The rash may persist during this phase, and there may also be bradycardia and changes in the electrocardiogram. [2]

DIAGNOSIS

The World Health Organization (WHO) suggests that serological methods be used to diagnose DENV and that genomic techniques be used to directly detect the virus. [1]

Based on simple suspicion, a blood sample must be collected for diagnosis. Within 8 days (preferably 5) after the onset of symptoms, blood samples must be processed for NS1 detection, and for genome and serotype detection, using the RT-PCR technique. From 8 to 15 days after the onset of symptoms, IgM is searched for using the ELISA technique; and, after 15 days, IgG is searched for. [1]

Non-structural protein 1 (NS1) is a highly conserved glycoprotein, present in high concentrations in the serum of patients infected by the virus and, because of this, it can be identified soon after the onset of acute symptoms and before antibody positivity. This is a direct method for diagnosis. [2] Given that NS1 detection is quite specific but not very sensitive, samples negative for this antigen cannot be considered negative for dengue, and should be confirmed by detection of IgM and IgG. [1]. Furthermore, considering potential differential diagnoses, all samples negative for dengue are screened for Zika virus and,

later, for chikungunya. [1] Other indirect diagnostic methods include: demonstration of seroconversion in antibody titers by hemagglutination inhibition (HI); 4x change in plaque reduction neutralization test (PRNT) titer, in paired samples, the first collected from the 6th day after the onset of symptoms and the second 15 days after the first; or anatomopathological, with histopathological and viral antigen testing by immunohistochemistry (IHC), no more than 48 hours after death. [2]

PREVENTION AND TREATMENT

Vector control, in an attempt to reduce the spread of Aedes aegypti, can be done by avoiding the accumulation of water, which favors the reproduction of the mosquito, in addition to the use of insecticides and repellents, composed of N,N-diethyl-3-methylbenzamide (DEET), which is highly effective against the mosquito. Vector control is based on the assumption that, by reducing the concentration below the entomological threshold, transmission can be delayed [9].

Dengue control in the country faces difficulties and challenges such as: bureaucracy imposed by shared responsibilities and favoring the spread of the mosquito, in the face of deforestation, precarious basic sanitation and climate change. Unsatisfactory basic sanitation also favors the accumulation of water in peridomestic environments. In addition, in order for the population to avoid the accumulation of stagnant water in homes, periodic epidemiological surveillance and awareness of residents about the importance of this measure are necessary. Due to these challenges, despite robust government investment, there has been no reduction in vector density that could reduce the spread of the disease in recent years. [1]

The development of vaccines for dengue is quite challenging, considering that protection against a given serotype will generate long-term homologous protection, but will only provide heterologous protection in the short term, for approximately 2 years, and may even trigger the worsening of the disease during a second heterotypic infection [8]. Furthermore, the immune response adapted to the virus is not fully understood, especially because there is no accessible animal model that mirrors human immune responses after infection. [9]

Several live attenuated vaccines have been developed using the DNA technique recombinant, including the attenuated dengue virus tetraviral vaccine (DENVax), the recombinant mutant DENV-4 vaccine, with a deletion of 30 nucleotides (rDEN4Δ30), and the tetravalent dengue vaccine, with chimeric yellow fever virus 17D (CYD-TDV). In the latter, the infectious component of the DNA of the yellow fever vaccine was modified to

incorporate the structural genes of dengue. [12]

Brazil was the first country in the world to make a dengue vaccine available in the universal public system. This is the Qdanga vaccine, manufactured by the pharmaceutical company Takeda, which is made with attenuated technology and was even recommended by the WHO in October 2023, for places with high burden and transmission of the disease. Preliminary studies have shown efficacy in protecting against the four dengue serotypes in children - the results indicated an 80.2% reduction in contamination and 90.4% prevention of severe cases. The vaccination schedule involves two doses, with a three-month interval between them, and the priority, throughout 2024, includes large cities, with high transmissibility in the last 10 years, and a resident population equal to or greater than 100,000 inhabitants. Furthermore, the focus of the Brazilian Ministry of Health, in 2024, is to vaccinate children and adolescents aged 10 to 14, due to the higher number of hospitalizations due to dengue in this age group. [13] The vaccine has already been incorporated into the Immunization Program (PNI). [12]

Regarding treatment, there is no therapy specifically aimed at dengue. Therapy is solely symptomatic, with hospitalization being necessary in more severe cases, in order to replace fluids and allow blood transfusion, if necessary. [1]

Therefore, treatment is based on adequate volume replacement, considering the staging between groups A, B, C and D, according to the clinical picture [2]. Group A is characterized by the absence of spontaneous hemorrhagic manifestations, warning signs, comorbidities, social risk and special clinical conditions, in addition to a negative lasso test, and can receive outpatient follow-up. [2]

Group B involves spontaneous skin bleeding (petechiae) or induced bleeding (positive lasso test), but without warning signs. Also within stage B, specific groups include: lactating women, pregnant women and adults over 65 years of age, people with comorbidities (such as hypertension, diabetes mellitus, chronic obstructive pulmonary disease, chronic kidney disease and liver disease) and individuals with social risk. Group B should be monitored in health units with observation beds until the test results are available and a clinical reassessment is performed. [2]

Group C, in turn, has some warning signs, but does not show signs of severity, and should be monitored in an inpatient bed until stabilization. Patients in group C should initially be treated in any health service, regardless of complexity, and should be given rapid intravenous hydration and monitored in an inpatient bed until stabilization and conditions for discharge, for at least 48 hours. If there is no clinical and laboratory improvement, the management should be the same as for group D. [2]

Group D is defined by the presence of signs of shock and respiratory distress, in addition to severe organic impairment and severe hemorrhagic manifestations. Therefore, monitoring in an ICU bed is necessary until stabilization, for at least 48 hours, followed by remaining in an inpatient bed. [2]

DENGUE AND PREGNANCY

With regard to dengue, which belongs to the same family as the Zika virus, the WHO and the Pan American Health Organization recommend that strict monitoring of the risks to the mother and the fetus is necessary. In this context, the risks of obstetric bleeding are noteworthy, so pregnant women with this condition should always be questioned about the presence of fever or a history of fever in the last 7 days. According to a study conducted in Brazil, the mortality rate due to dengue in pregnant women is higher than that of non-pregnant women of childbearing age, especially in the 3rd trimester of pregnancy. Furthermore, some other Brazilian studies show that pregnant women with symptomatic infections have a higher risk of fetal death and premature birth. [2]

According to a review study published in January 2023, in order to assess the severity of dengue in pregnant women, it is necessary to pay attention to the patient's immune response, since the results may be worse in those with previous diseases or immunosuppressive conditions, such as systemic lupus erythematosus, even increasing the risk of severe dengue. The results are also influenced by access to timely diagnosis and regular prenatal care, for faster identification, treatment and control of dengue. Dengue also increases the risk of bleeding, which results in the need for supervision and adequate management during childbirth. In 7.2 to 7.9% of cases, there may be problems during labor, sometimes requiring progression to cesarean section, in cases of severe dengue or other complications. [14]

The DENV virus can cross the placenta and affect fetal circulation, which is more likely when the infection is acquired shortly before birth. Higher levels of maternal viremia increase the risk of vertical transmission, which occurs in 1 to 6% of cases. However, it is worth noting that, in the case of vaccination or even previous infection, the fetus may receive protection due to maternal antibodies, which reduce the likelihood and impact of vertical transmission. Vertical transmission may also vary according to the viral strains, the geographic region and the prevalence of dengue in the population. [14]

Regarding perinatal outcomes, this same review showed that there may be harm to fetal growth and newborn development, sometimes including intrauterine growth restriction (IUGR), increasing the risk of chronic diseases and low birth weight. Although rare, gestational dengue can result in fetal mortality, which is directly proportional to complications such as organ failure

and increased bleeding. Breastfeeding is not contraindicated in mothers with dengue fever, because there is no viral transmission through milk, and breastfeeding provides nutrients and antibodies essential for protecting the baby. [14]

A systematic review published in June 2022 analyzed 36 studies and established that DENV infection during pregnancy is associated with an increased risk of maternal mortality, stillbirths, and neonatal deaths. However, there was no statistical association between infection and preterm birth, maternal bleeding, low birth weight, and spontaneous abortion. [15]

A retrospective observational study conducted at a tertiary referral center in southern India between January 2015 and December 2018 compared adverse outcomes between pregnant women diagnosed with dengue and women hospitalized due to a fever but with a negative dengue test. During the study period, there were six maternal deaths resulting from complications of the infection, five of them due to shock syndrome and one due to hemorrhagic fever, and no deaths in the control group. [16]

Therefore, these analyses allow us to infer that there is an increase in adverse maternal and fetal outcomes in pregnant women diagnosed with dengue. Pregnancy complications can be explained by the fact that physiological changes during pregnancy, such as the procoagulant state and hemodilution, can delay the increase in hematocrit or thrombocytopenia during dengue infection. Furthermore, pregnancy complications, such as hemolysis, HELLP syndrome and preeclampsia, can make it difficult to recognize infectious complications caused by DENV. Proinflammatory mediators resulting from the infection, such as interleukin-6 and tumor necrosis factor alpha, can cause uterine contractions and premature birth, while thrombocytopenia and hemorrhagic tendency can lead to placental dysfunction and hypoxia, affecting fetal nutrition, with consequent growth restriction or even neonatal death in more severe cases.. [16]

JUSTIFICATIVE

This systematic review is justified by its purpose of studying maternal and fetal outcomes in the face of dengue virus infection during pregnancy. As stated above, some studies have shown that there is a relationship between contamination by the DENV virus during pregnancy and potential complications, such as low birth weight and maternal mortality. However, there are disagreements between the articles regarding the implications that have statistical significance when comparing infected and healthy pregnant women. Thus, the literature is not very well defined regarding the incidence and prognosis of infection during pregnancy. Because of this, the present study is relevant, even to enable

the development of new strategies aimed at preventing negative outcomes and ensuring maternal and fetal well-being. It is worth noting that, in a context of re-emergence of the dengue virus, including in Brazil, this planning is especially necessary..

OBJECTIVES

GENERAL OBJECTIVE

- To investigate the relationship between dengue infection in pregnant women and maternal-fetal outcomes, with a focus on obstetric complications and their clinical importance, in addition to neonatal outcomes, in comparison with uninfected pregnant women.

SPECIFIC OBJECTIVES

- To investigate the risk factors associated with dengue infection in pregnant women, including demographic characteristics, exposure to the mosquito vector and previous medical history.
- To analyze obstetric outcomes in pregnant women infected with dengue, including complications during pregnancy, maternal death, thrombocytopenia and postpartum hemorrhage and miscarriage.
- To evaluate neonatal outcomes in babies born to dengue-infected mothers, including prematurity, low birth weight, stillbirths and neonatal complications. - Provide evidence-based recommendations for the prevention, diagnosis and management of dengue in pregnant women, with the aim of protecting maternal and fetal health and reducing the burden of the disease in endemic areas.

METHOD

Four simultaneous searches were performed. The first, performed using PubMed (https://pubmed.ncbi.nlm.nih.gov/), used the keywords “dengue pregnancy” and obtained 188 results on April 8, 9, and 10, 2024. The second and third searches were performed in the LILACS database (https://lilacs.bvsalud.org/), using the keywords “dengue pregnancy” initially and “dengue embarazo” subsequently. In these searches, 18 and 21 articles were found, respectively, on April 10, 2024. The fourth search, finally, was carried out in Scielo (https://www.scielo.br/), with the keywords “dengue pregnancy”, obtaining only 1 article as a result, also on April 10, 2024. These four searches used articles published between 2020 and 2024 as a filter.

The exclusion of articles that would not be included in the work was initially carried

out based on the title and abstract. For this purpose, the works obtained in the four searches were equally divided between the two main researchers. The inclusion criteria were: texts that addressed pregnant women and dengue (although not exclusively), meeting the question of the work (how dengue behaves in pregnant women and what is the outcome of this infection), articles written in English, Portuguese or Spanish and studies of women at any gestational age. The exclusion criteria included: articles that did not answer the study question, analysis only of dengue seroprevalence during pregnancy (epidemiological study), studies conducted on rats, focus only on the clinical management of the infection in pregnant women (without addressing the infectious repercussions per se), focus only on vertical transmission or neonatal repercussions, and analysis only of serological markers or vaccination in pregnant women. Therefore, of the 188 articles found in the PubMed search, 152 were excluded a priori and 36 were included. In the searches performed in LILACS, the 18 articles found with the keywords “dengue pregnancy” were also included in the 21 results obtained with “dengue embarazo”, so that of these 21, 16 were excluded and 5 were included. The only article obtained in Scielo was excluded.

The exclusion was then based on the full text. Thus, of the 35 articles initially included in the PubMed search, 8 were excluded because they were paid for and one because it did not meet the objectives of the study. The result was 27 articles included in this database. The 5 texts included from the LILACS search were maintained, on the other hand. Thus, in the end, 32 articles were obtained for a more detailed study.

These 32 articles were finally divided again between the two main researchers for analysis, with the most relevant information described in a summary table. Such data were subdivided into: identification of the article (DOI, year, location and type of article); population studied (number of patients, predominant age, race, trimester of pregnancy, comorbidities and co-infection), clinical and laboratory findings and outcomes (maternal outcome, fetal outcome and treatment in pregnant women).

RESULTS

Of the 32 articles included in the study, 6 were published in 2020, 6 in 2021, 8 in 2022, 10 in 2023 and 2 in 2024.

Regarding the place of origin, there was a predominance of articles from India, with 9 in total. In addition, 7 multicenter articles were found, two of which specified the locations: one used data from Asia, Latin America and Africa, while the other referred only to Southwest Asia (Brunei, Myanmar, Cambodia, Timor-Leste, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand and Vietnam). There were also 4 Brazilian articles, three of

which detailed the states of origin: Paraná, Recife and Ceará, in addition to 3 articles from Mexico and 2 from Indonesia. Finally, one article was found from each of the following countries: Burkina Faso, Peru, Sri Lanka, Nigeria, Australia and Pakistan, while one article did not specify its country of origin.

From the point of view of the study design, there was a predominance of case reports, with 9 in total. In addition, 8 reviews, 7 retrospective studies, 6 prospective studies, one meta-analysis and one observational study with two phases (the first cohort and the second cross-sectional) were found.

The number of patients studied ranged from one, in 7 of the 9 case reports found, to 2,121,582, in a retrospective study. 9 articles did not specify the number of patients involved. Furthermore, one article was found with each of the following samples: 3, 4, 41, 57, 62, 91, 136, 181, 216, 424, 780, 1,006, 27,605, 39,632 and 94,832. It is worth mentioning that not all patients included in the articles were, in fact, diagnosed with dengue, since this varied according to the study design.

With regard to age, there was a predominance of women between 20 and 39 years old, which coincides with the fertile period. For example, the Brazilian retrospective study that studied 2,121,582 women determined that 70.3% of dengue cases were concentrated between 20 and 39 years old. [17] Six articles outlined the mean ages, which were: 24.5 with a standard deviation (SD) of 0.71 (range 18 to 37 years); 26 in phase 1 (range 18 to 35 years) and 27.4 years in phase 2 (with the same range); 26.5 years, with an SD of 3.6; 27.1 with an SD of 6.23 (range 16 to 49 years); 28.6 with an SD of 2.88 (range 18 to 37 years); 29 (range 15 to 49 years). Regarding the variation in outcomes according to age group, only two studies were able to establish a relationship: one of them found that all age groups increase the risk of hospitalization, compared with the period between 10 and 19 years. This study used a sample of 16% pregnant women and 19.8% non-pregnant women aged 10 to 19 years; 48.6% pregnant women and 26.7% non-pregnant women aged 20 to 29 years; 27% pregnant women and 27.7% non-pregnant women aged 30 to 39 years; 8.4% pregnant women and 25.8% non-pregnant women aged 40 to 49 years. [18] The other study found a higher risk of adverse effects between the ages of 26 and 35 years, based on a sample with 42.28% of patients aged 16 to 25 years; 47.74% aged 26 to 35 years; and 9.98% aged 36 to 49 years. [19] Ten studies did not specify the ages of the patients studied.

Only 4 of the 32 articles included detailed the race of the patients. In the retrospective cohort study that included 27,605 patients with confirmed dengue, of whom 949 (3.49%) were pregnant and 26,656 were non-pregnant, 20,082 (72.3%) were white, of

whom 689 (72.6%) were pregnant and 19,393 (72.8%) were non-pregnant, that is, there was no significant difference between the groups in terms of race. Another 6,307 were black, of whom 216 (22.8%) were pregnant and 6,091 (22.9%) were not. [17] The prospective study carried out in Recife, Brazil, analyzed blood samples from 780 women who were admitted to the maternity ward at 27 weeks or more of gestation, were 15 years of age or older and had some obstetric complication. Of these patients studied, 480 (61.7%) were of mixed race, 157 (20.2%) were white, 141 (18.1%) were black, and 2 did not specify. [20] The Brazilian retrospective study carried out with 2,121,582 women of childbearing age was divided into: 26.9% white women, 3.9% black, 0.9% yellow, 33.5% brown, 0.3% indigenous, 23.5% of unknown race and 11% omitted in the system. Also according to this same study, 32.2% of dengue cases occurred in whites and 43.3% in mixed race. [17] Furthermore, the prospective study carried out with 1006 Nigerian women defined that they were all black[17].

In terms of gestational age, there is a clear predominance of patients in the 3rd trimester of pregnancy. In a prospective study conducted in India, for example, the average was 31.89 weeks, with a standard deviation of 7.31, being: 2 pregnant women in the 1st trimester (4.5%); 5 in the 2nd trimester (11.4%) and 37 in the 3rd trimester (84.1%) [22]. Two articles identified a higher risk of poor outcomes in the 3rd trimester of pregnancy - in one of them, the rate corresponded to 34.78% of cases, followed by the 2nd trimester, with 25.78% [19] In another, with a distribution of 4.9% of pregnant women in the 1st trimester of pregnancy, 17.1% in the 2nd and 78% in the 3rd, of the 6 maternal deaths, 1 occurred in the 1st trimester and 5 in the 3rd. [19] However, 12 articles did not specify the gestational age of the patients studied. It is also worth mentioning that, in one of the studies, there was a predominance of non-pregnant women (51%), since the inclusion criterion was being of childbearing age and having been notified with dengue [17]. Furthermore, one of the case reports addressed a woman on the 8th postnatal day, with fulminant hepatitis induced by dengue. [23]

Only 5 of the 32 articles detailed the comorbidities of the women included. In one of them, 5.3% of pregnant women and 4.8% of non-pregnant women had at least one comorbidity. Diabetes Mellitus was present in 1.7% of pregnant women and 1.1% of non-pregnant women; hematologic diseases, in 0.6% of pregnant women and 0.4% of non-pregnant women; liver diseases, in 0.2% of pregnant women and 0.5% of non-pregnant women. Furthermore, 0.3% of both groups had chronic kidney disease, 2.6% of pregnant women and 3% of non-pregnant women had hypertension, 0.3% of pregnant women and 0.5% of non-pregnant women had acid-peptic disease; and 0.4% of pregnant women and

0.5% of non-pregnant women had autoimmune diseases. This same study found that diabetes mellitus increased the risk of hospitalization. [18] In another study, of the 216 pregnant women with fever included, 12 (27.2%) had anemia, 10 (22.7%) had hypothyroidism, 2 (4.5%) had hypertension, and 2 (4.5%) had diabetes mellitus. [22] Regarding the case reports, only one of them detailed the patient's previous comorbidities: gestational diabetes mellitus. [24]

Regarding co-infection by other agents, in a prospective study conducted in Recife, of the 780 patients studied, 16.6% had recent or active arbovirus infection, of which 2.3% (3) had active/recent dengue infection, 41.5% (54) had ZIKV infection, 53.1% (69) had CHIKV infection, and 3.1% (4) had active/recent dual infection (CHIKV and ZIKV). [20]. A prospective study conducted in Mexico revealed 11 co-infections with DENV and CHIKV, 3 with DENV and ZIKV, 2 with ZIKV and CHIKV, and 2 with DENV, ZIKV, and CHIKV. [25] One review study reported a co-infection with dengue and malaria [26], while a case report conducted in Fortaleza described a co-infection with dengue and chikungunya [27]. A prospective Nigerian study found significant co-infections with ZIKV, DENV, and CHIKV, comprising 24.5% of all IgM-positive infections. Among the co-infections, 67.3% included CHIKV and DENV and 18.4% ZIKV and CHIKV. [21]

From a clinical point of view, the most common symptom was fever, cited in 19 studies, with a duration ranging from 2 days to 2 months. According to a prospective Indian study, the median was 37.7°C, and fever was present in 100% of the patients included [22]. Other very common signs and symptoms were: headache (cited in 11 studies), myalgia (verified in 10 articles, with an estimated prevalence of 90.9% [22] in the Indian study), arthralgia (9, with a prevalence of 88.6% [22]), vomiting (6, with a prevalence of 47.5% [22]). Retro-orbital pain (5), exanthema (skin rash) (5), jaundice (3, with an estimated prevalence of 2.3% [22]), hypertension (3, considering blood pressure greater than or equal to 140x100mmHg), tachycardia (3, considering heart rate greater than 100bpm), asthenia (2), dyspnea (2, with a prevalence of 6.8% [22]), abdominal pain (3), petechiae (2), ascites and fluid thrill (2), edema and weight gain (2), conjunctivitis (1), rash (1), hypotension (1, considering blood pressure less than or equal to 90x60mmHg), splenomegaly (1), chest pain (1), and gum bleeding (1). Regarding the sensory system, the estimated prevalence of behavioral changes was 9.1% [22], with 2 studies reporting seizures (with an estimated prevalence of 2.3% [22]), and one article reporting each of the following conditions: encephalopathy and loss of consciousness (also prevalence of 2.3% [22]). There were also reports of asymptomatic pregnant women in 2 studies and of one pregnant woman with uterine contractions.

From a laboratory perspective, the most prevalent alteration was thrombocytopenia, described in 10 articles. Furthermore, 4 reported an increase in TGO and TGP, indicating alterations in liver function, 2 described leukopenia, 2 reported leukocytosis, and 2 referenced anemia (here considering hemoglobin below 10mg/dL). One study addressed an increase in bilirubin and another, an increase in LDH. According to a retrospective Indian study, patients with dengue fever in late pregnancy had a lower platelet count (92,564.10 ± 388 vs 110,777.78 ± 340) (p-value = 0.435). TGO and TGP were also higher in patients with dengue fever at the end of pregnancy (149.03/156.77), with a significant difference for TGP (p-value = 0.048) [28].

Regarding maternal outcomes, the occurrence of thrombocytopenia was very frequent and cited in 12 of the 32 articles, with a prevalence ranging from 29.3% to 96.5% of patients, depending on the study evaluated [29, 30]. Also cited in 12 different articles, the progression to death was a very significant and worrying outcome, which affected from 0.2% of pregnant women in a retrospective study of SINAN with 2,121,582 women of childbearing age to 15.9% in an Indian prospective study with 216 pregnant women with fever, of which 44 were positive for dengue fever [22]. However, one study considered this outcome to be uncommon, being more related to delayed diagnosis, insufficient medical care, or consequences, including organ failure or significant bleeding [14]. Spontaneous abortion was also frequently cited in the studies and was mainly related to earlier gestational ages, exemplified by a retrospective Indian article, in which the prevalence reached 71.4% in pregnant women with dengue before 12 weeks of gestational age. [28] In this context, postpartum hemorrhage was found in 10 articles with a range of 2.5% to 25% of cases; next, the need for cesarean delivery was reported in 8 studies, some of them in the emergency context. Next, severe forms of dengue were addressed in 7 studies, showing that pregnant women have a higher risk when compared to non-pregnant women [18], with a greater relationship with the 3rd trimester and with DENV 4 [31]. Other less common outcomes were: pre-eclampsia (cited in 5 studies), placental abruption (4), dengue with warning signs (verified in 4 articles and having a greater impact at the beginning of pregnancy [28]), dengue hemorrhagic fever (3), dengue with complications (1), ICU admission (3), shock (3), fulminant hepatic failure (2), acute renal failure (2), acute respiratory distress syndrome (3), vaginal hemorrhage (2), generalized tonic-clonic seizure (2), labor with dystocia (2), HELP syndrome (1), gestational diabetes mellitus (1), DIC (1), threatened abortion (1), complications (1), encephalopathy (1), pregnancy-induced hypertension (1), severe postpartum sepsis (1), and hemophagocytic syndrome (1).

From the point of view of fetal outcomes, it is worth noting that only 20 articles

provided information on this subject. Among them, prematurity was cited 12 times and was the most common outcome, ranging from 5.1% of cases, when the virus is acquired after 24 weeks of gestational age, to 42.3% in a retrospective Indian study [30]. In this context, stillbirths were also another frequent repercussion, having been addressed in 11 different studies, with a prevalence of 10.3% after 24 weeks of gestation [28]. These data were followed by neonatal deaths, which were detailed in 7 articles, with a maximum occurrence of 16.7% in a 2022 article from Pakistan; and by low birth weight, which was described in 8 different studies, with a prevalence of 29.5% [22]. Oligoamnios was another frequent finding, which was evidenced in 5 different studies and was shown to be more relevant when dengue infection occurs before 24 weeks when compared to later infection (66.7% x 17.9%) [28]. Regarding the transmission rate, this was discussed in 5 articles, with data converging on a higher incidence when the virus is acquired in the third trimester, mainly 15 days before delivery. Finally, less prevalent manifestations were: fetal growth restriction (cited in 4 articles, with 55.6% of cases before 24 weeks [28]), need for ICU admission (2 studies), need for mechanical ventilation (1), asphyxia (1), encephalitis (1), poor general condition at birth (1), severe neonatal infection (1) and neurodevelopmental disorders (2). Congenital malformations are not consistently associated and have only been reported in one small study.

Finally, regarding the treatment given to pregnant women infected with the dengue virus, only 12 articles highlighted what was done. It is worth noting that among these, the majority were case reports, totaling 8, followed by 3 reviews and 1 prospective study. In this context, supportive measures such as fluid replacement therapy, use of analgesics such as Paracetamol, and careful observation were the most adopted measures, being described in 8 different studies, accompanied by transfusion of platelet concentrate, which was detailed in 7 articles. In this scenario, blood transfusion, fresh frozen plasma, and cryoprecipitate were also used, 4, 2, and 1 times, respectively. Corticosteroids were addressed in 7 texts, with their use varying between methylprednisolone, prednisolone, and dexamethasone; antibiotic use was mentioned twice. For specific cases, measures such as a postpartum balloon to control bleeding, Mg sulfate to prevent eclampsia, Nifedipine, and Hydralazine to control blood pressure, and the combination of benzodiazepine, sulfate, and Nifedipine for convulsions were necessary. Finally, ursodeoxycholic acid and vitamin B12 were mentioned in only 1 article, while ICU admission was necessary 4 times.

DISCUSSION

Based on the results obtained in this research, it is clear that there is a growing

concern regarding the behavior of dengue infection in pregnant women, which is evident from the number of articles found. [4]

Regarding the public included in the articles studied, it is not possible to establish a relationship between the color and age of patients with the highest profile of involvement or with the worst outcomes due to dengue infection, since few studies included this data. Co-infections, mainly by Zika virus and chikungunya, seem to be relatively common in the context of dengue infection, but it is also difficult to establish a conclusion, given the scarcity of data.

Regarding previous comorbidities, it is assumed that pregnant women with underlying health problems, such as diabetes, hypertension, or immunological diseases, are more likely to develop severe dengue. [32] However, since few articles detail the comorbidities of the public included, this analysis does not allow us to reach any conclusion in this regard.

Regarding clinical presentation, it is known that pregnancy itself can make it difficult to diagnose dengue because the infection can overlap or even compensate for the physiological changes of pregnancy. [18] Furthermore, although some studies have cited fever, headache, myalgia, and arthralgia in the clinical presentation of pregnant women, it is known that the characteristic clinical picture of dengue is less evident in pregnant women than in the rest of the population. [18] In this sense, it is worth noting that none of the 32 articles analyzed cited the positive loop test.

From a laboratory point of view, thrombocytopenia is more common in pregnant women than in other sectors of the population, having been described in several articles analyzed. Another very prevalent change is the increase in liver enzymes (AST and ALT). In this sense, differentiating dengue infection from HELLP syndrome can be quite challenging, since the latter is characterized by hemolysis, elevated liver enzymes, and thrombocytopenia, and may coincide with the clinical presentation of dengue. [23]

There may be progression to postpartum hemorrhage, severe forms of dengue fever, or even maternal death, as was evident in many of the articles reviewed. Death generally occurs due to activation of the immune system, with consequent release of cytokines/chemokines, autophagy of endothelial cells, and apoptosis of T cells. This causes plasma leakage, contraction of intravascular volume, and loss of fluid to the third space. Thus, it may progress to intravascular volume depletion, shock, organ hypoperfusion, and multiple organ dysfunction syndrome. [23]

In this regard, maternal outcomes appear to be worse in the 3rd trimester of pregnancy, since 2 of the studies analyzed reported a greater progression to death in this

period. It is worth mentioning, in this context, that diagnosis may be even more difficult in advanced stages of pregnancy, due to the increase in plasma volume of approximately 40% at the end of the 3rd trimester, with resulting dilutional anemia, which masks the hemoconcentration characteristic of dengue [33] and may underestimate the infectious load [29]. Furthermore, pregnancy itself involves a reduction in the inflammatory response, with immunological changes, to improve fetal tolerance and, thus, may increase the risk of infectious complications.[34].

In terms of fetal repercussions, some studies have detected a relationship between dengue infection and an increased risk of miscarriages and stillbirths, but it is not known whether fetal loss is secondary to hyperthermia or to the action of the DENV virus itself. It is also noted that several articles have reported an association with fetal growth restriction, prematurity, and low birth weight. Thus, although there is no consensus on this subject until further clarification is made, it is important to adequately monitor fetal growth, paying special attention to low birth weight and prematurity. [26] On the other hand, there appears to be no relationship between the action of DENV and fetal malformations.

Regarding the mode of delivery, there is no preferred method. However, the American College of Obstetrics and Gynecology (ACOG) recommends that platelet transfusions be performed to maintain platelet counts above 50,000 before major surgeries (such as cesarean section) and above 70,000 for epidural and spinal anesthesia. This is done to reduce the risk of postpartum hemorrhage. [33] It is essential to pay attention to symptoms that are initially benign, such as fever, and to investigate dengue even in asymptomatic or oligosymptomatic pregnant women, especially in endemic areas [23]. In addition, it is interesting that sentinel maternity units be created to monitor vertical transmission and potential adverse maternal-fetal outcomes of DENV infection, based on clinical and laboratory screening [20], since there is still no consensus on this subject..

CONCLUSION

Dengue fever in pregnant women is a significant concern due to the potential risks to both the mother and the fetus. Dengue virus infection during pregnancy can lead to serious complications, including thrombocytopenia, severe hemorrhage, and even maternal death. In addition, it has also been associated with adverse impacts on fetal development, such as prematurity, oligohydramnios, and fetal death. The complexity of dengue fever in pregnant women is compounded by the difficulty in differentially diagnosing symptoms, which can often be masked by physiological changes during pregnancy. In this sense, it is interesting that a national guideline be established for the management of dengue fever in pregnant

women since many health professionals are unfamiliar with the potential complications associated with it. Optimal management involves early diagnosis, appropriate serological testing, careful monitoring of fluid and hemodynamic status, and prevention of progression to more severe forms of the disease. In addition, it is crucial to implement robust preventive measures, such as effective control of the Ae. aegypti and educational programs aimed at pregnant women in endemic areas.

This systematic review stands out for having brought together articles from different countries and clinical designs, allowing for a deeper understanding of the maternal-fetal repercussions of dengue, which have not yet been fully elucidated. However, it has some limitations, since not all women included in the articles analyzed had dengue or were pregnant, as this varied according to the objectives and methodologies of the studies. Furthermore, some studies were conducted only in hospitals, which may have overestimated the complications resulting from the infection, while others were affected by the omission of data from the notification forms sent to SINAN, in the face of suspected DENV infection.

In short, addressing the challenges posed by dengue in pregnant women requires a multidisciplinary and collaborative approach between health professionals, researchers, and public health authorities. Therefore, continued research is crucial to expand and deepen knowledge about the effects of dengue infection in pregnancy and to develop effective prevention and clinical management strategies, with further studies being needed to elucidate issues not yet fully clarified by this review.

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YOUTH, VIOLENCE AND EDUCATION: NARRATIVES OF THE SOCIO-EDUCATIONAL SYSTEM

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ABSTRACT

This article aims to reflect on socio-educational measures in the state of Rio de Janeiro, through the analysis of the documentary "Juízo" (2022), directed by Maria Augusta Ramos and produced by Diler Trindade, in conjunction with the study of the Statute of the Child and Adolescent (ECA/ Law No. 8.069/1990). The work was produced by students with scientific initiation scholarships and academic incentive scholarship holders, linked to the research entitled "Social policies and Prison: an evaluation of the penal execution policy", developed by the Graduate Program in Social Memory and the School of Social Work of the Federal University of the state of Rio de Janeiro. The research was carried out through literature review and analysis of legal documents: law n° 8.069 (Statute of the Child and Adolescent), decree n° 17.943-A (Melo Mattos Code), law n° 6.697 (Minors Code), decree n° 847 (Penal Code of 1890) and law n° 12.594 (National System of Socio-educational Assistance). The article highlights the importance of problematizing the possibilities around the elaboration and execution of socio-educational measures by means other than punitive and individualizing, as well as the realization of critical analyses of the neoliberal context within capitalist society and the various expressions of violence, intersecting the markers of class, race and gender.

Keywords: Socio-educational measures. Youth. Documentary "Juízo". Violence.

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INTRODUCTION

This article was produced in the meetings of the study group, linked to the research entitled "Social policies and Prison: an evaluation of the penal execution policy", being the result of studies, debates and production of syntheses carried out by scientific initiation fellows and academic incentive fellows. We clarify that this research was coordinated by Dr. Lobelia Faceira, in the period 2018-2024, with support from CNPq through a Research Productivity Grant.

The article proposes reflections based on the documentary feature "Juízo" (2022), directed by Maria Augusta Ramos and produced by Diler Trindade, in conjunction with the study of the Statute of the Child and Adolescent (Law No. 8,069/1990, ECA). The ECA repeals the Minors Code (Law No. 6,697/1979) and attests to the contradictory position in which the conception of rights is established through the invisibility and annulment of these subjects by the assistential-repressive perspective from the existence and precariousness of spaces provided by the socio-educational care units (internment and semi-freedom) and by establishing a thin line between protection and punishment.

The article was structured from the theoretical and methodological framework of historical and dialectical materialism, building a critical analysis of the audiovisual production through a literature review, having as theoretical framework the productions of Hebe Signorini Gonçalves and Joana Garcia (2007); Jacqueline de Oliveira Moreira, Andréa Maris Campos Guerra and Carlos Roberto Drawin (2017); and Maria Liduina Silva (2011) for the analysis of national laws and guidelines regarding the scope of socio-educational measures.

In the first part of the work, we present a brief theoretical debate on the theme of childhood and youth and socio-educational measure. We also carried out the documentary analysis of the laws: Law No. 8,069 (Statute of the Child and Adolescent), Decree No. 17,943-A (Melo Mattos Code), Law No. 6,697 (Minors Code), Decree No. 847 (Penal Code of 1890) and Law No. 12,594 (National System of Socio-Educational Assistance).

In the second part of the text we highlight the information about the documentary "Juízo" highlighting the synopsis of the documentary, the director's technical sheet and the profile of the characters.

In the third part, we present a critical analysis of the documentary through a review of literature and legislation.

We conclude the work by presenting some reflections and final considerations on the theme of "socio-education" and "childhood and youth" in the scenario of knowledge production and, specifically, on the look of theory in relation to social reality, emphasizing

the importance of complementarity between rationality and sensitivity in the process of knowledge construction.

A BRIEF LOOK AT THE THEMES OF VIOLENCE, YOUTH AND SOCIO-EDUCATIONAL MEASURES

According to the Atlas of Violence (2024), the Brazilian child and adolescent population continues to be immersed in a context of deep violence and extreme social insecurity. In 2022, almost half of the homicides recorded in the country (49.2%) were of young people between 15 and 29 years old — a total of 22,864 young people, out of an average of 62 murdered each day. Although this is a significant number – and an important one, considering death as the maximum expression of rights violations – non-lethal violence is much more present among young people and adolescents than, proportionally, in other population groups. In the decade analyzed (2012-2022), 280,213 adolescents were raped, with most of the violent acts committed at home. When we use the gender perspective, we see that boys suffer more from lethal violence, while girls are the majority of victims of physical, psychological, and sexual violence — in a movement that impacts the possibility of a fully healthy development, as it inserts them in a cycle of violence that is invisible and, therefore, does not have adequate public policies to be effectively ended. (Gonçalves; Garcia, 2007; Scallop; Coast; Oliveira, 2021)

Despite the situation observed above, and the range of rights violations that occur in such a context, children and adolescents have a specific set of legislation, and internationally considered innovative, which characterizes them as a group in a peculiar condition of development — that is, not yet full of physical, psychological, social and political maturity — which, therefore, it must be considered an absolute priority of the nation, in terms of enabling rights, and the responsibility of the family, society and the State with regard to ensuring well-being, safety and care.

However, before the sanction of the Federal Constitution of 1988, whose article 227 consolidated the formal change of the paradigmatic approach, the issue of children and adolescents, previously called the issue of the 'minor', was already the object of State agency. Let us take as a basis the three main previous legislations on the subject: the Penal Code, of 1890 — which considered the criminal age to be 9 years old and instituted disciplinary imprisonment in industrial houses for the moral correction of "minors" and reparation to the State. The Juvenile Code of Brazil, also known as the Mello Mattos Code, of 1927 — responsible for inaugurating the consolidation of protection and assistance norms outside the legal sphere, although linked to the hygienist ideas of social control to

maintain order in urban centers. And the New Minors Code, of 1979 — which updates the Mello Mattos Code, and institutionalizes the Doctrine of Irregular Situation[4].

Although full of continuities with regard to selective and stigmatizing practices (Cifali; Chies-Santos; Alvarez, 2021), juvenile justice in Brazil has experienced remarkable advances from the implementation of the Statute of the Child and Adolescent (ECA), the adoption of socio-educational measures, and the creation of the National Socio-Educational Service System (SINASE) — legal and structural frameworks that are important instruments for the promotion of the rights and full protection of children and adolescents in situations of vulnerability.

The Statute of the Child and Adolescent, enacted in 1990, establishes a comprehensive normative framework that guarantees a range of fundamental rights to this population. Among these rights are access to health, education, protection against child labor, as well as the right to family and community life. In addition, the ECA introduced the principle of absolute priority, determining that children and adolescents should be considered as a top priority in public policies, programs and services.

Such principles also govern socio-educational measures, also instituted by the ECA, so that young people in conflict with the law have an alternative to deprivation of liberty in the fulfillment of legal sanctions in case of an infraction. To this end, the National System of Socio-Educational Assistance (SINASE), created in 2006, establishes national guidelines for the execution of socio-educational measures throughout the country – providing for the standardization and quality of socio-educational assistance and promoting the professionalization and education of adolescents in conflict with the law. In addition, the system has mechanisms for monitoring and evaluating the effectiveness of the measures, with the participation of various social actors, ensuring transparency and continuous improvement of the process. (Moreira; War; Drawin, 2017)

According to Rodrigues (2023, p. 31), the realization of a "[..] An effective socio-educational measure depends on the adolescent's adherence to the service, it is necessary to recognize him as an active subject in the process.", in addition to guiding the necessary improvements so that there is a welcoming environment, a monitoring of structural quality

[4] The "irregular situation" referred to in the term is related to what, legally, was understood as the "state of social pathology" that justified the arbitrary and punitive intervention of the State in the lives of children and adolescents. Irregular status encompasses situations of conflict with the law, but also of poverty and social vulnerability — without differentiating between such phenomena. From this perspective, vulnerable children and adolescents are considered *objects*, and not *subjects*, of law: they are made marginal to society, they do not have guaranteed rights, autonomy and are treated as an object of intervention by the family and the State. See: https://www.mprj.mp.br/documents/20184/2764825/Carla_Carvalho_Leite.pdf

and qualified listening, so that it is possible to establish a relationship of trust between adolescents and professionals.

Thus, it is noticeable that juvenile justice — considering the centrality of the provisions made in the ECA and Sinase — by recognizing the transition phase between childhood and adult life, proposes that socio-educational measures have an educational bias and not merely punitive. In the following sections, we present a brief analysis of the documentary "Juízo" and the contradictions implicit in the socio-educational context, permeated by moralism, the arbitrariness of the Brazilian judicial system and punitivism — translating, in practice, into a direct correspondence between an infraction/crime and a socio-educational measure/penalty; in distrust of non-custodial measures; and in a necessarily high number of hospitalizations. (Passeti, 1995 *apud* Cifali; Chies-Santos; Alvarez, 2021, p. 220).

THE DOCUMENTARY "JUÍZO"

The documentary Juízo (2022) was elected by the Brazilian Association of Film Critics as the 67th best Brazilian documentary in 2017. The feature film, produced by Diler Trindade and directed and written by Maria Augusta Ramos, follows the trajectory of young people under 18 years of age before the law, between the moment of arrest and the moment of trial for robbery, trafficking and homicide. With sequences filmed in real audiences and during visits to the Padre Severino Institute, Juízo was released on March 14, 2008 by Filmes do Estação, after some national and international premieres. Below we highlight the cast of the respective documentary: **Judges:** Luciana Fiala de Siqueira Carvalho and Guaraci de Campos Vianna; **Prosecutors:** Renato Lisboa, Alexandra Carvalho Pires and Eliane de Lima Pereira; **Defenders:** Tadeu Valverde and Patrícia Vilela; **Teenagers:** Alessandro Jardim, Daniele Almeida, Guilherme de Carvalho, Isabela Cristina Durães, Karina Lopes, Marco Aurélio Sant'ana, Wilson dos Santos, Ighor dos Santos Villela and Maicon da Silva Singh.

The second feature film of the documentary effort that became known as Trilogy of Justice, the documentary "Juízo" (2007), by Maria Augusta Ramos, projects a critical look at the reality that emerges from the hearings of the 2nd Court of Childhood and Youth of the State of Rio de Janeiro, Brazil and the conditions of "resocialization" to which underage offenders (from 12 to 18 years old) are subjected, contemplated with the socio-educational measure of internment, among the several recommended by the controversial Statute of the Child and Adolescent (ECA - Law No. 8,069, of July 13, 1990).

As a production that generated debate at the time of release, and still generates it today — see the viral[5] that became, in 2023, on the social network Tiktok with lines by Judge Luciana Fiala — "Juízo", brings some elements in its execution that deserve to be highlighted in this analysis.

Starting with the title. The noun 'judgment', which gives the documentary its name, according to the Michaelis dictionary of the Portuguese language, has as one of its common meanings the "ability to ponder in dealing with delicate or difficult issues; tendency to predict and try to avoid dangers, inconveniences, risks, etc." (Juízo, 2024), while, in a legal environment, the term relates to the space "(...) in which claims, litigations and demands are judged and sentenced, and in which justice is administered." It is exactly from the point of imbrication between these two understandings that the documentary begins: in the first scene, the aforementioned judge appears reading the process, together with the prosecutor and the defender, and questioning the defendant about his conduct. What could be a standard procedure for listening to the accused, in fact, turns into a moralistic sermon about the attitudes that led him there, the shame he causes to his family and how, as punishment, he would not be entitled to a measure of semi-assisted freedom. This dynamic is repeated throughout the documentary, which explains how the representatives of the State, authoritarianly in their place of privilege that is established in the observed power relationship, try to impose themselves, in a biased way, on children and adolescents in conflict with the law.

Another interesting point, this time with regard to the editing of the film, is the circularity and the idea of 'production line' that the sequences convey. This is a familiar image if we think of a Taylorist model factory: along a conveyor belt, workers, who perform only one function, add parts to form what will be a final product. When we return to the documentary, we see that there is a similar logic with regard to the path taken by children and adolescents in the socio-educational system which, far from working as provided for by law, has acted much more for the mass production and reproduction of marginalization and impoverishment of young people in Brazil.

Finally, we can also point out a series of rights violations that cross the various correlations, mentioned above, through which, in practice, interned adolescents transit. Although it is a 2007 film, and has generated debates at the national level in order to understand the disparities between what is provided for in the law and its execution, the conditions observed in the film are still present today in the daily life of several socio-

[5] About isso, ler: https://www.techtudo.com.br/noticias/2023/03/conheca-juizo-documentario-sobre-reformatorio-disponivel-na-netflix-streaming.ghtml

educational units, which is why we consider this an essential axis for the analysis that follows.

A LOOK AT THE THEME OF CHILDHOOD AND YOUTH IN THE DOCUMENTARY "JUÍZO"

It is interesting to begin by highlighting the fact that the documentary comes into contact with a legislative conflict: the filming of the faces of adolescents is prohibited during hearings in the Court for the Protection of Children and Adolescents by determination of the ECA, as well as the obligation to protect the identification of young people interned at the Padre Severino Institute, created in 1954 and deactivated in 2012, located on Ilha do Governador.

Consequently, the feature is now considered a "hybrid documentary", in which there are elements of fiction in the choice of actors. And although the socialization of the performers is also intrinsically marked by environments that share the same conditions, being affected daily by the same expressions of the social issue, there are still other characters playing true roles.

In this way, the context presented carries the idea of Theater of Justice, representing the way in which Brazilian Justice "is made by logics of choices, codes, spatial exhibitions (...) and by gestures". (Rufinoni; Lavor, 2018, p. 59) That is, the way in which social theater and the functioning of the judiciary are shaped by power relations and, essentially, by capitalism through the "system of social inequality that produces the defendant; also reveals the abyss we live in terms of this inequality" (Rufinoni; Lavor, 2018, p.59) reflected in the consequences between the dubiousness caused by the central issue in the search for the truth for the system and for the judicial process.

In the same sense, it is possible to interpret judicial 'counseling' as a crucial part of the dynamics of dramatization on which the rites of the legal system are based. Bonfim (2015) characterizes Brazilian morality by the contradiction between image and self-image that the people nurture of themselves, and the consequence that such disparity generates in terms of the realization of these values through actions, especially at the level of structural organization. This is a movement that is far from being conceptualized uncritically, but is based on the sociopolitical and economic characteristics of the Brazilian formation that — crossed by racial tensions, by the updating of colonial violence and by the absence of a complete revolution in the traditional sense, with the maintenance of a monopoly of land and the social relations that arise from it — lead to, contemporaneously, in a circumstantial and authoritarian execution of the laws, characterized by paternalism, in

order to confer "[...] to bourgeois discourse a special character of authoritarian thought, good-natured and benevolent, paternal." (Bonfim, 2015, p.17).

Thus, we observe that the situation presented is a reflection of such determinants: the treatment of the issue of socio-education is purposely moralizing as a result of the social self-image, which sees in the 'council' of the state authority an attitude that is not only praiseworthy, but necessary to 'fix' the life of the adolescent in a situation of conflict with the law that. On the other hand, and characterizing the contradiction mentioned above, the critical analysis of the social image points to an authoritarian appropriation of the function of official representative of the State, which is manifested in the advantage guaranteed by the disparity of power conferred on one and the other agent in the social dynamics in question — the accused black men, mostly young and in situations of social vulnerability; the white, adult and privileged female judge within the contemporary class dynamics in the capitalist system – and acts, effectively, for the individualization of the expression of the social question in the ideological sense of hiding the class conflict behind the problem that is the constitution of children and adolescents as lawbreakers. Thus, the level of discourse is readily pointed out as a relativization strategy observed in the applicability of socio-educational measures, and also potentiated in articulation with others.

Another point related to the reproduction of bourgeois ideology and the processes of oppression of the working class base is the double notion that the socio-educational measure can assume – salvation or threat – depending on the way in which the justice system denies the subject's eligibility for the application of punishability, imputing responsibility in an individual way and detached from reality to the extent that it perceives the deviation from the 'school-home' trajectory to be a 'lack of judgment', as stated in the following excerpts:

> "Defender: Now, you should note his low physique. In other words, this adolescent in a CRIAM, or anywhere else in DEGASE, that is, he will be massacred because of his physical condition. Especially because it is primary (...) It has family support.
> (…)
> Judge: I assure you... Look at me! I guarantee you that, if you were at home, you would not have been arrested. You wouldn't be at Padre Severino right now.
> Prosecutor: If you were in school. Are you studying?
> Teenager: No.
> Judge: I was hanging out on the street, in a place where drugs were sold. I was in trafficking, wasn't I?
> Teenager: No.
> Judge: The police have already arrived here, they have already said that you were in trafficking.
> Teenager: They were looking at me...
> Judge: I mean, so what happens now? I guarantee you that if you were at school, at home, you would be free from the situation you are going through here now. Free from the embarrassment you're putting your mother through. The question for you is... Look at me! Thanks? (...) Was it worth not studying? Was it worth it to be away from home?

According to the situation described, we can see how the perspective that ECA marks the rupture with the project of society represented by the Minors Code is questionable, especially from the discontinuities and political continuities present in the current law which, although it is an achievement for social struggle movements, has not been revisited since the year of sanction. Silva (2011), based on this contradiction, provokes reflections on the impasse in the 'citizenship of children', in the sense that the ECA has it "(...) formally regulated, without, however, there being real conditions for it to be put into effect and enjoyed" (p. 109), in the same way that it presents the issue of socio-penal control of adolescents mediated by the State, but which is also the object of claims that civil society wages to guarantee that these individuals have rights and opportunities that were denied to them.

This contradiction between the formal guarantee and the feasibility of the rights of children and adolescents can also be evaluated from the perspective of the consolidation of neoliberalism in Brazil in the 90s. This model of organization of the productive process and capitalist accumulation — characterized "(...) by the denial of state economic regulation, by the abandonment of full employment policies and by the reduction of social security mechanisms, in favor, of course, of regulation operated by the market" (Mota, 1995, p. 56) — quickly materialized in the sharpening of the expressions of the social question and in the deepening of the precariousness of the social relations of production. Although the ECA and the Federal Constitution of 1988 establish the perspective of guaranteeing rights in an equal way for all children, the bourgeois notion of universal right - on which Brazilian legislation operates - makes it so that only the children of this class become subjects of rights, leaving the children of the working class with the notion of object of rights, which not only takes away their access to citizenship, but relegates them to the place of miserability and of becoming the target of highly repressive policies of the State, a situation that intensifies as race and gender intersect. (Melo, 2023)

In this way, we do not refer lightly to the 'production line' to which the documentary refers us when it shows, circularly, boys and girls going through hearings, being taken to the units, going through vexatious procedures and running away. Although neoliberalism is the ideological framework of the productive organization characterized by flexible accumulation, which, in practice, eliminates the figure of the treadmill, this is a structurally organized conjuncture so that, socially and from childhood, the cycle of violence to which children and adolescents are subjected in Brazil is produced and reproduced. In other words, the violation produced by them is preceded by the action of "(...) a tyrannical and

unequal productive system, [governed] by a State that defends the interests of the minority" (Ros, 2011, p. 5). Thus, we see how the institutional hierarchy and workflow, even if operationalized based on the public policy of orientation to socio-education, are organized around a punitive and repressive logic such as a 'black grinding machine'[6] and impoverished people, in the sense of perpetuating the project of exploitation and domination of the working class, whose ultimate goal is, if not physical extermination, symbolic death.

FINAL CONSIDERATIONS

Although the approval of the Statute of the Child and Adolescent in 1990 had repercussions in all spheres of public life, forcing other legislation aimed at children and youth to adjust to the perspective of full protection, we have that this is not a completely feasible change in certain realities – especially in those experienced by the working class.

With regard to accountability for the commission of criminal and misdemeanor violations, the understanding of the peculiar stage of development is precisely what differs socio-education from prison in Brazil. The socio-educational system in its ethical-pedagogical and legal-sanctioning dimensions was not designed to punish the public for which it is intended, but to guarantee access to education, health, social assistance, culture, professionalization and sports — except for the right to unrestricted freedom, for obvious reasons, but still ensuring that internment is considered as a last resort. (Laroqui; Camel; Coutinho, 2022; Brazil, 2012)

The perspective of socio-education in relation to the guarantee of rights and social protection constitutes a complex challenge within the context of the contemporary socio-educational system, which is structured from a punitive logic and a functionalist ideological bias of structuring strategies of "resocialization", "re-education" and "reinsertion", individualizing, criminalizing and naturalizing the issue of violence and the expressions of the Social Question, in addition to annulling all social relations and sociability of the subjects in the period prior to hospitalization and application of the socio-educational measure.

With this, it is possible to affirm the unconstitutional state of affairs related to the treatment given to the issue of the involvement of adolescents with violence associated with crime. In this sense, it is important to point out that children and adolescents are the group with the largest number of legally constituted rights – which further intensifies the seriousness of the negligence shown by the Brazilian State.

[6] Ver: https://www.intercept.com.br/2019/09/22/degase-jovens-socioeducativo-rj/

Thus, and far from intending to exhaust the theme, we think that other arguments could be developed in order to understand the possibilities around the elaboration and execution of socio-educational measures by means other than the individualizing punitive one — as well as the realization of critical analyses that consider the State's motives in perpetuating such treatment in contemporary times. considering the neoliberal context of the organization of capitalism and intersecting the markers of race and gender to understand the different types of repercussions of this process on the working class.

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CONTINUING EDUCATION OF TEACHERS IN EDUCATIONAL ROBOTICS: AN APPROACH WITH BASIC, INTERMEDIATE AND ADVANCED LEVELS

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ABSTRACT

This article aims to describe the actions of a project developed at UNESP, Guaratinguetá Campus, aimed at the training of teachers from the public school system in the region of the Education Board (DE) of Guaratinguetá. The project was developed in partnership with the DE of Guaratinguetá and included the offering of courses at three levels: basic, intermediate and advanced. In parallel with the offering of courses at the basic and intermediate levels, a board coupled to a mobile robot was developed, including several components, whose functionalities are being presented in the advanced level course. The article briefly presents the objectives of the courses offered at each level, as well as the results of the evaluations of the courses at the basic and intermediate levels. It also briefly describes the design of the mobile board/robot, the object of the advanced course.

Keywords: Teacher training. Educational Robotics. Arduino.

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INTRODUCTION

This article aims to describe the actions of a project developed at UNESP, Guaratinguetá Campus, aimed at the training of teachers from the public school system in the region of the Education Board (DE) of Guaratinguetá. The project began in 2022 and had the support of the Legislative Assembly of the State of São Paulo, via State Parliamentary Amendment No. 2022.088.38181, for the purposes of funding and investment in the project to train teachers in the public network of the State of São Paulo.

The project was developed in partnership with the DE of Guaratinguetá, the courses having been structured in partnership with the Curriculum Specialist Teachers - PEC, in the areas of Mathematics and Educational Technology. The project included offering courses at three levels: basic, intermediate and advanced. Three editions of the basic course were held, one of the intermediate course and the first edition of the advanced course is being held.

One of the motivations for the proposal of the project is the fact that Basic Education schools have presented difficulties in changing their pedagogical practices to the new proposal of teaching by skills and competencies, recommended by the new BNCC (GERHARD and ROCHA FILHO, 2012). In this context, it is necessary to re-signify certain pedagogical practices to prepare students to face real problems, to the detriment of artificial ones, applied, most of the time, in a decontextualized way in the classroom, giving students greater prominence in the teaching and learning process.

In parallel with the offering of courses at the basic and intermediate levels, a board coupled to a mobile robot was developed, including several components, whose functionalities are being presented in the advanced level course. The microcontrolled multifunctional electronic unit for training in sensor technologies and robotics was developed based on the Arduino NANO and is equipped with a range of sensors and actuators, allowing the performance of several different experiments, ranging from the fundamentals of electronics and programming to advanced robotics projects, such as assembling an electric energy meter, Internet of Things (IoT) applications, home automation applications, configuration of a line-following robot, configuration of a robot that avoids obstacles, among other projects.

The article briefly presents the objectives of the courses offered at each level, as well as the results of the evaluations of the courses at the basic and intermediate levels. It also briefly describes the design of the mobile board/robot, the object of the advanced course. The article is organized as follows. In this section, a general presentation of the project was made. In section 2, the theoretical foundation of the project is presented. The methodology

used is presented in section 3. Section 4 describes the development of the project succinctly, presenting the objectives of each of the levels of the courses offered. Results of the evaluations of the courses by the participants, as well as data on the application of the project in the schools of the course teachers, are presented in section 5. Section 6 presents some conclusions and discussions arising from the development of the project.

THEORETICAL BASIS AND RELATED WORKS

The project sought to guide its actions in a way that is consistent with the National Common Curricular Base – BNCC (BRASIL, 2018), a document of the Brazilian Federal Government (Ministry of Education) that contains the curricular guidelines that must be followed by basic education schools. The National Common Curricular Base - BNCC is based on two premises: the integral formation of the human being and the construction of a more just, democratic and inclusive society.

The BNCC establishes as a goal, for the entire course of Basic Education, the development of 10 general competencies to be worked on with all students. The emphasis on the use of digital information and communication technologies (ICT) in the different stages of Basic Education are included in these competencies. For example, competency 5 defends the importance of:

> "Understand, use and create digital information and communication technologies in a critical, meaningful, reflective and ethical way in the various social practices (including school ones) to communicate, access and disseminate information, produce knowledge, solve problems and exercise protagonism and authorship in personal and collective life." (BRASIL, 2018, p. 9)

It is observed, therefore, that the insertion of Robotics in the educational context is consistent with this competence. Regarding this insertion, one can mention, initially, the development of the LOGO language by Seymour Papert and other researchers, which allowed children to control a robotic turtle through computer commands (Massa; Olive tree; Santos, 2022). The language was developed in the 60s, when the foundations of computing were still being established. The programming of the robot by the children, which was carried out by means of a computer, made it possible, for example, to draw various geometric figures. Papert was convinced that the machine would be able to change the way children learn, considering that this learning process would take place through the creation, reflection and purification of ideas. Papert's vision remains relevant to the present day, encouraging several schools to adopt methodologies and disciplines that work on this learning process, as is the case of Robotics actions used as learning instruments in various disciplines.

In the 80s, Papert and his research group at MIT started a partnership with the LEGO company, which resulted, in 1986, in the LEGO/Logo system, which allowed children to build various mechanical artifacts, which were connected to an interface and whose movements could be programmed with the Logo language (MARTIN et al., 2000). Martin et al. point out that this system was the first widely made robotic construction kit.

The insertion of Educational Robotics in schools should include teacher training programs because, as Reis et al. (2014) point out, it is not enough for schools to have materials such as robotics kits if there are no trained personnel to use them appropriately in the classroom. The authors also recognize the multidisciplinary character of Educational Robotics, emphasizing that it is not much explored by schools, especially public schools, partly due to the costs involved in the acquisition of kits, but also due to the lack of trained personnel for its use. In this context, the authors emphasize the relevance of establishing partnerships between universities and schools, as "an important means to introduce educational robotics in elementary and secondary education" (REIS et al., 2014, v. 2, p. 56).

The project developed by Silva et al. (2018) also presents a teacher training program for basic education teachers, carried out in 10 meetings of 3 hours, using the Criatecno CT100® Educational Robotics kit, based on the Arduino platform. The project is part of an extension program of Feevale, the training activities being carried out on the premises of the university campus. The programming of the kit's controller board was carried out using the Ardublock language, which is based on pre-defined blocks. In addition to the training program, the program also included workshops using the LEGO® MINDSTORM® NXT kit, aimed at students in the final grades of elementary school and high school students. The workshops could take place both at the university and in schools, with the necessary kits being made available by Feevale.

Da Fonseca Silva, Ramos da Silva and Roger Silva (2018) present the result of a survey carried out with teachers of a private Early Childhood Education school, which was the only school in the city of Uberlândia that included Educational Robotics in its curriculum. Robotics classes were offered to students aged 3 to 6 years, who carried out activities in groups of up to 4 participants, making assemblies using LEGO kits®. In the conclusions of the work, the authors suggest the need for new discussions on the use of Robotics in schools, and highlight, in this context, the need for better teacher training to use this resource in the classroom, thus contributing to a more meaningful learning by students.

Pinto, Elia and Sampaio (2012) describe the application of a teacher training course in Educational Robotics, which is structured in two axes, namely: the technological axis and

the pedagogical axis. The technological axis comprises two dimensions, hardware and software, namely: (i) hardware – computer, Arduino and electronic components; and (ii) software – environment and language for developing applications for Arduino. The pedagogical axis is called the Hierarchical Model of Interactivity in three layers - MHI-3C, which correspond to the following interaction modalities: researcher-teacher (layer 1), teacher-teacher (layer 2) and teacher-student (layer 3). The proposals for didactic activities and their application in the classroom context occur in layers 2 and 3. The authors argue, in relation to this form of organization, that "in the context of educational robotics, the role of the teacher acting both in the planning and in the execution of his didactic activity with the resources of robotics is of great importance" (PINTO; ELIA; SAMPAIO, 2012, p. 161).

The work of Souza, Rodrigues and Andrade (2016) aimed to analyze the effects of the introduction of Computational Thinking (CP) in the training of robotics teachers at SESI-PB. The project was proposed considering the difficulties presented by teachers and students, especially in the programming stage of the robots. Thus, the first phase of the project consisted of offering an introductory course to the PC for teachers and high school students at SESI-PB. The results obtained highlight the need, in the context of Educational Robotics, for the teaching of PC for teacher and student training. The authors also point out that "there are indications that CP positively influences student performance" (SOUZA; RODRIGUES; ANDRADE, 2016, p. 1266).

METHODS AND PROCEDURES

The methodological focus of the research was based, mainly in its initial phase, on action research (TRIPP, 2005), as the actions to be developed were structured together with the Curriculum Specialist Teachers - PEC, in the areas of Mathematics and Technology, of the DE Guaratinguetá, establishing a link between the university team and the teachers of the schools that would participate in the course. Also according to Tripp (2005), one of the characteristics of action research is the fact that it is participatory, thus differentiating itself from routine practice (individual) and scientific research (team/collegiate), and is also "collaborative in its way of working" (TRIPP, 2005, p.448). Under this focus, teachers of basic and intermediate level courses should participate in training activities, propose and carry out teaching projects using Educational Robotics with students from their schools, supervised by the University team.

The activities, in the basic and intermediate level courses, were developed according to the guidelines of a Project-Based Learning model – PBL, aiming to investigate, among other aspects, strategies for the use of PBL in a traditional teaching context, and the role of

active learning – students participating in the development of projects involving Educational Robotics in their schools – in improving the learning of concepts related to the themes of Rational Use of Educational Robotics Energy and Energy Efficiency.

As theoretical support for the approach by PBL, the model of the BIE Institute – Buck Institute for Education (www.bie.org) (MARKHAM; LARMER; RAVITZ, 2008), which presents PBL as an appropriate model to deal with the educational reality of the twenty-first century, emphasizing the contextual and interdisciplinary nature of learning. DUCH, GROH AND ALLEN (2006) EMPHASIZE THAT THE contents to be addressed in an application of PBL should aim to develop "higher level" thinking skills in students, aiming to acquire the cognitive levels established by Bloom: knowledge, comprehension, application, analysis, synthesis and evaluation (sense of judgment) (BLOOM, 1956 apud DUCH; GROH; ALLEN, 2006). It should be noted that the taxonomy initially proposed by Bloom underwent a revision in 2001, giving rise to Bloom's revised Taxonomy, in which the categories of cognitive domain are: remember, understand, apply, analyze, synthesize and create (FERRAZ; BELHOT, 2010). Thus, an application of PBL must meet the cognitive development of students according to the current categorization of the aforementioned Taxonomy.

The BIE institute proposes a standards-focused PBL model (MARKHAM; LARMER; RAVITZ, 2008), and, according to this model, the organization of a project must follow the principles briefly described below:

i. Start with the end in mind: definition, among other things, of the content standards, key skills, and mental habits that will constitute the expected results of the project.
ii. Formulate the Guiding Question: proposition of a relevant and significant question that makes students get involved with the project, requiring them to have an active posture and dedication to seek their own answers and their own knowledge (POZO, 1998).
iii. Plan the evaluation: specification of the products and artifacts expected from the project and how they will be evaluated, noting that the evaluation, in an ABP application, is commonly based on performance, as it involves a problem-solving activity.
iv. Map the project: it includes, among other aspects, the organization of the tasks and activities to be developed, the selection of the necessary resources and the preparation of a visual script (which can be a storyboard or a schedule, among others).

v. Manage the process: description of tools and strategies to assist in managing project development. It should provide, for example, the use of reference frameworks, which allow monitoring the students' learning with the project activities.

RATIONALE AND DEVELOPMENT

An essential aspect in the use of technologies in schools is to prepare teachers for the use of these technologies, that is, it is necessary to present, train and make indications of when and how to use a certain resource in the classroom. The indiscriminate and, in some cases, mechanical use of new technologies may not promote desirable qualitative and quantitative changes in the teaching-learning process.

Usually, when teachers do not have a more comprehensive training or, for example, without the proper training in a certain technology, they make minimal adjustments to the procedures performed in the classroom. That is, teachers reproduce the practices to which they were already accustomed, not taking into account the available technological resources.

As the use of new technological resources is quite limited, the lack of motivation, both of the teacher and the students, is an explicit consequence of this lack of training. The better prepared the teacher is in the use of a new technological resource, such as the use of Robotics, the more chances he will have of succeeding in the use of this instrument in his classroom actions. No less important is also to know how this resource can help you in the transmission of a given content in the classroom.

In the proposed courses, the contents were related to the Energy theme, mainly to the themes Rational Use of Energy and Energy Efficiency, under the prism of Robotics, and to those addressed in the new curricular matrix of the New High School in the state of São Paulo, within the Curricular Units planned for schools with Integral Education Program – PEI.

The courses were held according to the hybrid modality, that is, in the blended format. The face-to-face actions consisted of 4 (four) meetings, being held on Saturdays from 9:00 am to 1:00 pm at the Center for Innovation in Energy Efficiency – INOVEE, located at UNESP – Faculty of Engineering campus of Guaratinguetá. The face-to-face activities were used for the development of the content, as well as for the presentation of a task-based learning model and general guidelines for the development of teaching projects, which were developed in the schools by the course teachers.

Each face-to-face meeting was held in a technological workshop format, in which the course teachers were separated into teams, usually made up of teachers belonging to the same high school. After that, the theme proposed for the activities was presented, prepared by the course tutors, aiming to provide a first presentation of the organization of the script and the support materials of the experiment, and also to motivate the course teachers about the actions that would be carried out during the meeting. Figure 1 shows the holding of a face-to-face meeting of one of the basic level robotics courses, held on the premises of the Center for Innovation in Energy Efficiency – INOVEE.

Figure 1. Face-to-face activity of the course "Introduction to Educational Robotics: from Theory to Practice".



Source: Authorship.

The project's online actions were developed from 8 (eight) activities, lasting 2 (two) hours each, aiming to complement the conceptual content presented during the course's face-to-face activities. In addition to the conceptual contents, the training presented themes that were used by the course teacher to develop, with his students, a teaching project related to the subjects covered throughout the course.

Throughout the execution of the courses, the online actions were carried out synchronously and asynchronously. In synchronous mode, the actions were carried out in a "live" format, in which a theme related to the course was presented and discussed. In the asynchronous mode, video classes lasting between 20 and 60 minutes were available, in addition to complementary materials, such as: handout and manuals of electronic components. In both formats, electronic circuit simulation software was used that allowed the execution of experiments in a virtual way, that is, in online actions virtual laboratory activities were always performed. At the end of each online activity, an Evaluation Form was made available, which was open accepting a response for a period of 7 (seven) days.

The syllabus proposed for the execution of the basic level course consisted of the following topics: Notions of electricity and electronics. Electrical signals. Voltage, current,

and power. Energy sources. Instruments of measurement. Electronic components: resistor, capacitor, switches, diode, light-emitting diode (LED), display, transistor, relay. Fundamental rules of circuit analysis. Integrated circuits. Analog and digital sensors (temperature, pressure, ultrasonic, among others). Motor: DC and servo motor. Notions of algorithm construction and its forms of representation. Logical, relational, and arithmetic data types and operators. Arduino programming via IDE. Definition of the structure of a sketch. Types of variables and constants. Functions: configuration, digital I/O, analog I/O, mathematical, time, trigonometric, advanced I/O. Control structures. Comparison and Boolean operators. Serial communication. Library.

The proposed syllabus for the execution of the intermediate level course consisted of the following topics: Concept and forms of algorithm representation. Scheduling structure: assignment, selection, repetition, procedures, and functions. Vectors and matrices. Analog and digital sensors. Position, speed, pressure, optical, temperature, current, ultrasonic, piezoelectric sensors. LCD and OLED type display. PWM modulation concepts – *Pulse Width Modulation* . Practical applications of sensors. Electromechanical actuators, solenoids, motors. Programming with Arduino: Data types, data conversion, constants. Functions: mathematical, trigonometric, random numbers, advanced I/O, character. Communication: serial and I2C. Control structures, operators (bitwise, composite, boolean, arithmetic). How to create a function. How to install and use a library. Construction of robotic platforms with shields. Individual programming of the shields and integration of the modules for the construction of the robot: line follower robot and/or obstacle avoidance robot and robotic arm. Application of educational robotics content in interdisciplinary areas of teaching.

The pedagogical resources used in the execution of the course were:

- **Script:** material containing the objectives and concepts necessary for the execution of the experimental activity.
- **Multimedia material:** complementary reference material on the practical experiment, developed in a language adapted to the resources made available digitally, mainly in the form of hypermedia and/or hypertext.
- **Workbook:** class notes, formatted in the format of booklets, made available in order to be used as support material for the development of the proposed activities.
- **Video classes:** availability of online classes for students, with multiple video classes linked to the proposed themes and worked on during the online actions of the course.

- **Virtual laboratory:** learning object developed to allow simulations of virtual multifunctional electronic systems, so that the course teacher can exercise investigative attitudes about a particular subject.

The technological resources used in the execution of the course are listed below:

- The Google for Education platform: within the framework of this virtual environment, the Google Classroom and Google meet tools were mainly used.
- For the planned online actions, in order to perform virtual laboratory actions, the Autodesk Tinkercad online tool was used.
- Test bench containing the following equipment: power supply, multimeter, function generator and oscilloscope.
- Notebook, with internet access and with the Arduino IDE pre-installed.
- Arduino UNO R3 platform and various electronic circuits for the execution of the planned experimental activities.

RESULTS AND DISCUSSION

INTRODUCTION TO EDUCATIONAL ROBOTICS COURSE: FROM THEORY TO PRACTICE

150 vacancies were offered for the basic level course, being intended exclusively for teachers from the public school system of the State of São Paulo. The modalities allowed for registration, in the 1st and 2nd edition of the course, were: Basic Education II Teachers of Mathematics, Physics and Chemistry, or Basic Education II Teachers with classes assigned in the Technology and Innovation component (INOVA). In the 3rd edition of the course, the modalities allowed for registration were expanded to Basic Education teachers with classes assigned in Elementary or High School of any component in the calendar year 2023 and Pedagogical Management Coordinating Teachers (CGP/CGPA/CGPG). Considering that the use of robotics in the classroom can promote interdisciplinarity and motivate the execution of multiple activities in areas related to Science and Technology, we had an excellent demand for interested teachers, with 136 teachers registered to take the courses offered at the basic level, and 69 (sixty-nine) students were successful in concluding. The enrolled teachers came from schools in several cities in the region of the Board of Education of Guaratinguetá / SP, among which we can mention: Aparecida, Areias, Bananal, Cachoeira Paulista, Canas, Cruzeiro, Cunha, Guaratinguetá, Lavrinhas, Lorena, Piquete, Potim, Queluz, São João do Barreiro and Roseira.

The course teachers were evaluated through the development of the activities proposed during the face-to-face actions, and through evaluative questionnaires referring to

the online actions carried out in the course. In addition, the evaluation process also included the development of a teaching project that should be applied in the classroom, and the results of this project should be socialized with the other participants of the course. Figure 2 shows the socialization meeting of the basic level course.

Figure 2. Socialization meeting of the course "Introduction to Educational Robotics: from Theory to Practice".



Source: Authorship.

Table 1 presents the list of teaching projects developed by the course teachers (1st Edition) in their respective schools, whose results were socialized in the last face-to-face meeting of the course.

Table 1. It presents the following information regarding the teaching projects carried out during the 1st Edition of the Robotics Course: responsible, the title of the teaching project, the curricular component in which the action was carried out, the general competencies of the São Paulo curriculum and the objects of knowledge.

ACCOUNTABLE	PROJECT TITLE	CURRICULAR COMPONENT IN WHICH IT WAS APPLIED	GENERAL COMPETENCIES OF THE SÃO PAULO CURRICULUM	OBJECTS OF KNOWLEDGE
EE Professor Miquelina Cartolano	Producing Motion with Servo Motor: Ghost Project	Physics Practice	Scientific, critical and creative thinking	Electrical circuits, electronics and computers (semiconductors; transistors; integrated circuits; diodes), Electrical and electronic equipment (electrical voltage; electric potential; units of measurement; intensity of electric current).
E Murillo do Amaral	Audiometry test with LCD display.	Physics	Knowledge Scientific, critical and creative thinking	Technology and scientific language, and introduction to science education. Sound waves (pitch, frequency, timbre, intensity, propagation, and

				physiological qualities of the sound).
EE Sylvio José Marcondes Coelho	Mixing colors	Technology	Knowledge Scientific, critical and creative thinking Communication Digital culture	Programming (Plugged/Unplugged) Maker Culture Scientific thinking.
EE Prof. Luiz de Castro Pinto EE Prof. José Pereira Éboli	Parking sensor	Elective	Scientific, critical and creative thinking Digital culture Work and life project Responsibility and citizenship	Robotics (Technology and Innovation); Sources and types of energy Energy transformation Electrical circuits Conscious use of electrical energy (Science)
EE PEI Ernesto Quissak	Robotic arm	Elective Technology Mathematics Physics	Knowledge Scientific, critical and creative thinking Digital culture Work and life project	Directly proportional quantities and inversely proportional quantities. The Technical, Scientific and Informational Environment and the impacts on the use of the territory by the relations of the world of work.
148 Paulo Verghnis	Home automation	Physics	Scientific, critical and creative thinking Digital culture	Electrodynamics (electric current; resistors; Ohm's laws; electrical measuring equipment; capacitors; electric energy and power). Electrical generators and receivers. Electrical circuits.
EE PEI Maria Izabel Fontoura	Construction of a traffic light	Elective	Scientific, critical and creative thinking	Programming, hardware: Arduino Uno R3, Breadboard (Protoboard), wires, use of the TinkerCad platform.
ACCOUNTABLE	**PROJECT TITLE**	**CURRICULAR COMPONENT IN WHICH IT WAS APPLIED**	**GENERAL COMPETENCIES OF THE SÃO PAULO CURRICULUM**	**OBJECTS OF KNOWLEDGE**
EE Counselor Rodrigues Alves	Genius Game, Automatic Door, Temperature Sensor, Traffic Light	Curricular Deepening - Connected Mathematics	Knowledge Scientific, critical and creative thinking Digital culture Empathy and cooperation	Block Programming; Programming Language; Arduino; Basic concepts of Physics (led, resistor, motors, electrical circuit)
EE Prof. José de Paula França	Obstacle deflection robe	Elective Technology Physics	Knowledge Scientific, critical and creative thinking Digital culture Work and life project Empathy and cooperation	Programming, reading and interpretation of electrical circuits, electronic components, electricity, solutions and dilution, quantities and measurements.

EE Professor Paulina Cardoso	Sensor On Alarm and Off Button	Technology	Knowledge Scientific, critical and creative thinking Digital culture	To create solutions, based on robotics, identifying problems and proposing solutions related to the concepts of engineering, mathematics and art (STEAM).
148 Paulo Verghnis	Mixing colors	Technology	Knowledge Scientific, critical and creative thinking Digital culture Self-knowledge and self-care	Programming (Plugged in and out of the way), critical thinking
EE LIKE Oswaldo Cruz	Buzzer drive	Elective	Scientific, critical and creative thinking Digital culture Empathy and cooperation Responsibility and citizenship	Flowchart to determine the parity of a natural number. Multiples and divisors of a natural number. Prime and composite numbers.
EE Prof. Francisco Marques de Oliveira Junior	Mixing colors	Technology Mathematics Physics	Knowledge Scientific, critical and creative thinking Work and life project Empathy and cooperation	Electrical circuits. Electromagnetism. Electronics and computer science (semiconductors; transistors; integrated circuits; diodes). Electrical and electronic equipment (electrical voltage; electric potential, units of measurement; intensity of electric current and capacitors); Photoelectric effect (transformation of electromagnetic radiation into photoelectron current)
EE Prof. Nilo Santos Vieira	Obstacle deflection robe	Elective Mathematics	Digital culture	Introduction to algorithms and programming logic; Introduction to Basic Programming in C++. Practice with electronic components, shields, sensors, actuators. Electronic circuits, protoboard, and circuit analysis.
ACCOUNTABLE	**PROJECT TITLE**	**CURRICULAR COMPONENT IN WHICH IT WAS APPLIED**	**GENERAL COMPETENCIES OF THE SÃO PAULO CURRICULUM**	**OBJECTS OF KNOWLEDGE**
EE Prof. Edgard de Souza	Home automation	Elective	Knowledge Digital culture	To make students aware of the multifunctionality that Arduino has.
EE Prof. Abraão Benjamin	Mixing colors	Technology Mathematics Sociology	Knowledge Scientific, critical and creative thinking Digital culture	Programming (Plugged/Unplugged) and Maker Culture. The role of youth in territorial contexts: central and peripheral; material and virtual;

			Empathy and cooperation	professional and academic and cultural and political.
EE Gabriel Prestes	Automation in agriculture	Elective	Work and life project	Simple machines Natural phenomena and environmental impacts Public health programs and indicators

Source: Authorship.

At the end of the course, an evaluation instrument was applied to the students, containing questions grouped into two groups:

- **Group I:** objective questions about the course professors, didactic material, approaches used, development of the planned actions, both face-to-face and online; such questions about the expected results and expectations for the development of the activities aimed to evaluate the degree of agreement of the students with the statements presented, according to a 5-point Likert scale, ranging from 1 = totally dissatisfied / totally disagree to 5 = very satisfied / I totally agree.
- **Group II:** discursive questions, for the students to express their opinions on various aspects of the course.

For group I, 15 (fifteen) statements were listed for which the degree of agreement of the participants was verified, and they were listed below:

1) Achievement of course objectives
2) Development of the course program
3) The theoretical approach of the course
4) The practical approach of the course
5) The facilities and resources used to carry out the course
6) The teaching materials used
7) Your use/learning in the course
8) The distribution of the workload between theory and practice
9) The application of the knowledge acquired in the course in your professional practice
10) Ability of teachers/instructors to use teaching methods and techniques in the development of the course
11) Clarity and objectivity of the teachers/instructors when exposing the subject
12) Knowledge of teachers/instructors about the content taught

13) Potential contribution of the robotics course to develop in students competencies and skills, scientific, critical and creative thinking
14) Usefulness of the robotics course for the application of competencies recommended in the BNCC
15) General organization of the course (facilities, teaching material, platforms, teachers/instructors)

It was observed that most students agreed with most of the statements, with percentages above 70% (in relation to the answer options: "satisfied" and "very satisfied / totally agree"). For example, for statement (9), we obtained a degree of agreement of 94%, and for statement (14) we obtained a degree of agreement of 99%. On the other hand, we observe that some points need to be improved. The first aspect is related to the statement "The distribution of the workload between theory and practice", in which 30.3% disagreed (considering the options "dissatisfied" and "neutral"). Another point of attention is related to didactics and the way of presenting the contents, as we obtained a degree of disagreement of 12.1% in relation to the statement "Clarity and objectivity of the teachers/instructors when exposing the subject".

In relation to group II, it included, as mentioned, open questions, in which the students could express themselves on aspects related to the development of the course, such as: the points that most benefited them in the course, the points to improve in the actions developed, and there were specific questions for both the face-to-face and online approaches. Finally, we ask for suggestions for improvements in future editions of the course.

Some of the answers regarding the positive points of the course are listed below:

"The practice of the work, getting to know other tools, clarifying doubts."
"Welcome, facilities, preparation of teachers/instructors."
"Theoretical classes giving foundation to practical classes."
"Classes on Saturdays, qualified teachers, and availability of materials."
"Class schedule; use of tinkercad together with the teacher; recording of the class to have access later (in case of doubts)."
"Flexibility of schedules, videos, good quality and objective pdf material."
"Punctuality, support material, excellent quality classes."
"Practical, good assistance from the monitors and materials available."
"Quality of the material made available, monitoring in practice and working in pairs."
"Face-to-face classes, robotics kit and the help of students and teachers in relation to the assembly of circuits with arduino".
"Knowledge of the arduino, assembly of the circuits and group work."
"Hands on; practical class; Support from teachers regarding the assembly of circuits with arduino."
"Monitoring the monitors, working with physical material and contact with the teachers."
"Very didactic programming, use of available resources, answering questions with other students."
"To have the material available. Help from teachers and monitors."
"Face-to-face classes gave the opportunity for questions for further clarification."

"The resources used in the course."
"The didactics presented in the course."
"The practical approach of the course."
"The safety of teachers and trainees."
"The gradual expansion of the contents."
"The time dedicated to face-to-face classes."
"Instructors' skills, patience and facilities."
"Good explanation, good attention from the instructors and attentive."

Some positions of the course teachers on the points to be improved are presented below:

"A single point to consider would be the possibility of more face-to-face classes."
"The student group (50) is very large, it could be smaller, to enable more interactions."
"I believe that the challenge is in relation to our workload at school, which makes it difficult to effectively participate in distance classes."
"The approach is great, the only problem is the internet in schools, there is always some failure in the connection."
"To have more time to explore each content more calmly."
"Develop more assemblies, review the connections together with us."
"Having more face-to-face classes, for those who don't know anything, it's very difficult to learn at a distance."
"I think Time would be one of the words, since, incredible as it may seem, classes pass very quickly"
"Increase the number of classes or the school term on the day of the final presentations."
"Internet access."
"Demand for the activities because uniting with the school day to day was a challenge."
"Self-discipline and time management."
"Technological and connectivity challenges."
"It would be good to have greater availability of exercises to assist in learning..."
"The course coincided at times with the 360 assessment, which ends up overloading the teachers."

Finally, we list some suggestions presented by the course teachers for the continuous improvement of the course:

"Have more time for the development of projects."
"The possibility of increasing the number of face-to-face classes."
"Put a specific time for questions and comments at the end of class."
"The distance class is important, but to improve the follow-up, the teacher would have to have the robotics kit."
"To be placed with more emphasis on face-to-face."
"Creating a question chat."
"More face-to-face classes for better use."
"The possibility of having greater communication so that doubts can be explained."
"Longer time for practices."
"Longer time for face-to-face classes."
"Work on the final project, from the beginning of the course, along with the other subjects covered."
"Schedule of lives.."

Analyzing the answers of the students, with regard to what they liked the most, most expressed that the face-to-face classes on Saturdays, and the flexibility of the schedule to

follow the actions online, facilitated the monitoring of the course activities. They also praised the quality of the didactic material as well as the preparation of the team, teachers, scholarship holders and collaborators, who carried out the training action. Regarding what they liked the least, the points highlighted by the vast majority were the lack (or a reduced number) of robotics kits in schools, infrastructure problems related to the data network (internet/wifi), and problems arising from the large workload of the students in their respective schools. There were also manifestations about the insufficient time for the execution of the proposed activities within the face-to-face workshops, about the difficulty related to the programming actions, and also about the need to extend the deadline for the delivery of the forms referring to the distance learning activities developed throughout the course.

EDUCATIONAL ROBOTICS COURSE WITH ARDUINO: DEVELOPING INTERMEDIATE PROJECTS

50 vacancies were offered for the intermediate level course, being intended exclusively for teachers from the public school system of the State of São Paulo. Only the course teachers who had taken and achieved approval in the previous extension course – "Introduction to Educational Robotics: from Theory to Practice", were able to participate in this training. In this course we had 27 students enrolled, from schools in several cities in the region of the Board of Education of Guaratinguetá / SP, among which we can mention: Aparecida, Cachoeira Paulista, Cruzeiro, Cunha, Guaratinguetá, Lavrinhas and Lorena.

17 (seventeen) students were successful in completing the course. Considering that the course aimed to expand the contents seen in the basic level course ("Introduction to Educational Robotics: from Theory to Practice"), complementing the levels of theoretical and practical knowledge in the area of Robotics of basic education course teachers, demonstrating the potential of using robotics for the teaching of multiple contents, and reinforcing the use of another teaching tool focused on technology, It is considered that the number of graduating teachers was satisfactory.

At the end of the course, an evaluation instrument was applied to the participants in order to evaluate the course. The system and model of the evaluation form followed the same molds as the one used in the evaluation process of the basic level course. Below we present an analysis of the results obtained.

We recall that the objective questions were prepared in order to obtain evaluation results related to the didactic material used throughout the actions, the approaches used both in the development of face-to-face actions and in online actions, and about the team,

teacher and tutors, responsible for the application of the course. We used the 5-point Likert scale, ranging from 1 = totally dissatisfied / totally disagree to 5 = very satisfied / totally agree, in order to assess the degree of agreement of the students with the information presented.

Considering, in this analysis, the answers to the options "satisfied" and "very satisfied / totally agree", it was observed that the students agreed with all the statements, with percentage indexes, in the vast majority of questions, above 70%. For example, for statement (2) we obtained a degree of agreement of 93.8%, for statement (10) we obtained a degree of agreement of 100%, for statement (6) we obtained a degree of agreement of 93.8%, and for statement (13) we obtained a degree of agreement of 100%.

On the other hand, we observed that there are still some points to be improved, such as, for example, in relation to the statement "The distribution of the workload between theory and practice", 56.3% of the students positioned themselves as "satisfied". But we emphasize that the students evaluated the theoretical and practical approach of the course carried out by the responsible team in an extremely positive way.

Regarding the discursive questions, as in the previous course, the students expressed themselves on aspects related to the development of the course, such as: the points of the course that most benefited them, the points to improve in the actions developed, and, in both cases, different questions were proposed for face-to-face and online activities.

Some of the answers of the students regarding the positive points of the course are listed below:

> "Problem solving in practice, stimulating creativity and innovation, and preparing for future challenges."
> "Structure, material, support from teachers."
> "Support from teachers in the assembly of projects, interaction with colleagues and components available for assembly."
> "Quality of classes; knowledge of teachers/instructors; projects."
> "The use of the multimeter, the construction of the cart and the programming."
> "Flexibility of schedule, interaction (Network) and use of screen sharing to help with the challenges of remote classes."
> "Improved use of the Tinkercad platform and synchrony with face-to-face classes."
> "Expansion of knowledge of the Tinkercad platform; Complementation of distance learning classes with face-to-face classes."
> "Expansion of the use of the tinkercad platform, Theoretical class complements face-to-face practice."

Considerations on the points to be improved, indicated by the students, are listed below:

> "Very long face-to-face class period."

"Leave the codes ready and as the class progresses, the student can modify it. Typing takes a long time."
"Suggestion for the duration of the one-hour online class."
"Schedule at the beginning of the course and according to the SEDUC calendar, and more face-to-face classes."
"Very long (tiring) class time,"
"Time management by teachers (for culmination)."

Analyzing the answers of the students, with regard to what they liked the most, most expressed that the face-to-face classes on Saturdays and the flexibility of schedule to follow the actions online, were positive points that facilitated the monitoring of the course activities. The use of the instrumentation bench, used in the face-to-face actions, as well as the availability of robotics material so that the students could carry out the electronic assemblies, were also pointed out as positive points of the course. The synchronism between the content presented during the distance learning actions, and in these activities new features of the Autodesk TinkerCad software were used, and the face-to-face activities was also highlighted as one of the strengths of the course. The students also praised the quality of the didactic material, as well as the preparation of the team: professors, UNESP/FEG scholarship holders, and collaborators, who carried out the training action.

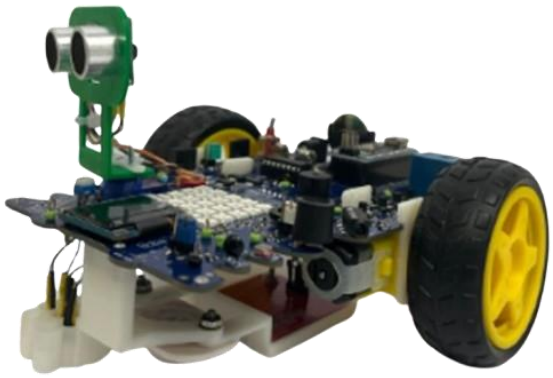
A point of attention is in relation to the duration of the face-to-face activity, because in this course the face-to-face activities lasted 6 hours/meeting, and the addition of 2 hours/meeting made the face-to-face actions very extensive.

EDUCATIONAL ROBOTICS COURSE WITH ARDUINO: DEVELOPING ADVANCED PROJECTS

The course, still in progress, is intended for the training of teachers from the public school system in the state of São Paulo approved in the previous extension course "Educational Robotics with Arduino: Developing Intermediate Projects", offered by UNESP – Faculty of Engineering and Sciences Campus of Guaratinguetá. 20 vacancies were offered for the course.

As the advanced level course is still running, we still do not have the indicative data to carry out an evaluative analysis of its completion. The activities of this course are being carried out with the robotic platform called "Robot-INOVEE" (Figure 3).

Figure 3. Robotic platform "Robot-INOVEE" developed by researchers from the Center for Innovation in Energy Efficiency.



Source: The author.

The Robot-INOVEE platform was developed by researchers from the Center for Innovation in Energy Efficiency – INOVEE, aiming at its use in robotics courses of all levels, from those involving fundamentals of electronics and programming to advanced robotics projects. This robust and versatile kit is equipped with a wide range of sensors and actuators that allow you to configure the robot both as a line follower and as an obstacle avoidance robot. Among the components, ultrasonic, light, sound, temperature, and current sensors stand out, as well as an RFID (*Radio Frequency Identification*) sensor for object recognition and a *Real Time Clock* (RTC) sensor, which allows you to perform timed tasks accurately. The microprocessor LED array makes it possible to create interactive light patterns, while the electronic relay provides additional control over external devices. The kit also features Bluetooth and Wi-Fi connectivity, making it easy to communicate and remotely control the robot. In addition, there are several measurement points where the user can monitor different parameters during the experiments, further expanding the learning possibilities. With this kit, it is possible to carry out up to 100 different experiments, being an ideal tool for a practical, rich and engaging experience, at each stage of the student's journey towards the world of robotics.

The syllabus proposed for this course was: Fundamentals of the robotic platform "Robot-INOVEE": microcontroller, integrated components and connectivity. Programming of the INOVEE Robot by IDE. Sensor reading. Visual output and physical output triggering. Remote mode control of external devices. Dial activation. Use of timing. Establishment of communication using I2C protocol and wireless communication. Development of applications in interdisciplinary areas using the Robot-INOVAE platform.

CONCLUSION

We observed that the courses, especially the editions referring to the introductory approach (basic course), aroused a great interest in the teachers of the public schools in the region of the Board of Education of Guaratinguetá, considering not only the number of teachers enrolled, but also the discussions related to the possibility of expanding, at a later time, the target audience of the course. In this context, the organizing team considers the possibility of establishing new partnerships, between the University and other Education Boards, or even with city halls in the region, aiming to offer new editions of the courses, revised and improved based on the suggestions and criticisms reported by the participants of the courses already held.

At the end of this project, we can highlight that teacher training courses, such as those described in this article, contribute to a better and more efficient use of new technological resources in the classroom by teachers, meeting the curricular guidelines established for basic education. More specifically, in the case of the state of São Paulo, the courses meet the need to better prepare teachers for the use of robotics kits, made available by the state for several public schools, as well as the preparation of teachers responsible for disciplines in the area of technology.

It should also be noted that the partnership established between UNESP and the Board of Education of the region of Guaratinguetá, aiming at teacher training for the use of new technologies in the classroom, can be beneficial for UNESP itself, as better prepared teachers will be able to offer better training to their students. This better training, based on new technologies, can contribute to the motivation of these students to pursue careers, at a higher level, in the areas of exact sciences (for example, opting for Engineering courses), and they may be, in a few years, students of the University itself.

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EVOLUTION OF C-CO2 IN SOILS OF DIFFERENT ECOSYSTEMS IN THE ALTO ACRE REGION, ACRE, BRAZIL

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ABSTRACT

Different studies, developed over the years, have shown that the increase in human activities on the soil can influence the release of gases related to the increase in the greenhouse effect. In this sense, the use of methods that evaluate the evolution of C-CO2 has been considered as important indicators to detect changes in the environment, since they can be influenced by the crop and its cultivation system as a result of impacts on microbial activity. The objective of this work was to evaluate the release of C-CO2 from soils submitted to different ecosystems. Laboratory tests were carried out where soil samples, submitted to five different ecosystems, were collected in three different periods throughout the year in the municipalities of Brasiléia and Epitaciolândia, Alto Acre region, in the state of Acre, and were subsequently incubated. Subsequently, the evolution of C-CO2 was evaluated, and the readings were carried out periodically until the 500th day of incubation of

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the samples. The data were analyzed in order to evaluate the effect of different plant species on the evolution of C-CO2. Regarding the collection carried out in April, there was no difference in the evolution of C-CO2 between the areas. However, in the month of June, which comprises the period of the beginning of the transition between the rainy season and the dry season, and in the month of August, the dry season, it was observed that in the area of native forest occurred the highest values of C-CO2 flux, differing statistically from other areas within these months of collection. Between the collection times, only in the area of agroforestry system no significant differences were recorded in the evolution of C-CO2. The highest accumulated values of C-CO2 were recorded in the following sequence: native forest > agroforestry system > area with cassava > cultivated pasture > area with banana. It is concluded that the areas that present a greater contribution of plant material to the soil can serve as a stimulus to the development of microorganisms that, consequently, increase the flow of CO2, especially until the beginning of the dry season and that the absence of moisture negatively influences the emission of C-CO2, causing significant differences in the amount of release of C-CO2 between the study areas at the same time of evaluation.

Keywords: Respirometry. Mineralizable carbon. Carbon dioxide.

INTRODUCTION

Studies regarding the implantation of different crops in the soil on its biota have proved to be a growing concern of society in search of improvements in the preservation and conservation of environments. It is known that soil is a dynamic natural body made up of mineral and organic materials and that it houses a series of organisms that determine the balance of many ecosystems.

This organic material, present in soils, is essential for improving their fertility and also for increasing plant productivity, in addition to serving as a substrate for microbial activity. Knowledge about the dynamics of decomposition of organic residues present in soils can contribute to the definition of more appropriate procedures for crop management and a better use of these materials with a view to increasing soil quality.

The biological processes that occur on the surface, or not, of soils also serve as indicators of their quality, being closely linked to each other, constituting a system that is considered complex and dynamic, where the density and diversity of the communities of microorganisms and how they are impacted by climate change, such as those that can be caused by the emission of carbon dioxide into the atmosphere, is often unknown. as well as on the implications related to the ecosystem itself.

It is known that during the decomposition of products such as organic materials, these microorganisms produce CO2, the release of which is an indicator of microbial activity, the supply (quantitative and qualitative) of organic substrates and other interactions between the microbiota and the soil matrix, as reported by Ciotta *et al*. (2004) and Araujo *et al*. (2016). In the soil, the main responsible for CO2 emissions are fungi and bacteria through the degradation of organic material (SILVA *et al*., 2007).

The measurement of the microbiological activity of these organisms, through respiration, biological nitrogen fixation, mineralization of organic compounds, enzymatic activity and microbial biomass is done by well-established techniques, and these characteristics are used, among other purposes, as sensitive indicators of pollution (BROOKES, 1995).

Thus, the metabolic activity of the microbial population in the soil can be analyzed through the amount of CO2 released by the respiration of microorganisms (ZIBILSKE, 1994), aerobic and anaerobes (GAMA-RODRIGUES *et al*., 2005). Microbial respiration is quantified from the oxidation of soil organic matter by aerobic microorganisms, which can be estimated by CO2 emission (MOREIRA; SIQUEIRA, 2006).

Soil respiration is given by the sum total of metabolic functions that result in the production of CO2, and that are related to soil biota, as well as to moisture, temperature

and aeration (JOICE, 2012). The activity of soil microorganisms is dependent on energy source and C, obtained mainly by the decomposition of soil organic matter - MOS (VEZZANI; MIELNICZUK, 2009).

The addition of C below the soil surface is as important to microorganisms as the addition over the surface, in which live and dead roots provide readily available substrates for microbial activity to transform nutrients and alter soil structure (HINSINGER *et al*., 2009).

C is the main constituent of soil organic matter (SOM), which interferes and interacts with practically all physical, chemical and biological processes and attributes that occur in the soil, influencing, for example, water retention, nutrient availability and cycling, the activity of micro and macroorganisms, the formation of aggregates, the complexation of heavy metals, among others.

More specifically, among the global compartments of C, soil is the largest reservoir of the terrestrial ecosystem. According to Houghton (2001), the stock of organic C in soils varies between 1.5 and 2.0 Pg, being about twice as large as the stock of C in the atmosphere and about three times greater than the C contained in the planet's plant biomass (LAL, 2004).

Carbon is one of the main components of soil organic matter (GUEDES, 2009), and its stocks vary according to the rates of addition by plant and/or animal residues, and of loss, among them, those resulting from erosion and oxidation by soil microorganisms. In soils without anthropogenic action, the content and stock of these elements are basically determined by temperature, humidity and soil type (BAYER *et al*., 2009).

The carbon cycle is its closed circulation in the compartments of the biosphere, atmosphere, hydrosphere, and lithosphere. In the atmosphere there is mainly carbon dioxide (CO2), which, even in a small proportion in relation to planetary carbon (0.001%), is essential for life on Earth and for the balance of the climate. The slow carbon cycle is the circulation of carbon fixed in sedimentary rocks and fossil fuels, which return to the atmosphere on a millennial scale, through volcanism, erosion (fluvial) and extraction. The exchanges of the biosphere and the ocean with the atmosphere form what is called the rapid carbon cycle (ALICE, 2005).

Mineralizable carbon is quantified from the evolution of CO2 (MENDONÇA; MATOS, 2005; LOSS *et al*., 2013). The rate of decomposition of organic material and the consequent release of C-CO2 are determined mainly by the intrinsic characteristics of the organic matter itself, such as: C/N ratio; carbohydrate contents, lignin; degree of aggregation; soil characteristics (pH, nutrient contents and moisture) and environmental

characteristics (temperature and precipitation) (DAVIDSON; BELK; BOONE, 1998; BROOKES, 1995).

CO2 has been the object of many recent studies, given that the increase in its concentration in the atmosphere causes the aggravation of the so-called greenhouse effect, which causes climate change through global warming, threatening the natural balance of the planet. This increase in the concentration of greenhouse gases (GHG) in the atmosphere over the years, which causes changes in vegetation, disturbances in aquatic levels and agriculture, affects food and nutritional security throughout the planet (HUNGATE *et al*., 2000; ALPINO *et al.* 2022), being called today as climate change.

Santos *et al*. (2024) report that the greenhouse effect is a natural phenomenon, composed of small amounts of GHGs, which maintains the Earth's average temperature due to the absorption of infrared radiation, however, the increase in the concentration of these gases can block the exit of thermal infrared rays and greatly increase the average temperature of the planet, causing negative consequences, such as decreased water; increase in the desertification process; extinction of plants and animals and decrease in agricultural and livestock productivity.

The report of the *Intergovernmental Panel on Climate Change* (IPCC, 2021), states that the planet will warm in the coming years, reaching an increase of 1.5 °C by the year 2030, and presents that in the year 2019 atmospheric concentrations of CO2 were higher than at any time in at least 2 million years and the concentrations of methane and nitrous oxide, Both significant greenhouse gases, they were higher than at any time in at least 800,000 years.

The results presented by the IPCC demonstrate that reducing deforestation in the Amazon would also be a way to balance the climate, which demonstrates the importance of studies that evaluate the impacts of the implementation of different agricultural systems on the dynamics of C-CO2 evolution. According to SEEG (2018), most of the greenhouse gases emitted come from indirect emissions, resulting from the conversion of forests into pasture and agriculture areas, and another portion comes directly from the agricultural sector, such as enteric fermentation and soil management.

Among the C reservoirs in terrestrial ecosystems, soil is the most expressive. According to the work of Jobbágy and Jackson (2000), the world stock of organic carbon in the soil is 1,502 Pg for the depth of 0 to 100 cm. In Brazil, Vasques *et al*., (2021), estimate, in the first meter of soil, an amount of 67 Pg of organic carbon. The Brazilian Amazon forest, according to studies by Cerri *et al*. (2006), has a potential to sequester C in the order of 421 to 470 Tg $^{year-1}$; of this total, about 30 % (126 to 141 Tg $^{year-1}$ of C) would be

accumulated by the soil, and the remaining 70 % (295 to 329 Tg $^{year-1}$ of C), due to aerial biomass.

According to Townsend *et al*., (2006), the world's main cause of CO2 release into the atmosphere is the burning of fossil fuels. However, the decomposition of soil organic matter directly affects the cycle and the release of CO2, which can be increased according to the type of crop and soil management, by influencing the deposition and mineralization of soil organic matter (LA SCALA *et al*., 2008; SCHWARTZ *et al*., 2010 MALUF *et al*., 2015).

Thus, studies that aim to understand the relationship between the plant community, the microbial community and the carbon emission associated with carbon dioxide are of fundamental importance to better understand the process of climate change. Thus, the objective of this work was to evaluate the evolution of C-CO2 from soils subjected to different crops, seeking to highlight the potential consequences in the environment.

METHODOLOGY

The experiment was carried out in the Alto Acre region, in the state of Acre, with soil sampling in the municipalities of Brasiléia (11° 00' 36" S - 68° 44' 52" W) and Epitaciolândia (11° 01' 44" S 68° 44' 27" W). According to Köppen's classification, the climate in the state of Acre is of the equatorial type, hot and humid. It has average annual temperatures ranging between 24.5 ºC and 32 ºC, remaining uniform throughout the state and predominating throughout the Amazon region. There are two distinct seasons: a dry season (May to October) and a rainy season (November to April). Rainfall rates vary from 1,600 mm to 2,750 mm per year (ACRE, 2010).

The treatments consisted of five areas, four in the municipality of Brasiléia (cassava planting, banana planting, agroforestry system and native forest) and one area in the municipality of Epitaciolândia (cultivated pasture), where soil samples, at a depth of 0 to 20 cm, were collected for physical characterization, and the granulometry and textural classification of the soil were determined. as shown in Table 1.

Table 1. Physical attributes of the surface horizon (0-20 cm) of the soils of the study areas

Experimental Area	Grain size				Textural Classification
	Coarse sand	Fine sand	Silt	Clay	
	---------- Kg $^{Kg-1}$ ----------				
Cassava	0,086	0,504	0,289	0,121	Franco-arenosa
Banana	0,006	0,588	0,281	0,125	Franco-arenosa
Pasture	0,435	0,031	0,152	0,082	Franco-arenosa
Agroforestry	0,081	0,518	0,254	0,148	Franco-arenosa
Eye	0,049	0,394	0,349	0,208	Franca

Regarding the chemical characteristics, these soils were analyzed for their hydrogen potential, phosphorus, potassium, calcium, magnesium contents, and organic matter content, as shown in Table 2, and all chemical and physical analyses were carried out at the Soil, Plant Tissue and Fertilizer Analysis Laboratory of the Federal University of Viçosa.

Table 2. Chemical attributes of the surface horizon (0-20 cm) of the soils of the study areas

Experimental Area	pH (H2O)	Ca2+	Mg2+	P	K	Organic matter
		------ cmolc dm^{-3} ------		------ mg dm^{-3} ------		day $^{kg-1}$
Cassava	6,08	2,69	0,71	3,6	27	1,98
Banana	6,10	7,34	2,48	17,8	63	0,26
Pasture	5,87	0,96	0,26	1,2	51	0,79
Agroforestry	5,47	2,13	1,44	5,8	81	2,96
Eye	5,59	4,94	3,32	4,4	81	3,00

For the study of the evolution of C-CO2, three soil samples were collected in each treatment at the depth of 0-20 cm. These samples were sent to the Multidisciplinary Laboratory of the Rio Branco Baixada do Sol campus of the Federal Institute of Education, Science and Technology of Acre, where they were air-dried for 72 hours. Then, 50 g of Air-Dried Fine Earth (TFSA) were incubated in plastic containers (hermetic closure) of 500 cm3, with humidity adjusted to 70% of the field capacity.

In each container containing soil, a vial containing 30 mL of 0.5 mol L-1 NaOH solution was inserted to capture CO2 and another containing 30 mL of H2O, in order to preserve the moisture of the samples. The containers were hermetically sealed and incubated at 25 ºC. After the first 48 hours of incubation, the containers were opened for approximately 15 minutes for air exchange and the flask containing the NaOH was removed. After the time, another flask containing 30 mL of a new 0.5 mol L-1 NaOH solution was placed for new incubation.

While waiting for the time for air exchange, 10 mL of the NaOH solution (previously incubated with the soil) was pipetteted to 125 mL erlenmeyer solution, and 10 mL of 0.05 mol L-1 BaCl2 solution and three drops of 1% phenolphthalein were added. Then, the samples were immediately titrated with 0.25 mol L-1 HCl solution until the titrated solution changed from violet to colorless. The incubation periods of the samples were repeated as described in Mendonça and Matos (2005). For the CO2 evolution assessments, soil samples were collected at three times, in April, June, and August 2021.

Finally, the results were submitted to analysis of variance with the application of the F test and the mean values were compared to each other by Tukey's test at the level of 5 %

of significance, with the aid of the statistical program Sisvar 5.8 - Program for Analysis and Teaching of Statistics developed at the Federal University of Lavras (FERREIRA, 2011), considering a completely randomized design in a factorial scheme, according to the number of sampling areas and times.

RESULTS AND DISCUSSION

The distribution of the evolution of C-CO2 did not present, in April, significant differences in any of the areas under study (Table 3) in relation to the type of crop and, consequently, soil management adopted. However, there is a trend towards greater accumulation of organic matter in soils with agroforestry and native forest, as shown in table 2.

Table 3. Evolution of C-CO2 in the study areas in the three months of soil sampling

Area Experimental	April	June	August	Cumulative total
	---------- mg CO2 100 cm^{-3} ----------			
Cassava	135,58From*	162.26Mb	136,80From	434,64
Banana	149,33Aa	157.82m	86.75Bb	393,90
Pasture	137.12Aa	155.17Ba	105.45Bb	397,74
Agroforestry	152.10Aa	171.75Ba	133.40Aa	457,25
Forest	159.04ab	199.58Aa	137.45ab	496,07

*Means followed by the same uppercase letter in the column or lowercase in the row do not differ significantly by Tukey's test at the 5% level of significance.

These results of the first sampling period may be associated with the management conditions and presence and the areas of monoculture existing in these areas, in addition to the existence of moisture because it is still within the longest rainy season in the state and because these areas also have the highest content of organic matter in the soil (Table 2). Loss *et al.*, (2013), observed in their study high levels of C-CO2 in an agroforestry system after contact with moisture, and relate this to better quality of soil organic matter, as there is greater plant diversity, which can also be extended to the area of native forest, when compared to the other systems analyzed in this work.

In June, there was a statistical difference for the evolution of C-CO2 in the native forest area in relation to the other areas under study. It is important to remember that in this month, the dry season begins. However, in the case of native forest, this area most likely has a greater capacity to maintain moisture in the soil for a longer period because it is an environment with a greater presence of organic material on the soil, contributing to keep the soil moist.

According to Costa *et al*. (2006), undecomposed organic matter has a water retention capacity of around 80% and humified materials can have a water retention capacity of 300 to 400%. Thus, in the area of native forest, the greater amount of organic material had a greater capacity to retain moisture in the soil, which, according to Miranda *et al*. (2008), favors edaphic respiration, consequently, the increase in the flow of CO2 in this environment.

Regarding the sampling carried out in August, the cultivated pasture and banana areas presented the lowest values of C-CO2 emissions, differing statistically from the other areas under study. This decrease may be associated with a lower availability of moisture in these areas and an excessive increase in temperature because it is the period when the climate is usually drier and sunnier.

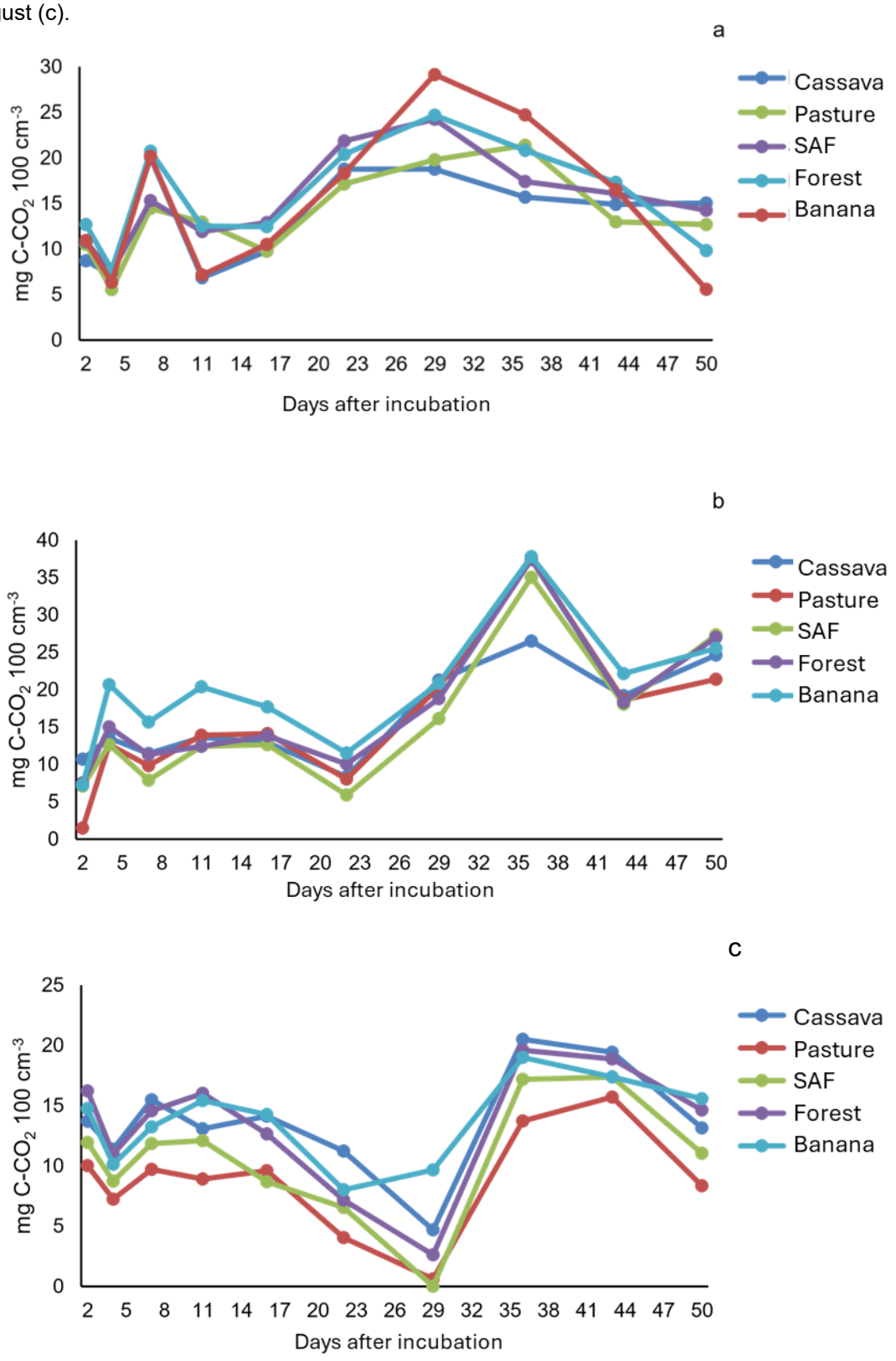
According to Araújo *et al*. (2016), the microbial activity, responsible for the production of CO2, is controlled by the temperature and water content in the soil, if it does not present a favorable temperature within the physiological limits of the organisms involved, the activity of C-CO2 emission may be interrupted.

Regarding the evolution of C-CO2 between the different soil sampling times, it is possible to see that there was a trend of increase in the values of C-CO2 evolution from April to June, coinciding with the end of the rainy season and, subsequently, a reduction in this evolution from June to August, when the effects of the dry season are accentuated (Table 3).

According to some authors (COSTA *et al*., 2008; PANOSSO *et al*., 2009; SILVA-OLAYA *et al*., 2013), soil temperature and moisture are the variables that best explain the changes in CO2 emissions over time, as can be observed throughout the incubation period during the months under study (Figure 1). Oliveros (2008) states that soil moisture exerts a great influence on CO2 emissions, as it can both favor and inhibit the production of CO2, with theoretically an optimal humidity that maximizes biological respiration.

Carvalho *et al*. (2008) and French *et al*. (2009), explain that soil microorganisms, when feeding on the available SOM, release C-CO2, culminating in peaks that can be observed over time (Figure 1). However, as they die due to lack of substrate, the evolution of C-CO2 slows down. However, these organisms that have died will be used as a source of energy by the others, which will multiply as the process of evolution of C-CO2 continues.

Figure 1. Evolution of C-CO2 in samples (0-20cm) incubated up to 50 days in the months of April (a), June (b) and August (c).



Junior Reis and Mendes (2007) emphasize that a high respiration rate can also be interpreted as a desirable characteristic when considering that the decomposition of residues will make nutrients available to plants. In addition, it is known that the activity of microorganisms also depends on the availability of nutrients so that there is quantity and

quality of organic material to serve as a source of energy for this population (GNANKAMBARY *et al*., 2008).

CONCLUSIONS

The areas that have a greater contribution of plant material to the soil can serve as a stimulus to the development of microorganisms that, consequently, increase the flow of CO2, especially until the beginning of the dry season;

In soils with low humidity, there is a reduction in C-CO2 emissions, causing significant differences in the amount of C-CO2 release between the study areas at the same time of evaluation.

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EXPANSION STRATEGY OF THE SHADDAY RESTAURANT TO GENERATE NEW POSITIONING IN BAHIA DE CARAQUEZ

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ABSTRACT

The research aimed to expand its presence in the gastronomic market in Bahía de Caráquez, managing to emphasize the importance of using effective marketing strategies to stand out and attract customers, as well as the importance of maintaining the quality of food and service during expansion. The methodology used was quantitative and qualitative, based on descriptive research. The technique used in the survey process, the data collected were tabulated through the spss25 software. The research had a preponderant element, highlighting that Bahía de Caráquez is a growing tourist destination. Therefore, the expansion of Shadday restaurant is of vital importance at this time, taking advantage of the need and the opportunity to offer an attractive gastronomic proposal for tourists and for the economic development of the place by providing. to local and national-international tourists a full satisfaction in the tourist journey undertaken.

Keywords: Strategies. Expansion. Positioning. Economic development.

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INTRODUCTION

The Shadday Restaurant located in Santa Elena provides its customers with a gastronomic service, for which it has seen the need to expand to other provinces, but that requires a good implementation and a market study to verify if it finds a target audience that provides a good service to the community.

Therefore, it is necessary to create new positions in another province based on an experience lived in the Shadday restaurant to grow and increase the presence in the national market. By expanding into new locations or market segments, the restaurant can attract more customers and increasing its revenue can increase its brand visibility and generate greater recognition among consumers. This can help attract new customers and build loyalty among existing ones.

Therefore, it is necessary to achieve the following objective: research effective marketing strategies to stand out and attract customers to the restaurant. Introducing new products or product lines to reach different market segments or address additional customer needs, managing to expand the restaurant's presence in new geographic markets, either nationally to reach new customers and take advantage of growth opportunities. Therefore, it is necessary to establish clear expansion objectives and measure the results of the analysis to know where the company is heading and what new markets it is going to attack. And delve into the restaurant's current market to achieve maximum growth within it before starting the expansion.

According to (Argentaria et at, 2024.p.7) Expansion is a form of business development that is based on intensifying the effort in the current activity of the company. Depending on whether or not the current market is maintained and the improvement of the products offered

Expansions are very important for the development of a venture because they allow you to have more profit margin and cover is directed towards the development of a product or service in the company's traditional markets. It is based on the expansion or exploitation of the company's current business, so it is closely related to its current activity.

According to (vespucci et at 2024.p.9) The first step to expansion and growth is strategic planning. This involves evaluating your current business model and identifying areas that need improvement. Start by taking a closer look at your products or services, your marketing strategies, your customer base, and your competition. Look for opportunities to optimize these areas and create a new plan and strategy that will help your business grow. This strategic planning process should be an ongoing and regular part of running your online business.

Several key aspects of this process are mentioned, such as evaluating the current business model, identifying areas that need improvement, examining products or services, marketing strategies, customer base, and competition, and looking for opportunities to optimize these areas and create a new plan. and strategy for business growth.

According to (Villacis et al., 2022.p.14)The objective must be achieved through training, educational, technological strategies and actions to seek a better approach to customers and interact with them such as: Knowing what trends the new knowledge society handles, understanding the main characteristics that consumers are looking for when having a consumer experience, and thus provide consumers with positive emotions when purchasing products.

Some specific actions are mentioned, such as knowing the trends of the new knowledge society, understanding the main characteristics that consumers are looking for when having a consumer experience and providing positive emotions to consumers.

According to (carmedata et al 2022.p.8) Geographic expansion is a fundamental business strategy that drives a company's growth and presence in new territories. By expanding through the opening of new locations, whether in local, regional, national, or international markets, companies are looking to take advantage of new opportunities, reach a wider audience, and increase their market influence.

This expansion strategy is not only focused on growing the physical presence, but also on adapting to the needs and preferences of different cultures and markets.

According to (Acosta et al, 1989.p.19), positioning is essential for the success of a marketing campaign and the search for it should be a concern of the executive from the launch of the product. If a company has taken a position in the right direction, it will be able to navigate the currents of market change gracefully, taking advantage of the opportunities that come its way.

The paragraph mentions that positioning is essential for the success of a market campaign and that the search for it should be a concern from the launch of the product. In addition, it is highlighted that if a company has taken a position in the right direction, it will be able to take advantage of the opportunities presented to it and go through the currents of market change.

According to (Ries, et al 2019.p.13) Positioning begins with a product, a service, a company, an institution or even a person. It is a process of penetrating the mind of the potential customer. It is not correct to call "product positioning", since nothing is done to the product itself. It is true that these go through certain changes to be positioned in the mind of the potential customer, but they are mere changes in their presentation, price, name and

distribution. That is, they are "cosmetic changes", so to speak, in order for the objective to be achieved.

Positioning is a process that seeks to penetrate the mind of the potential customer and occupy a prominent place in it. It is not about making changes to the product itself, but about making modifications to its presentation, price, name and distribution to ensure that the potential customer perceives it favorably.

According to (Otamendi et al 2020.p.3) Companies consider that the market is made up of small groups or segments, which are more homogeneous than the total market. The positioning strategy is developed with a specific segment in mind, since it is not possible to be successful with a strategy that tries to appeal to the entire market.

Segmentation is especially important for small businesses and freelancers, as it allows them to specialize in a market segment and offer additional value that larger companies cannot provide.

According to (sterman et al 2013.p.7) Positioning is an essential part of brand identity. It is the central and general concept, from which messages and active communication to consumers will start. It expresses the competitive advantage over competing brands. It includes a very clear communication purpose and a specific target audience

Brand positioning allows companies to differentiate themselves from the competition. By identifying and highlighting unique selling points, companies can carve out a distinct space for themselves in the marketplace. It also helps define the brand's personality, values, and messaging, which are essential to building a coherent and cohesive brand image

MATERIAL AND METHODS

The methodology to be used will be the quantitative method, the research will be descriptive, the technique that would be visualized is the survey, the same that will be done from the visit to the territory, the SPS27 software will be used to analyze the diagnosis, in the population of Bahía de Caraquez taking a sample of 90 people randomly using the finite formula which will help verify the need for expansion of the Shaday restaurant market.

In addition, the variables from the theoretical construct will be investigated, which will serve as a platform to support the application of the instrument, such as strategies and positioning. According to Villacis et al., (2020) It is important not to miss opportunities for establishments that adopt the application of promotional strategies through content marketing.

Regarding positioning, researchers Lemoine et al., (2020) Image is one of the most important variables in an institution, the same one that allows a greater prominence in the environment. Bearing in mind that we are currently living in a stage where perceptions are what influence the target audience, it is for this reason that positioning begins internally, so that in turn it can have an external impact and thus be able to enjoy the recognition that is forged in the minds of the audience of interest to customers.

To verify the elements of expansion, tourists and local people were asked about the experience of the contributions that the restaurants of the locality had given, it was done through the instrument of the questionnaire, asking the satisfaction of the tourist and the residents of Bahía de Caraquez

When asking tourists about the expansion of the Shadday restaurant, it was evident that it would be convenient to have a new restaurant with another gastronomic variety, which would help diversify the products to attract new audience, with this they would feel satisfactory local and national tourists. Therefore, it is strategic that the expansion is at the level of the coast, because it will help the coastal strip to have typical dishes of the place.

Another of the aspects that were analyzed with the responses of the tourists is the quality of service, offered by the Shaday restaurant, because the importance given to the welcome, service and quality of the product was seen that are managed based on the demands of the general public, this makes it position itself in the market optimally. In addition, the restaurant has been very generous to take into account the economy in this situation of the country, so at an adequate price according to the reality of the visitor

RESULTS

Reliability Statistics	
Cronbach's alpha	N of elements
,965	5

As evidenced by analyzing the reliability of the instrument through the Alpha.... The survey was found to be reliable, resulting in a reliability of 0.96

Table 1. Does the community need a new peninsular gastronomy restaurant?

		F	%	%V	%A
Valid	Disagree	4	4,4	4,4	4,4
	Neutral	2	2,2	2,2	6,7
	I agree	47	52,2	52,2	58,9
	Totally agree	37	41,1	41,1	100,0
	Total	90	100,0	100,0	

When analyzing the results of the research, it was evident that the best scored people with 52.2% equal to 47, totally agree with 41.10% equivalent to 37 individuals and disagree 4.4% corresponding to 4 people, evidencing that a peninsular food restaurant is needed.

The majority of those surveyed (52.2%) agree with the need for a new peninsular gastronomy restaurant in the community. We could explore the reasons behind this agreement, such as the lack of options for this type of cuisine in the area, a growing interest in peninsular gastronomy, or the belief that a new restaurant could benefit the community in terms of gastronomic offer and employment

A significant percentage of respondents (41.1%) strongly agree with the need for the new restaurant. We could delve into the reasons behind this strong agreement, such as the passion for peninsular gastronomy, previous positive experiences in this type of restaurant, or the perception that a new restaurant could improve the quality of life in the community.

Table 2.You think diversifying your food and beverage offerings would help attract a new audience.

		F	%	%v	%A
Valid	Disagree	2	2,2	2,2	2,2
	Neutral	4	4,4	4,4	6,7
	I agree	54	60,0	60,0	66,7
	Totally agree	30	33,3	33,3	100,0
	Total	90	100,0	100,0	

The results that are reflected in the survey applied to residents of the city, where the most representative answers were directed to these according to the best scored, among the best scored, is its people with 60% equal to 54, totally in agreement with 33.33% equivalent to 30 individuals and in neutral 4.4% corresponding to 4 people, evidencing that diversification is essential to attract new audiences.

The majority of respondents (60.0%) agree with the statement that diversifying the food and beverage offering would help attract a new audience. This suggests that there is widespread recognition of the importance of adapting to changing consumer preferences and attracting different market segments.

A significant percentage of respondents (33.3%) strongly agree with the statement. These respondents may strongly believe in the benefits of diversification and be willing to support significant changes to the restaurant's food and beverage offerings.

Table 3. He believes that identifying strategic locations is critical to the success of the expansion.

		F	%	%V	%A
Valid	Disagree	3	3,3	3,3	3,3
	Neutral	3	3,3	3,3	6,7
	I agree	43	47,8	47,8	54,4
	Totally agree	41	45,6	45,6	100,0
	Total	90	100,0	100,0	

It is reflected in the survey applied to residents of the city, where the most representative responses were directed to these according to the best scored, among the best scored is its people with 47.8% equal to 43, totally in agreement with 45.6% equivalent to 41 individuals and in neutral 47.8% corresponding to 3 people, evidencing that diversification is essential to attract new audience.

A majority of respondents (47.8%) agree with the statement. This suggests that there is widespread recognition of the importance of selecting strategic locations to ensure the success of a business's expansion. Respondents in this category might believe that the right location can increase the visibility, accessibility, and attractiveness of the business.

A significant percentage of respondents (45.6%) strongly agree with the statement. These respondents may strongly believe in the critical importance of identifying strategic locations and may consider it as a determining factor for the success of a business's expansion.

Table 4. The promotion, attention, quality, adequate is crucial to attract new customers of the proposal that Shaday Restaurant would make.

		F	%	%v	%A
Valid	Strongly disagree	2	2,2	2,3	2,3
	Neutral	1	1,1	1,1	3,4
	I agree	51	56,7	58,6	62,1
	Totally agree	33	36,7	37,9	100,0
	Total	87	96,7	100,0	
Lost	System	3	3,3		
Total		90	100,0		

It is evident in the survey applied to residents of the city, where the most representative answers were directed to these according to agreement among the best scored is its people with 56.7% equal to 51, totally agree with 36.7% equivalent to 33 individuals and in total disagreement 2.2% corresponding to 2 people, evidencing that if promotions and quality and attention are essential to attract new customers.

The majority of respondents (56.7%) agree with the statement. This suggests that there is widespread recognition of the importance of proper promotion, care, and quality in attracting new customers to Shaday Restaurant. Respondents in this category may believe

that these strategies are critical to attracting and retaining customers in a competitive market.

A significant percentage of respondents (36.7%) strongly agree with the statement. These respondents may strongly believe in the critical importance of promotion, care, and quality in attracting new customers and may consider them as the pillars of Shaday Restaurant's success.

Table 5. You believe that maintaining consistency in food quality and service is essential during expansion.

		F	%	%V	%A
Valid	Neutral	2	2,2	2,2	2,2
	I agree	65	72,2	72,2	74,4
	Totally agree	23	25,6	25,6	100,0
	Total	90	100,0	100,0	

It was evidenced in the survey applied to residents of the city, where the most representative responses were directed to these according to the best scored, among the best scored is its people with 72.2% equal to 65, totally in agreement with 25.6% equivalent to 23 individuals and in neutral 2.2% corresponding to 2 people, evidencing that the quality of food is essential to be maintained during expansion.

The majority of respondents (72.2%) agree with the statement. This suggests that there is widespread recognition of the importance of maintaining consistency in food quality and service during expansion. Respondents in this category might believe that consistency contributes to building a strong brand reputation and customer satisfaction.

A significant percentage of respondents (25.6%) strongly agree with the statement. These respondents may consider consistency in food quality and service to be absolutely essential during expansion, as it can make the difference between success and failure in a competitive market.

Table 6. It is important that the restaurant shaday. Consider the economic aspect to build customer loyalty

		F	%	% v	%A
Valid	no	3	3,3	3,3	3,3
	Yes	87	96,7	96,7	100,0
	Total	90	100,0	100,0	

It is evident in the survey applied to residents of the city, where the most representative responses were directed to these according to the best scored is its people with 96.7% equal to 87, totally in agreement with 3.3% equivalent to 3 individuals evidencing that it is important to take into account the economic to build customer loyalty,

The vast majority of respondents (96.7%) expressed that they do consider it important for the Shaday restaurant to take into account the economic aspect to build

customer loyalty. This indicates that the majority of respondents believe that accessibility in terms of price and the offer of promotions or discounts can significantly influence customer loyalty.

A small percentage of respondents (3.3%) indicated that they do not consider it important for Shaday Restaurant to take into account the economic aspect to build customer loyalty. This could suggest that these respondents value other aspects of the restaurant, such as the quality of the food or service, over economic considerations.

DISCUSSION

After analyzing several works similar to the research carried out verified in the authors (Villacis.et.al 2023.p.311) in the work entitled optimization of processes in purchasing to improve strategies in restaurants. He says that restaurants, whether they are small local establishments or renowned international chains, face a series of challenges in their purchasing process. These challenges can manifest themselves in a variety of ways, from fluctuations in food prices and irregular product availability to lack of control over ingredient quality and inefficient inventory management. These issues can erode profit margins, negatively affect customer satisfaction, and ultimately jeopardize the viability of the business. It is highlighted that these challenges can have a direct impact on profit margins, customer satisfaction, and the overall viability of the business. Several strategies are suggested to overcome these challenges, including negotiating contracts with suppliers to ensure stable prices and favorable terms, diversifying supply sources to reduce dependence on a single supplier, adopting inventory management technology to improve efficiency and reduce waste, and maintaining strict quality control standards to ensure consistency and customer satisfaction. These strategies are presented as practical and viable solutions to address the aforementioned challenges and protect the financial and operational health of restaurants.

According to (Juan Pérez .et. al 2018.p.7) in the work entitled, proposal of marketing strategies to improve customer loyalty in the tourist restaurant El Rincón del Pato in the city of Lambayeque, they state that the objective of a strategic marketing plan is to identify needs, problems and opportunities that can influence its financial base. You save money by becoming more efficient in your marketing activities, and you make more money by revealing new possibilities in your product line or in your share of the market. It is suggested that, by implementing a strategic marketing plan, the company can achieve two main goals: save money by making its marketing activities more efficient and generate more revenue by discovering new possibilities in its product line or market segment.

According to (Mariana Fernanda et al 2020.p.6) in the work entitled, sensory marketing and positioning in the restaurant sector state that currently, different companies around the world care about their customers remembering them and therefore apply different marketing strategies, however, most do not take into account sensory marketing, which is very important to achieve the positioning of a company, because they generate a sensory connection between the customer and the brand. It refers to the creation of sensory experiences that generate an emotional connection between the customer and the brand, using elements such as sound, smell, touch, taste and sight. By integrating these sensory experiences into their marketing strategies, businesses can create a deeper, more memorable connection with their customers

According to (Del Castillo Ventura et al 2021.p.1) in the work entitled, digital marketing and brand positioning of the cocotorete restaurant, Trujillo, 2021 currently state that in the era we live in, social networks have become a tool of a corporate nature that are used for commerce and to position a brand, as it constitutes a channel for the massive transmission of information due to the great reach they have. That is why they are very useful today for companies and individuals as they allow interactive and dynamic communication. It is highlighted that social networks act as mass communication channels, which means that they are capable of transmitting information to a large number of people in a short time. This is especially beneficial for businesses, as it allows them to reach their target audience effectively and increase their online visibility.

CONCLUSIONS

Bahía de Caráquez is a growing tourist destination. The expansion of Shaday restaurant takes advantage of this opportunity by offering an attractive gastronomic proposal for tourists and for the economic development of the place, which will allow capitalizing on the constant flow of visitors and generating greater income for the business.

The results have shown that in Bahia the market and understanding of local preferences are crucial for the success of the expansion. Shadday has the capacity to adapt to the Bahía de Caráquez market by offering a menu that is in accordance with the population and the tourists who visit it, in addition to having a gastronomic experience that is in accordance with the preferences of the place and visitors.

The Shadaay restaurant has a commitment to sustainability and social responsibility, which is what every population that works with the care of the ecosystem of the community of Bahía de Caráquez needs. This not only improves the perception of the restaurant, but

also strengthens its ties with the community and contributes to local development that will give sustainability to the population.

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GUT DYSBIOSIS AND GENERALIZED ANXIETY DISORDER: A SYSTEMATIC REVIEW

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ABSTRACT

Generalized Anxiety Disorder (GAD) is manifested by symptoms such as tension, fatigue, and negative thoughts, and can be influenced by diet. Diets high in fat and low in vitamins B2, B6 and B9 can alter the gut microbiota, causing dysbiosis, which affects the gut-brain axis, a communication pathway between gut and brain. This dysbiosis increases intestinal permeability and inflammation, impacting mood and anxiety. Therefore, the objective of this study was to search the most recent literature for studies that correlate the gut microbiota with mental health. This is a descriptive and exploratory study, carried out through a systematic review with articles published between 2014 and 2024, found in databases such as PubMed, BVS, and Google Scholar. The research used the PICO strategy, using descriptors such as "Gut microbiota", "Dysbiosis" and "Anxiety", combined by Boolean operators. The studies highlight the complex relationship between gut microbiota and mental health, showing that probiotics can reduce symptoms of anxiety and depression, although the results are more consistent for anxiety. Probiotics modulate inflammation and regulate serotonin, which is essential for emotional well-being. Dysbiosis, associated with poor diet or stress, reduces serotonin and increases inflammatory cytokines, aggravating mental symptoms. The connection between microbiota, the immune system, and mental health offers new therapeutic approaches, but more research is needed to advance this field.

Keywords: Intestinal dysbiosis. Generalized Anxiety Disorder. Gut microbiota. Mental health.

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INTRODUCTION

Generalized Anxiety Disorder (GAD) is characterized by persistent anxiety symptoms, affecting behaviors in everyday life. It manifests itself through symptoms such as motor tension, headache, fatigue, hyperactivity, mood swings, as well as symptoms involving negative thoughts of the future. This disorder can begin in childhood or adolescence, however, it is very common to start after the age of 20 [1].

The diet that people adopt in their lifestyle induces changes in the intestinal microbiota, stimulating mechanisms linked to the limbic system. This system, through stimuli to release hormones, is responsible for regulating mood. A diet with a high intake of fat and a deficiency of vitamins such as B2, B6, and B9 is interconnected with stress and anxiety symptoms [2].

According to Saraiva et al. (2019) and Christofoletti et al. (2022), the high consumption of processed foods and exposure to toxins that cannot be digested by the body can lead to a disorder in intestinal function, composition, and diversity of the gut microbiota, triggering dysbiosis. Therefore, intestinal dysbiosis is characterized by changes in the activity and distribution site of the intestinal microbiota, in which pathogenic bacteria predominate over beneficial ones. This balance reflects in the increase of intestinal permeability and with this, leads to a decrease in selectivity in the absorption of toxins, bacteria, proteins or peptides, contributing to local and systemic inflammation [3,4].

The gut-brain axis is a two-way communication system between the gut and the brain, involving neural, hormonal, and immune signals. The gut microbiome, which consists of trillions of microorganisms that inhabit our gastrointestinal tract, plays a key role in this communication [5].

Studies have shown that the composition of the microbiota can influence brain function and behavior, including aspects related to anxiety, mood, and stress. Certain gut bacteria can produce neurotransmitters or substances that directly affect the brain, while others are involved in regulating the immune system, which in turn can impact brain function [6].

Deeper understanding of the interaction between the gut microbiota and GAD could lead to innovative approaches in treatment, such as gut-targeted therapies, microbiome modulation, and dietary interventions. However, it is important to note that this field of research is still evolving, and more studies are needed to fully elucidate these complex interactions [7].

Gut dysbiosis is a problem that frequently affects these patients, and because there is an increase in the incidence of anxiety with few studies, this review searches the most recent literature for studies that correlate the gut microbiota with mental health.

METHODS

This is a descriptive, exploratory study elaborated through an exploratory research through a systematic review using scientific articles between 2014 and 2024, found in databases: *Google Scholar, Virtual Health Library (VHL) and* PubMed.

The elaboration of the research question was based on the PICO strategy (Santos; Galvão, 2014), with "P" referring to the study population (individuals diagnosed with generalized anxiety disorder); "I" to the intervention studied or variable of interest (treatments focused on restoring the gut microbiota to treat gut dysbiosis); "C" in comparison with another variable (standard pharmacological therapies for anxiety); and "O" referring to the outcome of interest (evaluation of the efficacy of microbiota restoration in relieving anxiety symptoms). Thus, the guiding question for the construction of the research was outlined: "What is the effectiveness of the treatment of intestinal dysbiosis in relieving the symptoms of generalized anxiety disorder?"

Data collection took place from July to September 2024, in the database of Medical Publications (PubMed), Virtual Health Library (VHL) and *Google Scholar.* For the search, the following Health Sciences Descriptors (DeCS) were used: "Gut microbiota", "dysbiosis", "Anxiety" and "Treatment", combining the Boolean operators "AND" and "OR", as shown in table 1.

Table 1: Articles found according to the search strategies in the selected databases

Database/Database	Intersection
PubMed (96)	("Dysbiosis"[MeSH] OR "Dysbiosis"[Text Word]) AND ("Anxiety"[MeSH] OR "Anxiety Disorders"[MeSH] OR "Anxiety"[Text Word]) AND ("Intestinal Microbiota"[MeSH] OR "Gut Microbiota"[Text Word]) AND ("Therapeutics"[MeSH] OR "Treatment"[Text Word] OR "Intervention"[Text Word])
Google Scholar (178)	(Disbiose OR "Dysbiosis") AND (Ansiedade OR "Anxiety Disorders" OR "Transtornos de Ansiedade") AND ("Microbiota Intestinal" OR "Intestinal Microbiota") AND (Tratamento OR Terapêutica OR Intervenção)

VHL **Portuguese (19):**	(Disbiose OR "Dysbiosis") AND (Ansiedade OR "Anxiety Disorders" OR "Transtornos de Ansiedade") AND ("Microbiota Intestinal" OR "Intestinal Microbiota") AND (Tratamento OR Terapêutica OR Intervenção)
English (29)	(Dysbiosis OR "Dysbiosis") AND (Anxiety OR "Anxiety Disorders" OR "Anxiety Disorders") AND ("Gut Microbiota" OR "Intestinal Microbiota") AND (Treatment OR Therapeutics OR Intervention) Spanish
Spanish (01)	(Dysbiosis or "dysbiosis") and (anxiety or "anxiety disorders" or "anxiety disorders") and ("gut microbiota" or "gut microbiota") and (treatment or therapy or intervention).

Source: the authors (2024).

Also, to compose and optimize the selected studies, the inclusion criteria considered were: articles published between 2014 and 2024, in Portuguese, English, and Spanish, available in full for free access and that address the topic related to the research. Course completion papers, monographs, theses, dissertations, book chapters, books, editorials, articles written with children, adolescents or the elderly, bibliographic, systematic or scope review articles, articles that have been published before 2014 were excluded.

The procedures carried out for the search and selection of articles in the database were: 1) association of the three descriptors; 2) selection and application of inclusion and exclusion filters; 3) reading of titles and abstracts, discarding duplicates, those that did not fit the research theme and the inclusion and exclusion criteria; 4) categorical and critical reading of the articles in full by two authors selecting 06 articles congruent with the theme for the elaboration of this review, represented by the PRISMA (2020) flowchart (Figure 1).

In order to reduce possible biases in the evaluation of the studies, such as analysis and design errors, two researchers participated in all stages of the research flowchart, reading the articles and filling in the instruments (tables with the data of the studies present in this review) using the double-blind method for subsequent comparison. Also, in cases where non-conformities occurred, a new reading and completion of the instruments was carried out by a third author.

In addition, the included studies were compiled and analyzed, and represented in the form of a table with the following data: author, year, title of the journal, number of participants, objective, duration of the study, and main results and intervention strategies.

The categorization of the results was carried out in a structured manner based on previously established criteria. Initially, the selected studies were analyzed for their methodological, thematic and contextual characteristics. The extracted data were organized

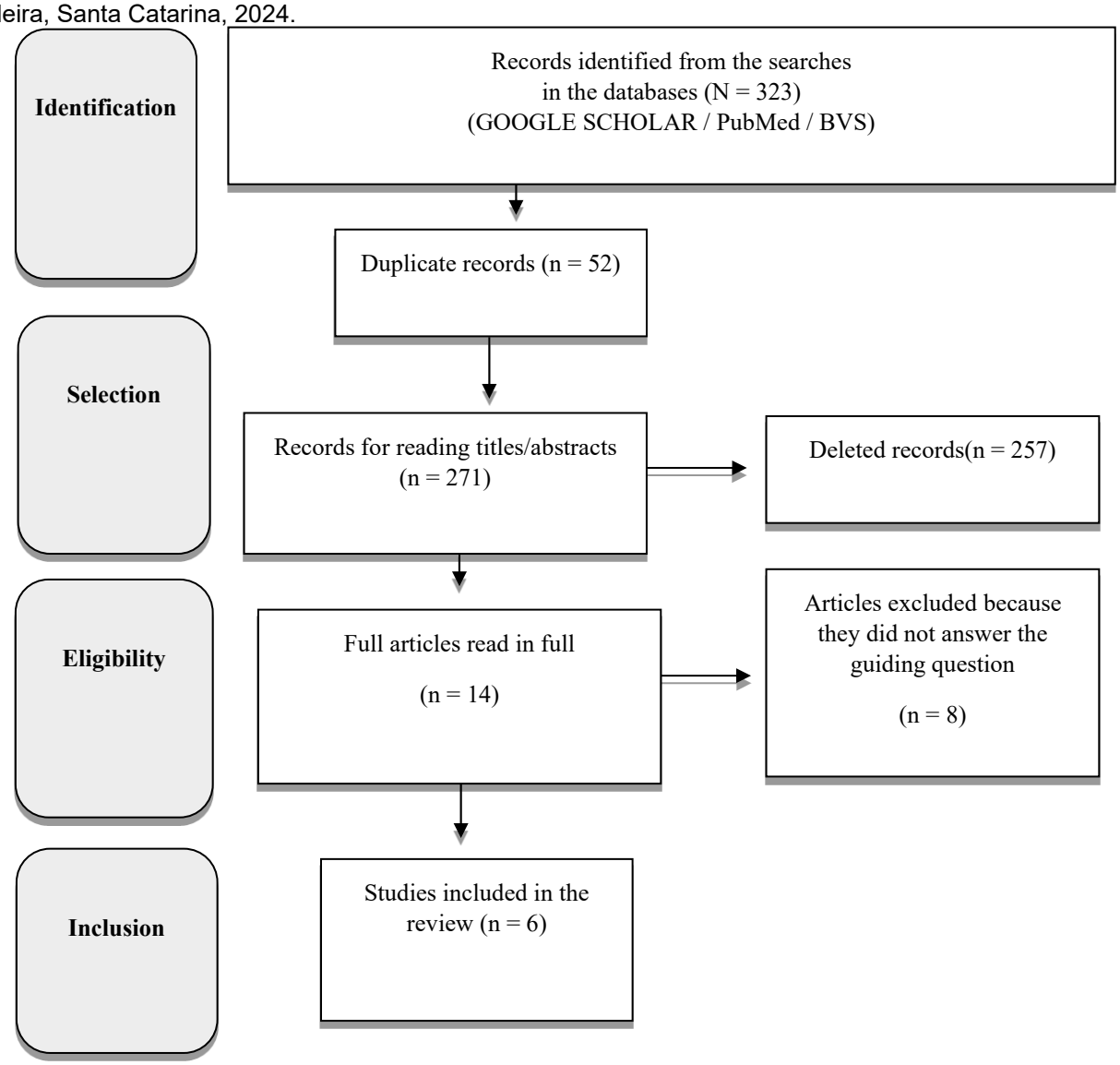
into categories according to their relevance to the study objectives, grouping the findings into main themes and subthemes, when necessary. Categorization will follow criteria such as type of intervention, target population, outcomes evaluated, and methodology employed. To ensure consistency, the categorization was validated by consensus among the researchers involved, ensuring the clarity and coherence of the groupings carried out.

All ethical precepts were respected by the researchers at all stages of the research, citing and referencing all the works included in the study.

RESULTS AND DISCUSSION

A total of 323 articles were found and, after analyzing the title, abstract, and applying the inclusion and exclusion criteria, 06 articles were included to be used in the final sample of this review. The search and selection of articles followed the recommendations of the PRISMA 2020 group (MOHER *et al.*, 2019) and can be seen in the following flowchart (Figure 1).

Figure 1 – Representation of the Flowchart of the articles included in the study according to PRISMA (2020). Videira, Santa Catarina, 2024.



Source: adapted from PRISMA 2020 (MOHER et al, 2009).

The six articles that made up the final sample were published between 2016 and 2024, in English, Portuguese, and Spanish. The types of articles were bibliographic reviews, systematic review and integrative search in the literature.

Table 2 presents the characterization of the articles that were used for the final sample, considering objective, year of publication, journals, country, duration of the study, and methodological quality of the study. These articles used in the final sample were published between 2017 and 2024 in English and Portuguese.

Table 2: Characterization of the studies included in the final sample. Videira, Santa Catarina, 2024.

Author Year	Newspaper	Country	No. of participants	Objective	Duration of the study	Main results
Lopes, et al, 2024 [1]	Contemporary Magazine	Brazil	05	The study aimed to investigate the effect of the gut microbiota on mental health, using integrative literature review as a method for this investigation.	-	The article highlights that the microbiota-gut-brain axis modulates the central nervous system (CNS) through the production of cytokines and changes in intestinal permeability, directly impacting mental health. In addition, patients with neuropsychiatric disorders, such as depression, anxiety, and schizophrenia, often have an imbalance of the microbiota.
Torres, et al, 2024 [9]	RBONE	Brazil	06	To analyze the efficacy of the Low FODMAP diet on anxiety, depression and quality of life in Irritable Bowel Syndrome by Rome IV criteria.	2 months	The literature search found 2,311 articles in the databases, after the inclusion and exclusion criteria, four (n=4) clinical trials involving 99 patients were included in the integrative review.
Zhu, et al, 2024 [11]	Journal homepage.	China	10	To report how stress in early life and anxiety-like behaviors are related to the gut microbiota.	-	Early stress reduced levels of amino acid transporters in the gut of mice, causing a drop in blood glutamine (Gln) levels and synaptic dysfunction in the medial prefrontal cortex (mPFC). Dysbiosis reduced the

						presence of **Lactobacillus reuteri**, limiting the replacement of glutamate (Glu) and GABA in the brain. The Supplementation with **L. reuteri** restored amino acid transport in the gut and corrected behavioral abnormalities, showing that manipulation can reverse the negative effects of stress.
Souzedo, Bizarro and Perreira, 2020 [5]	J Bras Psychiatr	Brazil	03	Objective of analyzing the gut-brain axis and depressive symptoms: a systematic review of randomized clinical trials with probiotics.	4 to 12 weeks.	A total of 587 articles were found, eight articles were included in the final sample. All randomized controlled trials, double-blind or triple-blind, were conducted in different geographic regions. The aim of these studies was to investigate the impact of probiotic consumption on symptoms of depression. allocated to the placebo or experimental group and received the intervention for periods ranging from four to twelve weeks
Minayo, Miranda and Telhado, 2021 [8]	Science and Collective Health	Brazil	03	To conduct a systematic review on the effects of probiotics on depression and anxiety as an	4 to 12 weeks	Of 107 articles found, only 9 articles met the selection criteria established in the methodology. In the analyses of studies on

				alternative treatment.		depression disorder, it was not possible to reach a conclusion that the administration of one or several probiotic strains is effective for the improvement of symptoms. However, for symptoms of anxiety and stress, they showed a significant improvement, because they do not have deteriorated mental conditions.
Timothy G Dinan e John F. Cryan, 2017 [12]	Neuropsychopharmacolo g	Ireland	02	Explore the mechanism s of interaction between the brain-gut-microbiota axis and how this affects behavior and the immune system.	-	The gut microbiota plays an essential role in regulating the immune system by influencing the production of lymphocytes and cytokines that modulate inflammatory responses. The microbiota's relationship to immunity also affects the intestinal barrier, helping to protect against pathogens while facilitating nutrient absorption. Evidence shows that the gut microbiota directly affects behavior through the microbiota-gut-brain axis. Animal studies indicate that changes in the microbiota can

						influence mood, anxiety, and exploratory behavior. In humans, the impact of the microbiota is explored in psychiatric disorders, such as depression and schizophrenia.

Source: the authors (2024).

DISCUSSION

The present study carried out by Souzedo, Bizarro and Pereira (2020), analyzed the impact of probiotic consumption on depression symptoms through eight randomized, double-blind or triple-blind trials in different regions. Of the eight articles used for the research, depressed people who did not use antidepressants, only had depressive symptoms, and had a combination of bacteria species as material for use. In all studies, subjects were divided into a placebo or experimental group and interventions ranged from four to twelve weeks. However, some studies found that probiotic supplementation was helpful in treating depressive symptoms, but others reported no significant difference. Taking into account the methodological difference between the studies, they may have contributed to the different results obtained [5].

Minayo et al. (2021), classified for analysis nine studies that evaluated the effects of probiotics administered daily to individuals with depression, anxiety, and psychological stress, and to qualify and quantify changes in individuals' symptoms, they used questionnaires with scientifically validated scales. In the analyses of studies that evaluated the effects on depression, it was not possible to reach a conclusion that the administration of one or several probiotic strains is effective for the improvement of the symptoms of the disorder. Three of the studies showed an improvement in symptoms, where a total of 150 adults were evaluated, but it was not specified which parameters showed an improvement to determine the scope of the intervention. However, studies have shown positive changes in mood improvement [8].

After conducting research by Dinan and Cryan (2016), suggest that the use of probiotics and nutritional interventions may be beneficial for the treatment of stress-related disorders, where they indicate that the absorption of dietary amino acids by gut epithelial cells plays an important role in the regulation and concentration of amino acids in the blood and brain, contributing to the normal functioning of brain function. On the other hand, the

imbalance of excitatory and inhibitory neurotransmitters in the brain and the activation of signaling cascades can be significant factors in stress-induced neurobehavioral abnormalities [11].

It can be said that in the literature analyzed in the study by Minayo et al. (2021), they described the fact of a hypothesis that probiotics act effectively on mental health through the regulation of inflammatory markers and serotonin neurotransmitters, and that it may be possible to say that these mechanisms work together to produce the effects of the administered probiotics, when it is taken into account that the immune system, the central nervous system, and the enteric nervous system are connected to each other. Another class of probiotics are psychobiotics, which are capable of producing substances such as GABA and serotonin involved in cognitive and mood regulation, acting directly on the brain-gut axis, which has already proven benefits in the inflammatory profile and emotional processes when administered [8].

There is evidence from studies reported by Dinan and Cryan (2016), which state that certain bacteria existing within the human gut are able to play a key role in immune development and have the ability to produce molecules with neuroactive properties that can impact the physiology and behavior of the brain. The gut microbiota plays an essential role in regulating the immune system by influencing the production of lymphocytes and cytokines that modulate inflammatory responses. The microbiota's relationship to immunity also affects the intestinal barrier, helping to protect against pathogens while facilitating nutrient absorption. Evidence shows that the gut microbiota directly affects behavior through the microbiota-gut-brain axis [10,12].

The work in question by Souzedo, Bizarro and Pereira (2020), described that the intestinal microbiota has an influence on our brain, taking into account that the composition of the microbiota, where it is has microorganisms capable of stimulating the afferent neurons of the ENS, thus triggering inflammation that leads to the production of cytokines that cross the blood-brain barrier acting directly on the brain, causing a disturbance. When a microbiota of a healthy individual is compared with that of a depressed patient, a significant decrease in intestinal permeability is found [1].

However, the authors Dinan and Cryan (2016) described that the gut microbiota has come to be recognized as a critical brain function and regulator of behaviors, where its composition can be influenced by several factors, such as: diet, antibiotic use, and stress. Studies conducted with mice show a growing body of evidence indicating that stress early in life can cause lasting changes in the gut microbiota, thus contributing to the development of possible neuropsychiatric disorders throughout life [11].

With this, Souzedo, Bizarro and Pereira (2020), reported that dysbiosis occurred by the ingestion of low-quality food, and immunological adversity are responsible for the decrease in the availability of serotonin in the body, since about 95% of all serotonin in the body is synthesized by intestinal enterochromaffin cells. Another precursor of serotonin is the tryptophan metabolites, which are also generated in the microbiota. As a result, dysbiosis influences brain concentrations, which positively impacts the development of mental illnesses [1].

As presented in the work of Dinan and Cryan (2016). Depression is considered a pro-inflammatory state that is associated with the presence of biomarkers of inflammation. With the impairment of intestinal barrier functions and a significant increase in intestinal permeability, intestinal bacteria translocate through the intestinal wall to mesenteric lymphoid tissue, where the exposure of mucosal immune cells increases, which can activate an immune response and the release of inflammatory cytokines with stimuli from the vagus nerve and spinal afferent neurons. In addition, there is an increase in intestinal permeability, which can also increase the translocation of metabolic products produced by bacteria and cause centrally altered activity [10].

However, the present study by Minayo et al. (2021) commented that the symptoms of anxiety and stress showed a significant improvement when compared to those of depression, due to the fact that depressive conditions include deteriorated mental states, thus being a challenging disorder for treatment. People with high stress on a daily basis have changes in the intestinal barrier, resulting in the production of inflammatory cytokines, all of which indicates that these people may present symptoms of depression and anxiety, since patients with such symptoms have an increased profile of pro-inflammatory cytokines and positive acute phase proteins, therefore, the relationship between the intestine, inflammatory profile and neuroendocrine responses are intrinsic [8].

Research carried out by Dinan and Cryan (2016) points out that the main function of intestinal barriers is to regulate the absorption of nutrients, electrolytes and water for absorption and thus prevent the entry of pathogens and toxins. Microglia are a type of resident brain cell, similar to macrophages, key immune cells that detect environmental changes in the brain and regulate neuroinflammatory processes. A growing body of evidence points to a connection between microglia and the microbiota-gut-brain axis, which has implications for several neurodegenerative disorders and stress-associated conditions [10].

In addition, the studies presented by Torres et al. (2024), point to an association between IBS, anxiety, and depression, mediated by the peripheral central mechanism and

genetic factors, this brain-gut microbiota interaction may explain altered bowel habits, abdominal pain, and psychiatric comorbidities associated with IBS. These predictive models are associated with the quality of life of individuals, found an association between gastrointestinal symptoms and psychological factors with reduced quality of life in patients with irritable bowel syndrome [9].

Torres et al. (2024), analyzed the effects of the *low* FODMAP diet on anxiety, depression, and quality of life, using the Rome IV criterion in patients with irritable bowel syndrome (IBS), where they were able to observe that patients with anxiety, depression, and distress have severe gastrointestinal symptoms, in addition to fatigue and worsening quality of life. The acceptability of the low-FODMAP diet is very important for the management of IBS patients, but it requires significant dietary restrictions and the elimination of some common foods in everyday life. Therefore, it can be stated that IBS is directly associated with anxiety, depression, and reduced quality of life, through gastrointestinal symptoms, psychological, and dietary factors [9, 10].

CONCLUSION

It can be concluded that the studies carried out reveal the complexity of the relationship between the gut microbiota and mental health. Studies indicate that intervention with probiotic strains can have significant benefits in reducing symptoms of anxiety and depression, although depression-related outcomes are less consistent.

In addition, probiotics play an important role in modulating inflammation and regulating serotonin, which is essential for emotional well-being. Dysbiosis, often caused by poor diet or stress, leads to decreased serotonin and increased inflammatory cytokines, contributing to the development of anxious and depressive symptoms.

In addition, the interconnection between microbiota, immune system, and mental health opens up new possibilities for the treatment of emotional disorders. Continuity of research is important to broaden understanding and develop more effective therapeutic strategies.

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CONTENT EVALUATION OF INSTAGRAM POSTS RELATED TO FOOD AND HEALTH PRODUCED BY DIGITAL INFLUENCERS

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ABSTRACT

With the growth of social networks, influencers have a great impact on the eating habits of their followers, promoting products and diets without scientific basis. The present study evaluated the content of *Instagram*® posts related to food and health, produced by digital influencers without a qualification in nutrition. The methodology used was descriptive, exploratory and analytical, with a qualitative approach, analyzing five influencer profiles between March 2023 and September 2024. The publications were categorized into "Dissemination of sponsored products" and "Guidelines on what to eat". The results showed that influencers encourage the practice of exercise and the consumption of products, without considering nutritional individuality and health risks. It is concluded that the guidance of these digital influencers can have a negative impact on the physical and mental health of their followers, reinforcing the need for qualified professionals to provide nutritional guidance.

Keywords: Social network. Nutrition. Health. Impact.

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INTRODUCTION

Social media are increasingly present in people's daily lives, with advertising and digital influencers constantly impacting their routine (Soares et al., 2020). The excessive use of social networks leads to an excess of information, which can positively or negatively impact people's lives (Muniz, Pereira, 2019). Being a digital influencer implies having a direct impact on the choices of your followers, lifestyle, opinions and especially on consumption, which can impact the health of these people (Alves, 2019).

The human body is a complex biochemical system, linked to genetic characteristics and dependent on nutrients from food to function properly. Proper nutrition is critical for a healthy metabolism, the functioning of organs and tissues, growth, reproduction, physical activity, and disease resistance (Bittencourt, 2018).

The social network *Instagram*® is compared to a large *shopping mall*, it is undeniable the influence that the publications and opinions of digital influencers, also known as bloggers, exert on their followers, further encouraging the consumption of the products and services they promote (Barbosa, 2019). The ideal of beauty promoted on social media makes people feel the need to change their habits to fit aesthetic standards, making them susceptible to miraculous solutions offered by influencers. They often base their recommendations only on their personal experiences, without considering the diversity of bodies and the need for reliable information and without adequate training, especially in the area of nutrition, to pass on information and guidance on nutrition (Kamida, Rizeto, Mungioli, 2021).

The illegal practice of the profession occurs when unqualified people or professionals from other areas carry out the practice of activities that are private to the nutritionist. According to Law No. 8,234 of September 17, 1991, only those who have an Undergraduate Degree in Nutrition from an Institution recognized by the Ministry of Education and are duly registered with the Regional Council of Nutritionists (CRN) have the right to be called Nutritionists and prescribe diets, which is a practice exclusive to this professional (Brazil, 1991). The Councils are firmly opposed to the illegal exercise of the profession of Nutritionist and fight against any proposal that aims to attribute to other professions, activities that are exclusive to nutritionists (Federal Council of Nutritionists – CFN, 2018).

Considering that these digital influencers, without training in the area of nutrition, have an important reach and influence in the lives of people who use social networks, there is a need to know how they affect the eating and living habits of these people and what risks they are exposed to. Therefore, it is essential to analyze the content produced and

identify the patterns of the acts of digital influencers on *Instagram*® on matters related to food and health.

MATERIALS AND METHODS

This is a descriptive, exploratory and analytical study with a qualitative approach by convenience, analyzing content related to food and health posted by people without qualification in nutrition.

Five *Instagram*® profiles chosen by convenience were analyzed, from March 2023 to September 2024, where the inclusion criteria were: having more than one million followers, addressing weekly content about food and health; not being a nutrition professional; being sponsored by a food or supplement brand and; encouraging the following of fad and/or restrictive diets. The criteria for excluding the pages were: being linked to an educational institution focused on nutrition; not to publish weekly subjects related to food and health; not be sponsored by any brand related to food and supplements.

Respecting the identity of the digital influencers selected for this study, they were named A, B, C, D and E. Personal data such as age, profession and education were obtained from the *Google*® *platform* and exposed in the study, respecting the identification of each one. For content analysis of these publications, the method proposed by Bardin (2016) was used in its stages: a) organization of the analysis; b) codification; c) categorization; d) treatment of results, inference and interpretation of results.

During the investigative period, content published by A, B, C, D and E related to food and health was analyzed daily. To carry out the follow-up, the influencers were followed on *Instagram*® and followed. Posts that met the inclusion criteria were saved (a function allowed by *Instagram*®) and analyzed through floating reading.

Three publications on non-consecutive days of each influencer were selected for content analysis. The selected publications were presented by means of *posts* on the *timeline*. Through the analysis of the number of followers and likes on the selected publications, the percentages of the audience that interacted with these publications were calculated. No follower had their identity revealed, only numbered.

For the analysis of the results, the data obtained were inserted into a matrix for analysis in *the Microsoft Excel*® and *Word*® *programs* (version 2016) and tabulated in tables and graphs for descriptive analysis.

The study was not submitted to the Research Ethics Committee (CEP) because it was an analysis of documents exposed to the general public and did not have names

exposed. However, all other ethical precepts were respected by the researchers at all stages of the research.

RESULTS

After the superficial reading suggested by Bardin (2016), the categories of analysis emerged, and the discourses were organized into two categories: "Disclosure of products and foods from sponsoring brands" and "Disclosure of what one should eat" (Chart 1).

Chart 1 - Categories emerged for content analysis from the publications of digital influencers on *Instagram®.* Videira, Brazil, 2024.

Category 01	**Category 02**
Disclosure about what to eat	Promotion of products and food from sponsoring brands.
Keywords: Diet; Reduce; Ideal weight; Cut; Physical exercises; Detox; Fasting.	Keywords: Supplements; Creams; Protein bars; Straps; Cafes; Shakes; Gold.

After identifying the profile of the digital influencers and the selected pages, the five in this study are all women, aged between 20 and 37 years, playing varied roles such as digital influencers, entrepreneurs, actresses, personal trainers, bodybuilders and *coaches*. Their content collectively reaches more than 15 million followers, mainly promoting physical exercise practices and healthy lifestyles, often combined with advertising for food supplements, beauty products, clothing and food from sponsoring brands.

The objectives of *the digital influencers'* Instagram® posts include encouraging intense physical activity, promoting specific and restrictive diets, promoting products associated with sponsoring brands, and disseminating lifestyle ideas that often lack scientific basis. In addition, there is a strong emphasis on supplements and weight loss practices, with often extremist discourses that disregard nutritional individuality and the risks associated with the exaggerated consumption of products or adherence to fad diets.

The three discourses selected on alternate days, together with the numbers and percentages of "likes" in the publications (Charts 2, 3, 4, 5 and 6), are presented individually below.

Chart 2 - Content, number and percentage of "likes" of publications by digital influencer A. Videira, Brazil, 2024.

Digital Influencer A					
Publication 01		**Publication 02**		**Publication 03**	
Publication of how you lost 7 kg		Advertising of cream X to remove folliculitis and flaccidity by brand sponsorship.		Advertising about supplementation X by brand sponsorship.	
Number of Tanneries 91,700	Number of Followers % 5,4	Number of Tanneries 36,500	Number of Followers % 2,1	Number of Tanneries 47,000	Number of Followers % 2,8

The following publications made by digital influencer A were selected as a highlight to exemplify the speeches.

Publication 01 is about "how to lose 7 kg":

> As I lost 7kg by changing some simple habits and putting these new habits in my life (...) I ended up gaining a little weight unintentionally. And to get back to my ideal weight I started to eat more fiber, less fat, basically I increased the amount of vegetables a lot and decreased a little the amount of foods with high caloric density (...)

Publication 02 is about "cream to remove folliculitis and flaccidity":

> Did you know that you can transform your butt with physical exercise, healthy eating and hydration. Yes guys, hydration, both water and X. X is the icing on the cake, I mean, the icing on the butt. It fights flaccidity, folliculitis, reduces the appearance of stretch marks and cellulite (...).

Publication 03 is about "protein bar":

> Brand X my favorite snack with the colors of my selection. 25% off with my coupon.

The protein bar sold as a healthy product, has some ingredients checked in its nutritional table, such as: vegetable fat, polydextrose, palm fat, natural identical flavoring, maltitol, bi-distilled glycerin, soy lecithin, polyglycerol polyricinoleate, potassium sorbate and mix of tocopherols.

Chart 3 - Content, number and percentage of "likes" of publications by digital influencer B. Videira, Brazil, 2024.

Digital Influencer B					
Publication 01		**Publication 02**		**Publication 03**	
Advertising about alfajor of brand X by brand sponsorship.		Advertising about supplementation X by brand sponsorship.		Advertising about supplementation X by brand sponsorship.	
Number of Tanneries	Number of Followers %	Number of Tanneries	Number of Followers %	Number of Tanneries	Number of Followers %
322,000	6,8	145,000	3,1	177,000	3,8

The following publications made by digital influencer B were selected as a highlight to demonstrate the speeches.

Publication 01 is about "healthy alfajor":

> Seriously, just a little bit... There is no way to resist brand X. This alfajor. SERIOUS! If you don't know it, you need to try it. Perfect for any moment. Powdered milk, spoon brigadeiro, hazelnut and white chocolate (...).

Alfajor, sold as a healthy product, has some ingredients checked in its nutritional table such as: wheat flour enriched with iron and folic acid, vegetable fat, polydextrose,

natural caramel IV coloring, ammonium bicarbonate, sodium acid pyrophosphate, calcium carbonate anti-caking agent, flavoring, sodium metabisulfite, maltitol, sucralose, acesulfame potassium, stabilizer INS 476 and flavorings.

Publication 02 is about "whey protein":

> What is the grade? The one from brand X is at least ten k, best cost benefit and "taste" there is! X does not have a physical store, so you buy directly from the factory through the website (...).

Publication 03 is about "peanut butter":

> (...) This folder doesn't need details, there's no way not to like it! And using the coupon you have 10% off on the entire site.

Peanut butter sold as a healthy product, has some ingredients checked in its nutritional table: vegetable oil, emulsifiers soy lecithin and polyglycerol esters of ricinoleic acid, sweetener maltitol, flavorings, salt, xylitol, sucralose and acesulfame potassium.

Chart 4 - Content, number and percentage of "likes" of publications by digital influencer C. Videira, Brazil, 2024.

Digital Influencer C					
Publication 01		**Publication 02**		**Publication 03**	
Advertising about supplementation X by brand sponsorship.		Publication about everything you eat in a day.		Advertising about brand X protein shake by brand sponsorship.	
Number of Tanneries 299,000	Number of Followers % 17,6	Number of Tanneries 85,300	Number of Followers % 5,0	Number of Tanneries 28,2	Number of Followers % 1,7

The following publications made by digital influencer C were selected as a highlight to exemplify the speeches.

Publication 01 is about "protein bar":

> A protein bar from brand X helps with everything. Use my coupon.

The protein bar encouraged by blogger C is the same as blogger A.

Publication 02 is about "everything I eat in a day":

> Everything I eat in a day totally out of the routine. (...). I started the day with water on an empty stomach like every day, and I went to practice my physical activity (...). I put an energy drink X "for" inside. I went to make my breakfast which was two eggs with bread, a cut mango that was very sweet and black coffee, I mixed it with my thermogenic coffee X that is there in the corner I don't know if you saw it. (...). As an afternoon snack I got açaí, there was açaí X at will. So I took açaí and put peanut butter X that has protein and strawberry fruit. (...).

Publication 03 is about "*protein shake*":

> Practicality in the life of those who train is like a pot of gold. Even more so if it's a REAL protein shake, the perfect answer for your post-workout ensuring muscle recovery. The X is the perfect balance with 15g of PROTEIN and ONLY 3.5g of "carbo" (...).

The *protein shake* sold as a healthy product has some ingredients checked in its nutritional table such as: modified starch, coconut oil, sunflower oil, calcium carbonate, salt, sucralose, gellan gum, dipotassium phosphate.

Chart 5 - Content, number and percentage of "likes" of publications by digital influencer D. Videira, Brazil, 2024.

Digital Influencer D					
Publication 01		**Publication 02**		**Publication 03**	
Publication of seven tips to speed up your metabolism and get out of the plateau effect.		Publication about top 5 supplements.		Advertising about supplementation.	
Number of Tanneries 14,560	Number of Followers % 1,4	Number of Tanneries 18,568	Number of Followers % 1,8	Number of Tanneries 20,000	Number of Followers % 2,0

The following publications made by *digital influencer* D were selected as a highlight to exemplify the speeches.

Publication 01 is about "seven tips to speed up your metabolism and get out of the plateau effect":

> Seven tips to speed up metabolism and get out of the plateau effect? First: de-inflame the body, cut sugar, gluten, milk and alcohol. Second: physical exercise every day, at least 30 minutes. Third: increase lean mass, the more muscles you have, the faster your metabolism gets and the more calories you expend. Fourth: intermittent fasting, you will stimulate your metabolism to work better, through a detox that is autophagy, promoted by fasting. Five: Healthy gut, so you have to drink more water and eat more fiber. Six: use more spices such as ginger, cinnamon, cloves, pepper. It can be in the form of tea or use in food. (...).

Publication 02 is about "top 5 supplements":

> First place: Morosil, promotes lipolysis which is the breakdown of body fat (...) The general recommendation is 400mg a day. Second: Coenzyme Q10, it's wonderful to increase energy, get out of the plateau effect, that difficulty of losing weight you know (...). General recommendation 100mg a day, along with meals that have good fats. Third: pysillium with chitosan, a perfect combination to reduce hunger, satiety, control binge eating and clean the intestines. General recommendation is 250mg of *Pysillium* and 350mg of Chitosan. Take 10 minutes before meals along with water, it is very important to drink plenty of water. Fourth: whey, is the best supplement to help hit protein goals, kill that desire to eat sweets without eating junk. It can be in the afternoon, it can be at night, I love to make *shakes* with frozen fruits, it looks like a little sorbet. And five: creatine that I can't do without either, it improves training performance a lot, increases lean mass, makes the muscle look good, you know? With that tone. The general recommendation is 3g a day, it can be taken pure, with water, mixed in the shake, as you wish. (...).

Publication 03 is about "supplements":

> A supplement to give energy? Thermogenic coffee X; A supplement to help burn fat? Morosil X; One to give focus, disposition and get out of the plateau effect? Coenzyme Q10; One to stimulate the gut? Magnesium; And to help increase lean mass? Creatine and whey but you have to do weight training. And which brands are reliable? The ones I wear, I love (...).

Chart 6 - Content, number and percentage of "likes" of publications by digital influencer E. Videira, Brazil, 2024.

Digital Influencer and					
Publication 01		**Publication 02**		**Publication 03**	
Advertising about shaping belt X by brand sponsorship.		Advertising about supplementation X by brand sponsorship.		Post about choices in a meal.	
Number of Tanneries 29,500	Number of Followers % 0,5	Number of Tanneries 305,000	Number of Followers % 5,0	Number of Tanneries 83,300	Number of Followers % 1,4

The following publications made by the digital influencer E were selected as a highlight to exemplify the speeches.

Publication 01 is about "shaping belt":

> DRY... I use it 6 to 8 hours a day every day and girls, real, it's "everything!!!."

Publication 02 is about "creatine and pre-workout":

> Always before training. COUPON X.

Publication 03 is about "meal choices":

> This is my breakfast, I'm in a hotel and the most common thing to happen is that you have a table full of sweets, cookies and then you start eating with your mind, it says like this: wow sugar. (...). The way you do one thing, you do all the others, put it in your head. If you arrive at your breakfast and you put everything messy, out of order at work (...). When you understand this phrase your diet will change, your relationship will change, your body will change, your mind will change. Pay attention to this, remember.

DISCUSSION

With the floating reading proposed by Bardin (2016), the discussion will be conducted based on the two categories identified: **Category 1:** Disclosure of what to eat and **Category 2:** Disclosure of products and foods from sponsoring brands. It is noted that digital influencers have common goals, which is to encourage the practice of daily physical exercise and consume products and foods from sponsoring brands.

In Category 1, identified by "Disclosure about what you should eat", it is perceived that in the *fitness* universe , food plays an indispensable role, being related to health benefits such as achieving better performance in physical exercise, or to have a leaner

body with more defined muscles. These fitness muses on *Instagram*® post tips on food, lifestyle, recipes and exercises for their followers without scientific basis, or specific training in the health area, only with personal experience, often with extremist speeches contributing to the punitive conception of food (Bueno, Montanha, 2019).

As is the case of Digital Influencer A who in her publication 01 tells how she lost 7kg. A fact that also occurs in publication 02 of Digital Influencer C, who tells everything she eats in a day, Digital Influencer D who in publication 01 gives seven tips to speed up your metabolism and get out of the plateau effect, and Digital Influencer E in publication 03 who talks about meal choices.

According to Theodoro, Fernandez and Reis (2021), this influence can be negative for individuals with no knowledge between the ideal and the real, generating psychological suffering for not reaching the standards, for not having financial conditions and feeling excluded from the healthy coexistence of society. However, the author says that these publications can motivate people to adhere to a healthy lifestyle by changing their lifestyle habits.

What draws attention in publication 01 of Digital Influencer D is the fact that it propagates that certain foods inflame the body, causing nutritional terrorism and encouraging its followers to stop consuming them without scientific basis or a clear explanation.

Restrictive diets can cause negative psychological and metabolic effects, increasing the risk of eating disorders. Individuals in dietary restriction tend to eat uncontrollably after periods of limitation, facing emotional problems such as anxiety and depression. The so-called "fad diets" promote quick results, but have no scientific basis, leading people to focus on what they should avoid instead of focusing on a balanced diet that meets their nutritional needs (Santana, Melo, 2020).

In a study carried out by Leite (2022) on the influence of diets and food tips published on *Instagram*®, he pointed out that of the 78 survey participants, 74.4% pointed out an inclination towards food tips. According to the author, these digital influencers do not care if their audience fits with what they consider to be an ideal and healthy diet, representing a risk to the health of those who follow the tips without a reliable scientific basis, which is often just advertising.

In this same publication (publication 01 of Digital Influencer D), the digital influencer encourages her followers to adhere to intermittent fasting in order to "*stimulate your metabolism to work better, through a detox that is autophagy, promoted by fasting",* this without any scientific basis or advice to consult a professional nutritionist.

Intermittent fasting causes a ketogenic state, where the body starts using fatty acids and ketones as an energy source, especially for the brain, after 6 to 8 hours of fasting. This results in a reduction in LDL levels and an increase in HDL levels. Ketones require more energy to produce, contributing to weight loss. This change in metabolism may also reduce the risk of cardiometabolic disease, suggesting that intermittent fasting may be helpful in treating obesity and metabolic syndrome. Studies indicate that this practice decreases cardiovascular risk, possibly due to the reduction of oxidative stress and systemic inflammation (Hanna et al*.,* 2021).

However, intermittent fasting is not suitable for everyone, as there are individuals who should not go too long without eating, such as people with type 1 diabetes, pregnant or breastfeeding women, individuals with eating disorders or other health conditions, as well as those who need a regular intake of food due to certain medications. Prolonged practice can lead to symptoms such as tension, irritability, fatigue, depression, and moodiness. Another concern is the possibility of alteration in the menstrual cycle (Silva, Batista, 2021).

In a study on fad diets carried out by Rodrigues and Ferreira (2021), with 54 university students from the Federal District, it pointed out that the most followed diet was intermittent fasting, where 33.6% have already adhered to it. Of these 54 participants, only 11.1% had individualized nutritional monitoring and 88.9% had no follow-up, being influenced by social networks. Another study carried out by Bernardes, Vilela and Machado (2023), on the influence of social networks and fad diets with 92 participants, observed that 58.70% of the participants had already followed a diet they saw on social networks, among the most followed types of diets intermittent fasting corresponded to 32.61% of the total participants and 19.57% corresponded to some type of diet followed by a blogger.

It is possible to note that the profiles analyzed based on the selection and exclusion criteria as exposed in the methodology are all female. The same occurred with the study by Pereira (2021), which analyzed content from 5 (five) digital influencers, where they were all female. Theodoro, Fernandez, and Reis (2021) also state that the higher prevalence of women as digital influencers is related to the fact that women become more sensitive due to the relentless pursuit of the standard of beauty imposed by the media as a lifestyle.

The most popular profiles on social networks are of women with good *socioeconomic status* who present their lives as models of perfection. They influence thousands of followers, using their experiences and opinions. Currently, the body has become an important way to express personality and self-esteem, serving as a showcase in society and used as a *marketing* strategy the association of certain products and their image with their body (Mota et al*.,* 2019).

This fact corroborates the present study where in category 2, entitled "Promotion of products and foods from sponsoring brands", influencers encourage the consumption of these sponsored products. These products are sold as *fit* and healthy with the promise of helping you stay focused on healthy eating, have more energy during the day and achieve the desired body. All of the influencers observed in this study encourage the consumption of supplements and protein foods from sponsored brands, such as *shakes, whey protein* and protein bars, as well as other products aimed at burning fat, increasing energy and focus.

Self-supplementation can be dangerous due to the lack of information about the products, which can lead to contamination and the consumption of ineffective supplements. Instead of promoting muscle growth, the excess can be stored as fat. The excessive use of protein supplements can overload the liver and kidneys, cause cardiovascular damage, alter the nervous system, joint pain, infertility and serious kidney problems, as well as dehydration and muscle fatigue. Only a specialized professional, such as a nutritionist, can provide guidance on the need to use food supplements, including the ideal amount, time and form of ingestion. This professional is the most qualified for this task. In addition, it is essential to collect a set of individual information to ensure an adequate prescription (Macedo, Ferreira, 2021).

Products with nutrition and health claims tend to have a more favorable nutritional profile, featuring fewer total and saturated fats and more fiber compared to products without these claims. However, these parameters alone do not guarantee better nutritional quality. Despite being attractive, these products do not ensure a healthier impact for consumers. Foods labeled as "healthy" are often associated with weight loss, while "unhealthy" foods are seen as responsible for weight gain, suggesting that health and obesity are related (Carneiro, 2022).

In addition to supplements, these digital influencers encourage the consumption of ultra-processed foods, calling these sponsored foods healthy. This is the case of Digital Influencer B in publications 01 and 03.

Advertising about ultra-processed foods minimizes the health risks associated with these foods, which are nutritionally questionable due to their ingredients. Due to their formulation, they tend to be consumed in excess, replacing *fresh* or minimally processed options. They are often high in fats, sugars, sodium, and low in fiber. By promoting these products, influencers can create a false impression of benefits, hiding the dangers of their consumption (Pereira, 2021).

According to Venturini et al. (2020), the "fitness muses ″ address that, despite the routine with strict diets and intense exercises, the architecture of the body needs to be

enhanced with a shaping belt, often driven by discourses that value thin waists as a standard of beauty. This practice seeks to align women's bodies with norms of femininity that deviate from the natural due to physical training. Worn for up to eight hours a day, these girdles refer to corsets and bodices, reinforcing the idea that women must conform to increasingly unattainable beauty standards, reflecting norms of social acceptance.

A fact that corroborates the present study where in publication 01 of the Digital Influencer E she encourages the use of a shaping belt for long hours daily. Both publication 01 by Digital Influencer E, and publication 02 by Digital Influencer A on cream to remove flaccidity and folliculitis, no scientific basis was found on effectiveness, which means that it has no scientific basis and is only *marketing* for sponsoring brands.

For Pereira (2021), the recommendations made by these digital influencers go against the principles of nutrition and current legislation, since they are not registered with the Nutrition Council, thus becoming unqualified professionals to disseminate such information. Even if they were nutritionists, the guidelines analyzed would be inadequate, as they would violate the code of ethics and conduct of the profession.

The female audience often feels fragile when comparing themselves to fitness bloggers on social networks, trying to follow diets and eating habits to achieve the same results. This search for aesthetic standards can lead to frustration and eating disorders, such as anorexia and bulimia. The nutritionist plays a crucial role in this context, and must be aware of distorted information about nutrition and help the population to modify their eating behavior in a healthy way. It should emphasize the importance of individualized eating plans, taking into account preferences, intolerances, and health conditions, to avoid complications and promote well-being (Esteves, Veras, Santos, 2022).

CONCLUSION

In view of the above, it is possible to see that thousands of people are influenced daily by these women, affecting the physical and mental health of their followers who seek in every way to fit into the standard of beauty exposed by them. These digital influencers make publications about food, exercise, and supplementation without any scientific basis, and without even knowing the audience that follows them, they often just want engagement for sponsored brands.

The audience that follows these influencers is looking for quick, easy, and sometimes miraculous information to achieve a body similar to theirs. Often, these people follow these recommendations and purchase supplements without understanding whether the information is really reliable. It is important to note that only health professionals, such as

nutritionists, are qualified to prescribe supplements and developing appropriate food plans is a nutritionist's exclusive activity.

The importance of the professional nutritionist in disseminating information on food and nutrition with a scientific basis is noted so that in this way they can combat false information and nutritional terrorism propagated by digital influencers, making it clear that each human being is unique and, consequently, their nutritional needs vary from person to person.

Finally, the lack of supervision for this type of posting means that thousands of lay people are influenced daily to consume or not consume certain foods, which can have harmful consequences for the physical and psychological health of those influenced. Therefore, there is a need to develop public health policies that can mitigate these harmful effects and thus promote a better quality of life.

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THE ROLE OF CALCIUM HYDROXYAPATITE IN STIMULATING COLLAGEN PRODUCTION AND IMPROVING SKIN QUALITY IN AESTHETIC TREATMENTS: AN INTEGRATIVE REVIEW

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ABSTRACT

With the incessant search for different aesthetic procedures to minimize the effects of aging, it becomes necessary to increase research on the effects, improvements, and methods of skin care. Scientific evidence was then sought on the functioning of calcium hydroxyapatite in stimulating collagen production and improving skin quality in the treatments involved. To this end, an integrative review was used, and the search was carried out in the *PubMed* and Virtual Health Library (VHL) databases. The descriptors used were: *calcium hydroxyapatite and dermal filler and collagen*. A total of 61 articles were found, of which 14 met the inclusion criteria in the research. It was noticed that the dual action of the biostimulator, which acts both as an immediate filling agent and as a long-term collagen stimulator, highlights its effectiveness in improving skin quality and obtaining long-lasting and natural results in the context of facial rejuvenation.

Keywords: Calcium hydroxyapatite. Collagen. Dermal fillers.

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INTRODUCTION

The aging process is characterized by a series of physiological changes that affect the structure and function of the skin. Over the years, the production of collagen and elastin decreases, leading to the appearance of wrinkles and sagging. The skin, being the most exposed organ in the human body, constantly suffers from the effects of external factors and natural wear and tear over time, which makes the signs of aging more apparent. With the increase in longevity and the aesthetic pressures of society, the demand for methods to prevent and combat aging is growing, often through aesthetic treatments (Ferraz *et al*., 2021; Silva *et al*., 2022).

As time passes, there are disproportionate changes in soft tissues, the appearance of blemishes and changes in skin texture, as well as the appearance of wrinkles and furrows. Facial aging is related to histological and molecular transformations, such as reduced availability of hyaluronic acid, dermal collagen, and elastin, resulting in progressive thinning of the skin and loss of elasticity. This complex process involves a combination of genetic and biological factors, and external influences (Galvez *et al*., 2023; Muller *et al*., 2024).

Given this scenario, aesthetic interventions have proven to be increasingly relevant, especially considering the increase in demand for non-surgical facial rejuvenation procedures. Calcium Hydroxyapatite (CaHA) emerges as a promising alternative for the treatment of these conditions, not only as a filler, but also as a biostimulator that promotes neocollagenesis. Studies show that the application of CaHA can induce the formation of type I collagen, gradually replacing type III collagen, which contributes to the improvement of skin quality and the restoration of facial volume (Gorbea *et al*., 2021; Neca *et al*., 2022).

The use of collagen biostimulators, such as CaHA, has been shown to be a growing practice, especially in both body and facial harmonization procedures. These products are used to treat flaccidity, improve skin firmness and promote volumization, presenting satisfactory results in several areas, such as the face, abdomen, thighs and buttocks. Unique properties such as a high elastic modulus and viscosity make it a promising option for tissue revolumization and support. In addition, its dual action of stimulating the production of type I collagen and providing immediate apparent results, highlights its importance in the treatment of volume loss associated with aging (Lorenc *et al*., 2018; Gorbea *et al*., 2021; Oliveira *et al*., 2021).

Despite the advances, there is still a lack of robust scientific information on the application of these biostimulators, which highlights the need for studies that consolidate their efficacy and safety. Understanding its action in the aesthetic context is essential to

support therapeutic choices, optimize facial rejuvenation techniques, and ensure the safety and efficacy of procedures (Lorenc *et al*., 2018; Nogueira and Silva, 2022).

Therefore, this work aims to investigate, through an integrative literature review, the efficacy of CaHA, evaluating its role in stimulating collagen production, improving skin quality and its application methods, investigating possible complications, in addition to patient satisfaction results.

METHODOLOGY

Based on the general objective of this research, this study is an integrative literature review, which was structured in 6 stages, namely: elaboration of the research question; literature search; data collection; discussion of the results and presentation of the integrative review, which allowed a triangulation and complete view of the results.

The present study sought to understand in a general way the role of CaHA in stimulating collagen production and improving skin quality in aesthetic treatments. Thus, the integrative review helped in the search and guided the quality of the studies used for research. Data were collected through the search for articles relevant to the proposed objectives. Data collection was carried out in July 2024 with the search for articles in the following electronic databases: *PubMed* and Virtual Health Library (VHL), using original articles in full that covered the years 2008 to 2024.

To carry out the research, controlled descriptors based on Health Sciences Descriptors (DeCS) were used, using the Boolean operator AND to limit it to specific studies. The descriptors used: *calcium hydroxyapatite cosmetic* AND *dermal fillers* AND *collagen* for research in English. Excel was also used to help separate the articles by means of a table to facilitate the analysis.

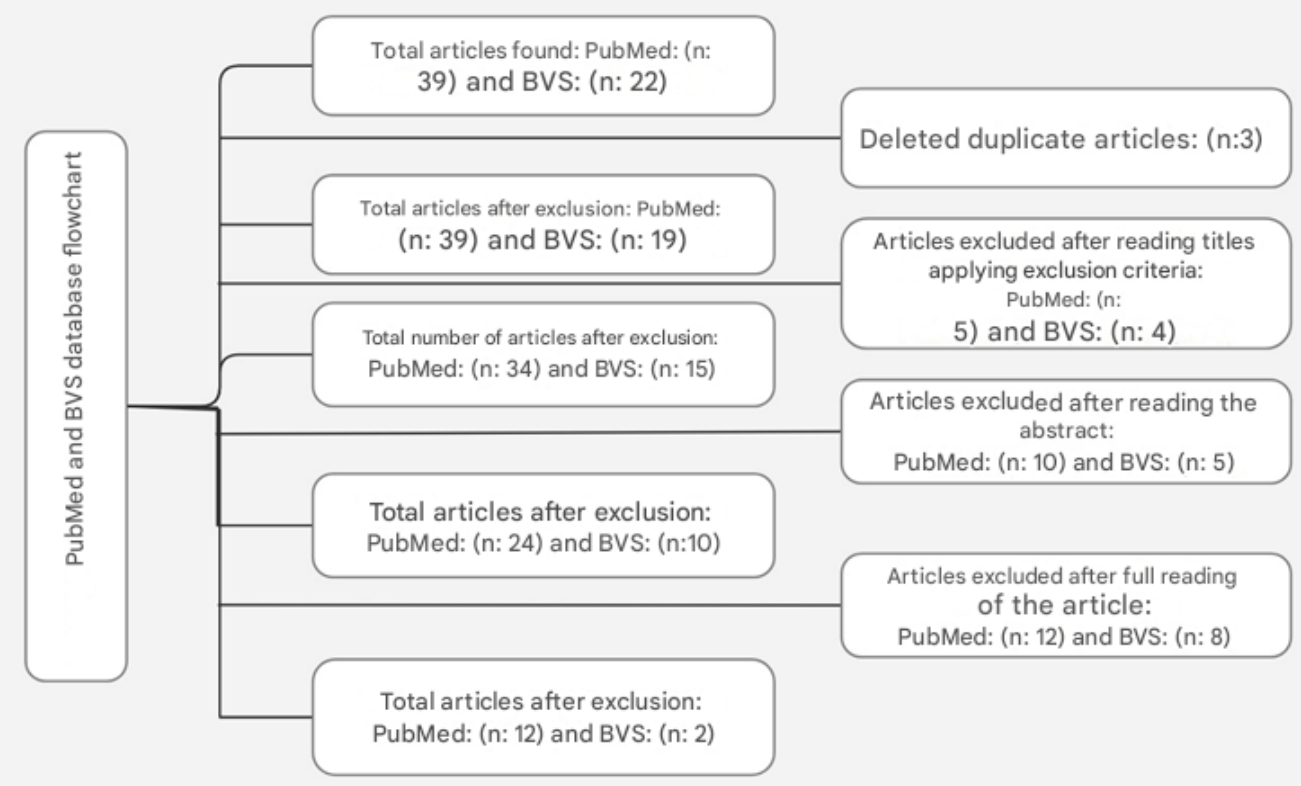
In the selection stage, the following inclusion criteria were adopted: original articles published between 2008 and 2024, available in full in English and addressing CaHA, its applications in aesthetics, associated complications, stimulation of collagen production and improvement of skin quality. The following were excluded from the sample: articles with studies on animals, conference proceedings, theses, dissertations, and technical reports.

Then, the abstracts and titles of the articles were analyzed, applying the inclusion and exclusion criteria to verify the relevance of the research theme. After this initial evaluation, the selected articles were read in full, and those that did not fit the theme or did not meet the criteria required for this integrative review were discarded.

The process of searching for materials was conducted with the help of automated filters in the databases, where the inclusion and exclusion criteria were applied. The

representation of this process can be seen in the adapted PRISMA flow diagram, presented in Figure 1.

Figure 1 - Flowchart of the article selection process.



Source: The authors (2024).

RESULTS

Thus, 14 articles that best addressed the theme were selected, which are shown in Chart 1.

Chart 1 - Selected studies.

Origin	Title	Authors	Year	Considerations
PubMed	*Consensus Recommendations for the Use of Hyperdiluted Calcium Hydroxyapatite (Radiesse) as a Face and Body Biostimulatory Agent*	Almeida *et al.*	2019	Best practices and guidelines for the application of hyperdiluted calcium hydroxyapatite (Radiesse) in aesthetic procedures, emphasizing its versatility and benefits in skin rejuvenation in facial and non-facial areas.
				Go on

PubMed	*Facial rejuvenation with the new hybrid filler HArmonyCa™: Clinical and aesthetic outcomes assessed by 2D and 3D photographs, ultrasound, and elastography*	Galvez *et al.*	2023	Clinical and aesthetic results of the use of the new HArmonyCa™ hybrid filler for facial rejuvenation, evaluating its efficacy and safety through objective methods such as 2D and 3D photographs, ultrasonography and elastography.
PubMed	*Biostimulating fillers and induction of inflammatory pathways: A preclinical investigation of macrophage response to calcium hydroxylapatite and poly-L lactic acid*	Nowag *et al.*	2024	It addresses the initial response of macrophages to biostimulant fillers, such as calcium hydroxapatite and poly-L-lactic acid, and how this response influences collagen regeneration and the organization of the extracellular matrix, highlighting the differences in the inflammatory pathways induced by these materials.
PubMed	*Complications of collagen biostimulators in Brazil: Description of products, treatments, and evolution of 55 cases*	Ianhez *et al.*	2024	It discusses the complications associated with the use of collagen biostimulators in Brazil, presenting a description of the products, treatment methods and the evolution of 55 clinical cases.
PubMed	*Dermal Fillers and Combinations of Fillers for Facial Rejuvenation*	Beer.	2009	Evolution and use of dermal fillers for facial rejuvenation, addressing the combinations of different types of fillers and their characteristics, efficacy and applications in treatments.
PubMed	*Facial Rejuvenation With Fat Grafting and Fillers*	Crowley *et al.*	2021	It evaluates the current trends of fat grafting and fillers in the management of facial rejuvenation, including the cellular changes that occur with aging, the biostimulatory effects.
				Go on
Origin	**Title**	**Authors**	**Anus**	**Considerations**
PubMed	*Introducing aesthetic regenerative scaffolds: An immunological perspective*	Corduff.	2023	Use of injectable biomaterials, called aesthetic regenerative scaffolds, which can direct the body's immune response to promote tissue regeneration in aesthetic treatments, instead of inducing chronic inflammatory processes.

PubMed	*Physiochemical Characteristics of Calcium Hydroxylapatite (CaHA)*	Lorenc *et al.*	2018	It discusses the physiocanemic characteristics of Calcium Hydroxylapatite (CaHA), highlighting its rheological properties, such as modulus of elasticity (G') and viscosity, which contribute to its efficacy in facial volume enhancement treatments and in the stimulation of collagen synthesis.
PubMed	*Histological effects of a combined collagen stimulation procedure consisting of microfocused ultrasound, soft tissue filler, and Ca-HA injections*	Casabona *et al.*	2023	Histological effects of a combined collagen stimulation procedure involving the use of microfocused ultrasound, calcium hydroxyapatite-based fillers, and microneedling, highlighting the efficacy and synergy of these techniques in improving skin laxity.
PubMed	*Nonsurgical Tear Trough Volumization: A Systematic Review of Patient Satisfaction*	Gorbea *et al.*	2021	Non-surgical volumization of the nasolabial fold region, analyzing patient satisfaction and complication rates associated with the use of injectable materials, with the objective of providing guidance for professionals in the field of aesthetic medicine.
				Go on
PubMed	*Calcium hydroxyapatite: a review for efficacy, safety and imaging when used as a filler and as a biostimulator*	Martins *et al.*	2021	Efficacy, safety, and patient satisfaction in the use of calcium hydroxyapatite as a collagen filler and biostimulator, in addition to addressing its visualization in imaging studies.
Origin	**Title**	**Authors**	**Anus**	**Considerations**

PubMed	*Applicability of collagen biostimulators (poly-l-lactic acid and calcium hydroxyapatite) in dermal filler in off-face areas of the body*	Silva *et al.*	2022	Applicability and efficacy of collagen biostimulators, such as Poly-L-Lactic Acid and Calcium Hydroxyapatite, in dermal fillers in off-face areas of the body, presenting clinical evidence and recommendations for their use in body harmonization.
BVS	*Facial Dermal Fillers: Selection of Appropriate Products and Techniques*	Matarasso.	2008	Evolution of facial rejuvenation techniques, highlighting the importance of dermal fillers as effective methods to restore facial volume and contour, in contrast to traditional surgical approaches.
VHL	*Calcium Hydroxylapatite (Radiesse) for Treatment of Nasolabial Folds: Long-Term Safety and Efficacy Results*	Bass *et al*.	2010	Safety and long-term efficacy of Calcium Hydroxylapatite (Radiesse) dermal filler for the correction of facial wrinkles and folds, especially nasolabial folds, based on a comparative study between Radiesse and human collagen.

Source: The authors (2024).

DISCUSSION

Skin aging causes structural, morphological and functional changes in all its layers, mainly due to the significant reduction of fibroblasts. This compromises collagen production, resulting in sagging and other aesthetic dysfunctions. In addition, there are changes in body composition, such as a decrease in lean mass, leading to thinner, wrinkled, dehydrated, fragile skin with a slower healing process, due to the loss of elasticity. Thinning of the skin occurs by reducing components of the extracellular matrix, such as collagen, elastic fibers, and glycosaminoglycans (Silva *et al*., 2022).

Each biostimulator has unique characteristics that lead to its usefulness and specific indications, which increase the opportunities for combined treatments. As a result, CaHA, popularly known as Radiesse®, is a popular dermal filler in aesthetics, widely used to correct wrinkles and replace volume lost over the years. With a proven track record of efficacy and safety of over ten years, it is an attractive choice for professionals and patients alike. In addition to acting as a bulking substitute, it also stimulates collagen production, resulting in long-lasting effects (Beer, 2009).

CaHA has stood out in the aesthetic filler market due to its unique properties that differentiate it from other materials, such as those based on hyaluronic acid. With a high modulus of elasticity, this biostimulator provides a more effective lifting effect. Additionally,

its ability to act as a collagen and elastin biostimulator makes it an attractive option for patients seeking not only immediate results but also long-term benefits. This characteristic is less common among other fillers, which often offer instant results but do not necessarily contribute to skin regeneration (Martins *et al*., 2021).

Thus, studies bring CaHA as an effective and outstanding biostimulatory agent in facial and body aesthetics, promoting not only an increase in volume, but also an improvement in skin quality. It has been shown that its application stimulates neocollagenesis, resulting in a long-lasting and natural rejuvenation effect. Additionally, its biodegradability and favorable safety profile make it an attractive option for patients seeking minimally invasive interventions. The combination of its mechanical and biological properties contribute to skin revitalization, offering satisfactory aesthetic results and a quick recovery, which makes it a popular choice among professionals in the field (Almeida *et al*., 2019).

Recognized for its ability to stimulate the endogenous production of collagen, a crucial factor in maintaining the elasticity and firmness of the skin, when injected, it not only provides an immediate volumizing effect, but also triggers the production of new collagen. Research indicates that even at significant dilutions, Radiesse continues to promote the synthesis of type I collagen and elastin (Almeida *et al*., 2019; Galvez *et al*., 2023).

Contributing to long-lasting results and an improvement in skin elasticity, this biostimulatory property makes CaHA a valuable option, offering sustainable and natural results for patients. In addition, it has a higher modulus of elasticity (G') compared to other fillers, allowing better adaptation and support in areas such as the temporal region and chin. This combination of immediate effects and the continuous stimulation of collagen production make it a preferred choice in facial rejuvenation procedures (Lorenc *et al*., 2018).

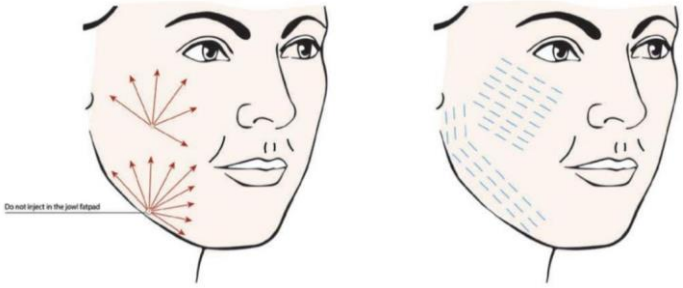
CaHA has been shown to be effective in aesthetic procedures, both in facial areas and in areas of the body, however it is important to note that it is not recommended for lip augmentation, since an unacceptable number of lip nodules has been recorded due to the agglomeration of the product. Its application aims to promote the firmness and elasticity of the skin, being particularly beneficial in regions such as the thighs, abdomen and arms, where sagging is often observed. Studies show that, when injected, it results in gradual improvements in the texture and appearance of the skin (Matarasso, 2008; Silva *et al*., 2022).

For biostimulation and improvement of skin firmness with CaHA, 2 to 3 sessions are usually indicated, with intervals of 1 to 2 months between them. The ideal dilution can vary

according to the area to be treated, the degree of sagging and the thickness of the skin. However, a team of 10 dermatology and plastic surgery specialists, all with extensive experience in facial and body rejuvenation, held a discussion on the best clinical management of this product. The consensus was that the most effective dilution to obtain the best results is 1:1 for facial treatments, 1:2 for the neck region, 1:1 for the buttocks, 1:1 for the inner thighs, 1:1 for the abdomen and 1:2 for the arms. The most recommended technique is fan backinjection using a cannula, with 2 to 5 entry points, depending on the area to be treated (Almeida *et al*., 2019).

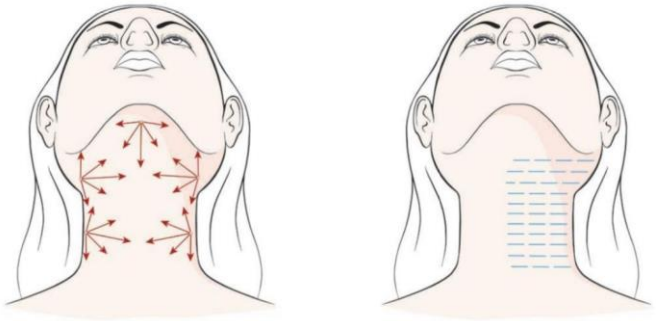
Best practices for application in the most popular regions are illustrated in Figures 2, 3, 4, 5, 6 and 7.

Figure 2 - Facial biostimulation techniques with CaHA.



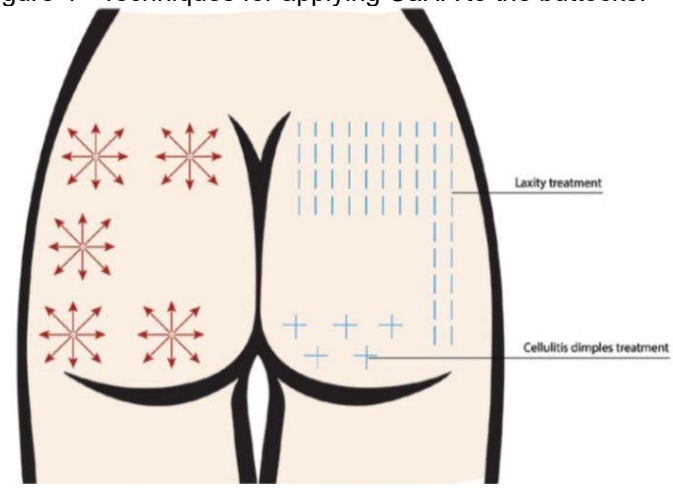
Source: Almeida *et al*. (2019).

Figure 3 - CaHA biostimulation techniques in the neck.



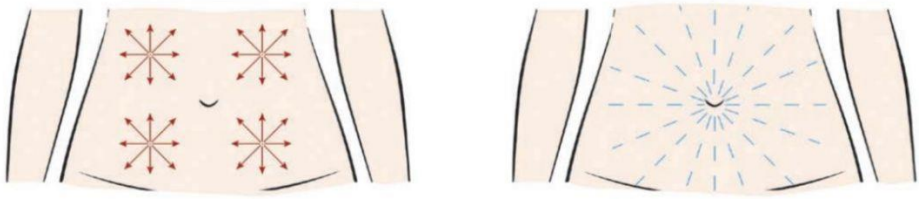
Source: Almeida *et al*. (2019).

Figure 4 - Techniques for applying CaHA to the buttocks.



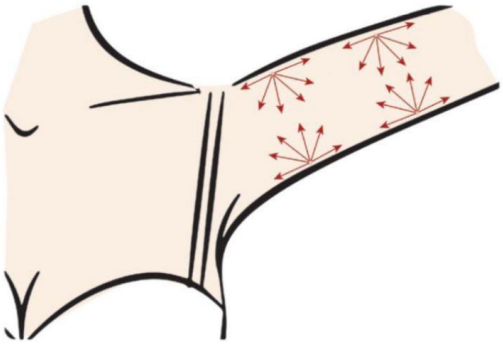
Source: Almeida *et al*. (2019).

Figure 5 - Techniques for applying CaHA to the abdomen.



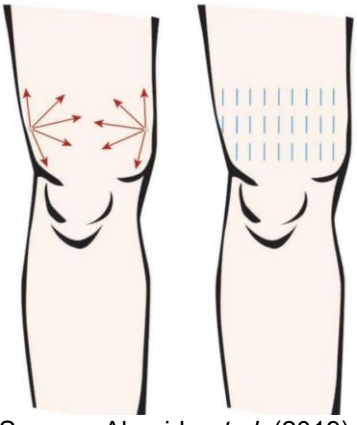
Source: Almeida *et al*. (2019).

Figure 6 - Technique for applying CaHA to the arm.



Source: Almeida *et al.* (2019).

Figure 7 - Techniques for applying CaHA to the inside of the thighs.



Source: Almeida *et al.* (2019).

At the sites where the injection occurs, there is localized trauma to the tissue, resulting in hemorrhage and release of molecular patterns associated with cellular damage. Soon after, the formation of thrombi composed of activated platelets, fibrinogen and fibrin, attracts neutrophils to the area, triggering an inflammatory response. Monocytes from the blood then migrate to the site and differentiate into M1 and M2 macrophages which respond differently to the fillers, with a low inflammatory reaction to CaHA. Differentiating fillers based on immune activity and fibroblast response may have clinical relevance, especially with increasing use in skin tightening treatments in various areas of the body. Understanding how these treatments induce collagen deposition is essential, and more research is needed to clarify these processes and aid in the most effective clinical choice (Corduff, 2023; Nowag *et al*., 2024).

Several hypotheses attempt to explain the unique mechanism of action of CaHA, which seems to differ from the inflammatory response observed with other biostimulators. Among them, the role of CaHA as a calcium reservoir, regulating fibroblasts and stimulating neocollagenesis through direct interactions with its microspheres stands out. Each biostimulatory formulation follows specific immune pathways, resulting in distinct proportions of collagen, elastin, and other components of the extracellular matrix (ECM), which influences the structure and function of the skin. These processes still vary according to genetic factors, age, and health conditions (Nowag *et al*., 2024).

The thrombus resulting from the initial lesion functions as a support for cell adhesion. This thrombus is rapidly covered by plasma proteins such as albumin, fibrinogen, fibronectin, vitronectin, μ-globulin, and complement system components. Over time, these proteins are replaced by others that compete for space on the surface of the thrombus (Corduff, 2023).

Neutrophils are the first cells to arrive at the site, they act by trying to eliminate foreign material through degranulation, phagocytosis and release of extracellular traps, followed soon after by the recruited monocytes. In the absence of bacterial infections, their survival is short, usually 2 to 3 days. The recruited monocytes, on the other hand, are activated and transformed into macrophages, which can differentiate into two types: M1 pro-inflammatory macrophages and M2 macrophages, the latter responsible for reducing inflammation and promoting tissue regeneration. M1 macrophages release inflammatory cytokines, such as TNFα, IL1β, IL-6, and IL-8, creating a feedback loop that attracts more inflammatory cells until the threat is eliminated. When tissue trauma is excessive, the acute inflammatory response is prolonged and intensified (Corduff, 2023; Nowag *et al.,* 2024).

The levels of cytokines in human macrophages of types M1 and M2, after incubation with CaHA, were similar to those of controls, suggesting a non-inflammatory potential of CaHA. In addition to previous histological studies that indicate that CaHA does not trigger an inflammatory response, this study brings additional evidence to support the hypothesis that CaHA's mechanism of action follows a more regenerative pathway, while the others tend to induce a characteristic foreign-body inflammatory response (Nowag *et al*., 2024).

The filler consists of CaHA microspheres, with sizes between 24 and 45 µm, suspended in a sodium carboxymethylcellulose gel. The gel is gradually absorbed, while the microspheres remain, providing a structure for collagen formation. On average, the effect of this filler lasts from 12 to 18 months, but there are reports of lasting more than 30 months in some cases. After about two months of application, it is possible to observe histiocytes and fibroblasts, with dilated endoplasmic reticulum rich in procollagen, around the microspheres. After six months, the deposition of type I collagen occurs, with a lower presence of type III collagen (Crowley *et al*., 2021).

The transitional ECM is remodeled to the ECM of the original tissue, with cells that reflect the function and structure of that tissue. During healing, type III collagen is replaced by type I. In a comparative analysis, CaHA fillers showed higher production of type III collagen at 4 months and type I at 9 months, as well as increased elastin, cell proliferation, and angiogenesis, with no signs of inflammation or granulation tissue. These results suggest that CaHA promotes ECM remodeling in a manner distinct from the fibrous inflammatory response typical of foreign bodies (Corduff, 2023).

It is concluded that the levels of cytokines in human macrophages M1 and M2 after exposure to CaHA were similar to those observed in controls, suggesting a non-inflammatory profile for CaHA. Previous histological data also indicate that CaHA does not trigger an inflammatory response, reinforcing the hypothesis that its mechanism of action is more regenerative, while other biostimulators tend to generate a typical foreign-body inflammatory reaction (Casabona *et al*., 2023; Nowag *et al*., 2024).

A three-fold increase in epidermal and dermal thickness was observed when treating the skin with the proposed treatment, which includes injections of CaHA-based soft tissue fillers. Studies reveal that after three years of follow-up, many patients showed a moderate and sustained aesthetic improvement, and it is also noteworthy that no significant adverse events, such as nodules or granulomas, were recorded during the observation period, which reinforces the safety of the use of this filler in comparison with others available on the market. These findings indicate that Radiesse® is an effective and safe option, providing

long-lasting results without relevant complications (Bass *et al*., 2010; Casabona *et al*., 2023).

In another long-term follow-up, 40% of CaHA-treated folds showed at least a 30-month grade improvement after the last application. Thus, higher patient satisfaction rates and a higher probability of return were obtained compared to other fillers. These results highlight the safety and efficacy of Radiesse® in soft tissue augmentation, indicating that it is as safe as collagen itself (Silva *et al*., 2022).

In another study, elastography images indicated an increase in viscoelasticity in both the reticular dermis and the subcutaneous tissue, suggesting the formation of new collagen fibers. This increase in collagen begins to be noticeable about 60 days after the treatment, reaching its peak between 90 and 180 days after the intervention. With regard to safety, no unexpected or serious treatment-related adverse events were observed. All reported adverse events were mild and completely resolved with topical treatment (Galvez *et al*., 2023).

Among the adverse effects observed with the application of CaHA, in a series of 1748 cases, nodules were most frequently related to complications caused by other biostimulators, while Radiesse® was more frequently associated with edema, a mild redness and inflammation, present in most patients, but resolved spontaneously within the first 48 hours, without the need for additional treatment (Galvez *et al*., 2023; Ianhez *et al*., 2024).

The study by Martins et al. (2021) indicates that patient satisfaction with this material is high, reflecting its effectiveness as both a filler and a biostimulator. Compared to traditional fillers, CaHA not only improves facial contour but also promotes skin firmness, which can be especially beneficial in rejuvenation treatments.

Therefore, CaHA has obtained a great acceptance and satisfaction of patients in relation to other biostimulators, professionals cite the comparatively lower tendency of CaHA of post-injection water absorption, greater moldability and ability to stimulate collagen as additional benefits in relation to the others. They suggest that the injection results in more collagen and elastin production and less inflammation than the injection of the others. In addition, it is also known to have longer-lasting effects, with longevity of up to 2 years, then suffering degradation and natural absorption by the body (Gorbea *et al*., 2021).

Two and a half years after the application of 1.6 mL of the biostimulator, magnetic resonance imaging revealed an increase in tissue volume, with no evidence of remaining CaHA. This suggests a prolonged stimulation of collagen production and its complete biodegradability. They then reported the satisfaction results made with 62 patients who

received CaHa filling: 58 (93.5%) of these patients were satisfied, 3 did not notice any change (4.8%) and only 1 expressed dissatisfaction (1.6%) (Crowley *et al*., 2021; Gorbea *et al*., 2021).

FINAL CONSIDERATIONS

This study found scientific evidence of the applicability of collagen biostimulators, CaHA has been consolidated as an innovative and effective option in aesthetic treatments, especially with regard to facial rejuvenation. In addition to acting as an immediate filler, it stimulates collagen production, promoting a significant improvement in skin quality over time. This duality of action meets the aesthetic needs of patients and contributes to skin health, making it an attractive choice for professionals in the field.

The integrative review conducted in this study revealed that the application of CaHA can induce the formation of type I collagen, gradually replacing type III collagen, which is critical for the restoration of facial volume and skin elasticity. The results obtained in several studies analyzed demonstrate that the biostimulator not only provides immediate aesthetic results, but also promotes long-term benefits, aligning with the expectations of patients who seek less invasive interventions with natural results.

However, despite the advances and growing popularity of CaHA, there is still a pressing need for more research exploring its applications, safety, and efficacy in different clinical settings. The paucity of robust data on its complications and long-term outcomes underscores the need for an ongoing commitment to scientific research. Only through rigorous and well-structured studies will it be possible to establish clear and grounded guidelines for the use of CaHA in aesthetic practice.

Finally, the training and constant updating of health professionals who work in the aesthetic area are essential to ensure the safety and effectiveness of the treatments offered. Awareness of its properties and its implications for aesthetics must be accompanied by an ethical and responsible approach, always prioritizing the well-being of patients. In this way, CaHA is not only a valuable tool in aesthetic medicine, but also as an invitation to reflect on the importance of informed and safe practices in skin care and the search for healthy aging.

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CHALLENGES AND PERSPECTIVES OF THE NEUROPSYCHOPEDAGOGUE'S PERFORMANCE IN THE FACE OF MATHEMATICAL LEARNING DIFFICULTIES

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ABSTRACT

The present study aimed to present and analyze works that address the role of the neuropsychopedagogue in the face of mathematical learning difficulties. To this end, we used qualitative and bibliographic research using Google Scholar as a search platform, delimiting the period of the last 10 years (2013-2023), based on the descriptors: "mathematics difficulty", "mathematical learning difficulty", "mathematics and the role of the neuropsychopedagogue", with the contribution of theorists such as, Rosa (2022), Brazilian Society of Neuropsychopedagogy (SBNPp) (2021), Silveira (2023), among others.

Keywords: Learning Disability. Dyscalculia. Neuropsychopedagogy.

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INTRODUCTION

The evolution of studies in the area of education focused on learning difficulties in general, and mathematics, has undergone great advances over the years, facilitating the identification of factors that contribute to students having learning difficulties during the schooling period.

Neuroscience has been a great ally in this process, with studies on the functioning of the human brain and discoveries of how learning is consolidated, along with psychology and pedagogy, the transdisciplinary science called neuropsychopedagogy emerges, which plays a fundamental role in the lives of students and has been growing due to its importance in preventing learning difficulties and preventing school failure.

The awakening to research on this topic was due to the observation and reports of people with difficulties in learning mathematics due to the way it was presented in basic education, as well as concerns about mathematics so necessary in everyday life being considered difficult by many people, and possible contributions of the Neuropsychopedagogue to students with learning difficulties and learning disorders, making the necessary referrals.

It is intended, based on the study of articles on Google Scholar, to present and analyze what authors who research on this theme defend regarding the difficulties of learning mathematics and the role of the neuropsychopedagogue and possible interventions.

In view of this, it is necessary to highlight the importance of problematizing how the discipline is worked, rarely without the help of playfulness. The chosen theme is relevant to raise discussions about mathematics learning and change the idea that society permeates, that it is okay not to know mathematics because it is considered difficult.

Intervention in mathematics learning difficulties from the beginning of school life is of paramount importance to diagnose difficulties and disorders, as well as referrals in search of solutions.

CHALLENGES AND PERSPECTIVES OF THE NEUROPSYCHOPEDAGOGUE'S PERFORMANCE IN THE FACE OF MATHEMATICAL LEARNING DIFFICULTIES

Article 10 of resolution 03/2014, of the SBNPp (Brazilian Society of Neuropsychopedagogy), points out that Neuropsychopedagogy is a transdisciplinary science that studies cognitive processes, for this purpose, it seeks the relationships between the studies of neurosciences, the knowledge of cognitive psychology and pedagogy.

This new field of knowledge brings important contributions to education because it has the possibility of perceiving the individual in his totality. The neuropsychopedagogue has a fundamental role in the school trajectory of students with learning difficulties, for Silveira (2019, p. 2) the "action of the neuropsychopedagogue must be aimed at preventing learning difficulties and preventing school failure not only of the student, but also of educators and all those involved in the educational process". Still on the role of the neuropsychopedagogue, the author defines that,

> In general terms, the work of neuropsychopedagogical counseling is related to the objective of educational/school psychology to assist the global development of the student through multiprofessional teamwork together with managers, teachers, advisors, parents and coordinators so that the learner has his basic learning needs developed. [...] it aims at prevention, assessment, psychological guidance and follow-up, preferably applied in the institutional context with a view to the aspect of educational inclusion, to the detriment of individual care, which is only carried out in cases for which there is really this need (SILVEIRA, 2019, p. 5).

The Brazilian Society of Neuropsychopedagogy regulates neuropsychopedagogical advice in two areas of activity, the institutional field and the clinical field, "Professional performance in Neuropsychopedagogy occurs in the institutional context in collective and, when necessary, individual care for probing and/or screening aiming at referrals to health professionals; and for individualized care occurs in the clinical context." (SBNPp, 2014, p. 1)

In this line of thought, Santos 2020, lists that the neuropsychopedagogue acts as a fundamental piece in the implementation of humanizing and meaningful Inclusive Special Education, renewing links between school, family and student, and through stimuli such as selecting, memorizing, storing and evoking information, the brain becomes a learner and transforms information into meaningful knowledge. For the author, the neuropsychopedagogue must intervene in a positive way, using neuropsychopedagogical methods and strategies with the contribution of neuroscience seeking to mitigate learning deficits.

As research and knowledge of neurosciences focused on education grows, the search for solutions for the learning of students with learning difficulties, those considered lost cases and who for some time were excluded for not learning, intensifies. The role of the neuropsychopedagogue is of fundamental importance in the academic life of these learners, assisting in the investigation of difficulties and seeking the necessary referrals to solve difficulties and school failure.

The neuropsychopedagogue plays a fundamental role in the area of education and in the development of children, adolescents and adults. Its importance lies in its ability to

understand and intervene in issues related to learning and cognitive development, considering both neurological and psychopedagogical aspects. The Diagnostic Evaluation in which the neuropsychopedagogue performs diagnostic evaluations to identify possible learning difficulties, neuropsychological disorders, cognitive deficits and other problems that may affect academic performance.

Personalized intervention based on assessment is also used, the neuropsychopedagogue develops personalized intervention strategies and plans to help individuals overcome their difficulties and reach their maximum potential in learning. Identification of learning disorders is especially important in the early identification of learning disorders, such as dyslexia, dyscalculia and ADHD (Attention Deficit Hyperactivity Disorder), allowing for early and appropriate interventions.

Guidance to educators The neuropsychopedagogue works closely with teachers and other education professionals, providing guidance on teaching methods, curricular adaptations, and pedagogical strategies that meet the individual needs of students. Promotion of cognitive development: In addition to helping overcome learning difficulties, the neuropsychopedagogue can also develop cognitive stimulation programs to improve skills such as memory, attention, logical reasoning, and socio-emotional skills.

School inclusion, this professional plays a crucial role in promoting the inclusion of students with special needs, ensuring that they have access to quality education and learning opportunities that are appropriate to their individual needs. Emotional support: In addition to the cognitive aspects, the neuropsychopedagogue can also provide emotional and psychological support to students who face difficulties at school, helping to increase their self-esteem and confidence.

Partnering with other professionals often collaborates with other health professionals, such as psychologists, speech pathologists, and occupational therapists, to offer a multidisciplinary and comprehensive approach to learning and development issues. In summary, the neuropsychopedagogue plays an essential role in promoting inclusive and quality education, helping to identify, understand and overcome the barriers that can affect the learning process and development of each individual. Their work contributes to the academic success and emotional well-being of students, providing them with the opportunity to reach their full potential.

THE DIFFICULTIES OF LEARNING MATHEMATICS

Studies show that the human brain is predisposed to learning mathematics, and with this teaching and learning in schools should be facilitated (Rosa 2022), which contradicts being labeled as difficult and considered a "bogeyman" for some people (Andrade 2018).

Thus, the table below shows factors that contribute to learning difficulties and disorders in the acquisition of important learning skills. Among the main factors that contribute to the student's learning difficulties, Garcia (1998, apud, SILVA, et al., 2017) highlights:

Key Factors	
•Low Motivation	• Improper handling of teaching materials and methodologies
•Economic Factors	• Incorrect presentation of stimuli
• Incorrect food in quantity and/or quality	• Inadequate or insufficient reinforcement
• Poor sleep quality	• Inflexible School Curriculum
•Superlotted Rooms	• Problems in the family nucleus

Source: Prepared by the authors (2023)

Regarding mathematics learning difficulties, Masola and Allevato (2019) define as the main teaching and learning difficulties, the lack of motivation of students to learn, the lack of interest in most of the content taught; traditionalist methodological approaches to the approach to contents; and difficulties in associating mathematical content with the studies of other disciplines and with the needs of daily life. In addition to learning difficulties, learning disorders can be highlighted (table below) which are factors that contribute to delays in learning mathematics (DUTRA, 2019).

Learning Disorders	
•Dyscalculia	•Dyslexia
•Dysgraphia	• ADHD

Source: Prepared by the authors (2023)

Regarding dyscalculia, ROSA (2022, p. 184) states that,

> It is a lifelong disorder that can be diagnosed at almost any age, but it is usually first recognized in childhood. As with other learning disabilities, dyscalculia is not treated with medication. Instead, specialized learning strategies and strategic accommodations are used to help children and adults with the condition compensate for difficulties and approach mathematics with confidence.

Still on dyscalculia, Silva (2022) argues that it cannot be considered a disease or a chronic condition, it must be [7] as a learning difficulty that through pedagogical interventions overcomes learning deficits. The teacher has a fundamental role in the investigation of

difficulties, distinguishing lack of interest and learning difficulties in order to make the necessary referrals.

Dutra, (2019) highlights that ADHD is characterized by inattention, agitation and impulsivity, symptoms that interfere with the learning of mathematics, as it requires concentration, learning difficulties are accentuated for these students. Regarding dyslexia, the author points out that some dyslexic students have problems with arithmetic and other aspects of mathematics, have difficulties solving simple calculations such as addition, subtraction, multiplication, division and multiplication tables.

Dysgraphia is a difficulty in the motor act of writing, it is characterized by illegible handwriting and difficult to understand, the child finds it difficult to write letters, words, numbers and symbols (Cordeiro, 2018).

Dyslexia has a neurobiological origin and affects learning, reading and writing, the dyslexic child has a slow learning pace compared to the rest of his peers, they may have difficulties with mathematics, assimilation of symbols and memorizing the multiplication table (Coelho, 2012).

NEUROPSYCHOPEDAGOGICAL INTERVENTION IN MATHEMATICAL LEARNING DIFFICULTIES

Learning math is considered difficult for some people, creating blockages that they can follow during school or throughout their lives. This problem has an aggravating factor when learners have a learning disorder, since they tend to leave the classroom pattern.

Rosa (2022) points out that the diagnosis of dyscalculia can be at any age and there is no single test, diagnostic assessments are used that test mathematical skills with scores based on school age and year and anamnesis is carried out to collect fundamental data on the learner's history.

For Caetano 2021, the neuropsychopedagogical intervention is didactic and playful, with the objective of improving learning, the neuropsychopedagogy professional cannot, under any circumstances, advise on medication. The same happens with the treatment of dyscalculia "there is no cure and cannot be treated with medication, it is necessary to monitor these students and, if necessary, a set of Neuropsychopedagogical evaluations," (ROSA 2022, p. 190).

PATHS OF RESEARCH

For the construction of this article, we adopted bibliographic research, which is materialized through reading works already published in printed and digital books and

articles published in periodicals (GIL, 2002). As for the approach, this article is characterized by a qualitative nature, seeking to reflect on works on "The Learning Difficulties of Mathematics and the Role of the Neuropsychopedagogue".

In this perspective, to carry out this article, we chose to search for the theme studied in the Google Scholar and Scielo databases, due to the credibility and the number of works deposited there, delimiting the period of the last 10 years, which correspond to 2013 to 2023, through the following descriptors "mathematics difficulty", "mathematical learning difficulty", "mathematics and the role of the neuropsychopedagogue", which are key terms related to the theme of this research. The filter followed the following procedures: I – the papers should have the characteristics of an article; II – be written in the Portuguese language; III – that were classified by the relevance of the theme. The search was made in order to provide and motivate the public interested in mathematical difficulties.

Chart 1: Articles found during the Google Scholar search

Title	Keywords	Year	Author
Neuropsychopedagogical Assessment of Mathematical Learning Disorder (Dyscalculia)	Dyscalculia; Learning Disorder; Neuropsychopedagogy; Mathematics Teaching.	2022	Claudionor Alves da Santa Rosa
Contributions of neuroscience and neuropsychopedagogue in the teaching and learning process	Neuroscience; Neuropsychopedagogy; Learning disability	2021	Silvana Ferreira Lima; Meiriane Lopes; Terezinha Sirley
Evaluation of mathematical predictive skills in the early grades of elementary school: an integrative literature review	Mathematical evaluation; Mathematical predictor skills; Neuropsychopedagogy	2021	Edvaldo Alves de Moraes; Fabrício Bruno Cardoso; Lígia Serrano Lopes
Neuroscience and the teaching of mathematics: a literature review	Neuroscience; Neuropsychopedagogy; Mathematics; Apprenticeship	2021	Elias Araújo da Silva Júnior

Source: Prepared by the authors (2023).

RESULTS FOUND

The first article presented in the results, "Neuropsychopedagogical Assessment of Mathematical Learning Disorder (Dyscalculia)", directly corroborates the discussions about mathematics learning disorder. This is a descriptive qualitative explanatory research, and aims to present the process of neuropsychopedagogical assessment to diagnose, treat, monitor and guide academic interventions for the Mathematics learning disorder, dyscalculia.

For the author, the early diagnosis of mathematics learning difficulties avoids problems throughout life, and can "act in a way that develops undeveloped parts of the brain to raise the level of learning of these individuals at all stages of teaching and learning." (ROSA 2022, p. 182) The author also points out that it is necessary to monitor

students with dyscalculia by professionals such as neuropsychopedagogue, psychopedagogue, neuropsychiatrist, neurologist, neuropediatrician, speech therapist, pediatrician, psychologist. For confirmation of Dyscalculia or other learning disorders.

The article "Contributions of neuroscience and the neuropsychopedagogue in the teaching and learning process" is a study in which the authors bring the important role of the neuropsychopedagogue combined with the knowledge of neuroscience, aims to present the contributions of the neuropsychopedagogue combined with teaching practices, the authors made a case study with an elementary school child in which they analyzed difficulties in reading and writing. And they concluded that the student was not within the expected standards for his age group.

For the authors, the lack of adequate stimuli for maturational and educational development resulted in "impairment in language, speech and specific learning in mathematics, suggestive of Dysphasia, Dyslalia and dyscalculia, as well as delay in cognitive development," (Lima; Lee; Sirley, 2021).

Another article found is "Evaluation of mathematical predictive skills in the early grades of elementary school: an integrative literature review", the study aimed to analyze from the integrative literature review the screening and evaluation instruments about the predictive or essential mathematical skills to be developed in the Initial Grades of Elementary School.

The results showed "the presence of studies that emphasize and prove the existence of difficulties in the mathematical learning of students in the Initial Grades of EF, without details regarding the instruments validated for the necessary intervention" (Morais; Cardoso; Lopes, 2021).

The work "Neuroscience and the teaching of mathematics: a bibliographic review" is an exploratory study of literature review based on research of bibliographic sources, aims to analyze the main teaching strategies based on neuroscience, contributing to a deeper learning in mathematical language by students.

For the construction of the work, the following steps were developed:

> neuroscience and cognitive neuroscience were conceptualized; the connection between neuroscience and the learning process of an individual was presented, especially in the area of mathematics; The main theories of learning were exposed and among these, the one with the greatest link with teaching strategies based on neuroscience was highlighted. (Júnior 2021, p. 46).

Thus, when analyzing the articles, we understand, based on the reflections enhanced by the authors of the four studies, that neuroscience combined with education has contributed to the improvement of mathematics learning difficulties and learning

disorders, as well as the importance of referral to professionals who confirm the disorders, as well as early diagnosis that avoids delays and even greater failures.

In view of all this presented so far, we observe that both studies reinforce the discussions about the importance of mathematics and professional intervention in solving difficulties, showing how relevant research in this area is.

FINAL CONSIDERATIONS

Understanding and addressing learning disabilities in mathematics is of utmost importance to ensure that students have an inclusive and quality education. In summary, demystifying the mathematics deficit and supporting students with learning disabilities requires a comprehensive approach that involves teacher training, differentiated teaching strategies, individualized support, and an inclusive mindset. It is essential to recognize that each student is unique and may need specific approaches to succeed in mathematics and other academic fields.

In this sense, it is necessary to demystify the deficit in mathematics and professionals to identify learning difficulties and learning disorders to mediate in the process of seeking learning in the best way. Discussions in this area are essential to update society on solutions to the difficulties in learning mathematics that is so necessary in daily activities.

Thus, we consider it important that the teacher is attentive to investigate the reason for non-learning, and thus seek the necessary referrals. Finally, we add that it is necessary that there is more research published on the learning difficulties of Mathematics, as it is essential for us to understand what the learning difficulties are and the ways to overcome these gaps and so that Mathematics stops being considered difficult and learners can take a liking to the knowledge focused on this area, demystifying the ideas that Mathematics is difficult to learn.

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EVALUATION OF THE MEDICAL INTERN'S KNOWLEDGE OF VISCERAL LEISHMANIASIS

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ABSTRACT

Leishmaniasis belongs to a group of diseases that are still considered public health problems in many countries, this is due to the high global mortality, still very present in the main epidemiological indicators. In Brazil, it is caused by the protozoan Leishmania infantum chagasi and transmitted by sandflies, with the dog being considered the main source of infection in the urban environment, and man the accidental host. It is a serious disease with few therapeutic options and, even when properly treated, has a lethality of about 5%. The state of Mato Grosso do Sul and the city of Campo Grande have suffered, in recent years, environmental changes that may have contributed to the spread of the vector, such as the construction of a gas pipeline, the destruction of areas of the cerrado, as well as the opening of avenues following the watercourses and the felling of vegetation for the construction of popular houses. In view of these changes in the city and the proportion that Visceral Leishmaniasis is gaining, this study sought to understand the knowledge of medical students, in the internship stage, in the city of Campo Grande – MS. This is a quantitative, descriptive cross-sectional study. The sample was by convenience, and 100% of the students were approached during the sessions. The results point to regular knowledge of the students in the internship modality. It is expected that the student reflects on his knowledge about this disease, considering the importance of epidemiology for assertive conduct.

Keywords: Visceral leishmaniasis. Primary care. Collective health. Medicine. Knowledge.

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INTRODUCTION

The initial description of the VL parasite was made in India by William Boog Leishman, however, this was confused with Trypanosoma. Indian doctors in the small town of Dum-Dum (India), hence "dum-dum" fever, used the Sanic term "kala azar" (black disease) to name a severe and fatal disease that they believed to be caused by trypanosomes (WHO, 2011).

Also according to WHO (2011), in 1908, in Tunisia, amastigote forms were identified in domestic canids, demonstrating that they were also the intermediate hosts. It was only in 1914, in India, that it was proven that the areas of incidence of the disease coincided with the areas of concentration of sandflies.

In South America, the first case of human VL was reported by Migone, in 1913, in Paraguay, in a patient who had contracted the disease in the state of Mato Grosso. Between 1936 and 1939, Evandro Chagas carried out studies in Brazil that confirmed that the disease attacks both humans and dogs, and the sandfly Lutzomyia longipalpis was identified as a probable vector (Alencar, 1977).

Studies on the transmission cycle of the disease in Brazil were undertaken primarily in Ceará, culminating in the incrimination of the fox Lycalopex vetulus as the main wild reservoir and, once again, confirming the dog as the most significant domestic host. This is due to the habit of these animals adapting normally to the coexistence of men, thus being able to promote the connection between the wild and domestic cycles of VL (Gontijo and Melo, 2004).

It is estimated that the annual incidence is 500 thousand new cases of visceral leishmaniasis. The average prevalence is about 15 million cases in the world and that approximately 90% of the cases occur in India, Bangladesh, Nepal, Sudan and Brazil, affecting mostly the poor population of these countries (Lindoso and Goto, 2006).

In the Americas, native cases are recorded in Argentina, Bolivia, Colombia, El Salvador, Guatemala, Honduras, Mexico, Paraguay, Venezuela and Brazil, which accounts for 90% of the cases that occur on the continent (Miranda-Sa, 2006).

In Brazil, VL is distributed throughout the Northeast (Maranhão, Bahia and Ceará), Southeast (Minas Gerais, Espírito Santo and São Paulo) and Midwest (Goiás, Mato Grosso and Mato Grosso do Sul) (Lainson and Rangel, 2005).

The profound environmental transformations that have occurred in recent decades, together with socioeconomic factors that have promoted the migration of the rural population to urban centers, have contributed to the occurrence of VL urban cycles, increasing the number of cases (França-Silva et al., 2005). Urbanization is a new element

and little is known about the epidemiology of VL in these foci, recent studies are focusing on the relationship between the components of the transmission chain in the urban cycle, which is more complex and varied than in the rural one (Gontijo and Melo, 2004).

In Brazil, the transmission of Leishmania sp. It takes place in two ways: the vector and a vertebrate host. The vector is represented by dipteran insects, known as sandflies, with Lutzomyia longipapipis as its main representative, although more recently in the State of Mato Grosso do Sul a new vector has been observed, Lutzomyia cruzi (Gontijo and Melo, 2004; Monteiro et al., 2005).

The vertebrate host is represented by wild animals (opossums, primates, rodents, canids); domestic animals (dog, cat, horse) and man (Rey, 2008).

The clinical manifestations of the disease in dogs and humans are similar and present nonspecific signs, such as irregular fever for long periods, anemia, progressive weight loss, apathy and cachexia in its final stage (Feitosa, 2006).

Kala-azar is a generalized and chronic infectious disease. Fever is the most notable symptom, due to its constancy, being of the regular or remitting type. In many cases, the fever curve shows a double daily rise. But there are also subfebrile cases or cases with hyperthermia (40 - 41°C), accompanied by a rapid pulse, pallor and asthenia (Rey, 2008).

Splenomegaly is the second most important manifestation. The volume of the spleen increases relatively quickly, both in children and adults, and can exceed the umbilical scar. Its consistency is hard and, even though it is painless to palpation, it causes a sensation of dull pain due to the distension of its capsule. The enlargement of the liver is usually on a smaller scale than that of the spleen. There is almost always a micropolyadenia. As the disease progresses, anemia is accentuated and there is a marked tendency to hemorrhages. The disease may evolve rapidly, leading the patient to cachexia and death within a few weeks or a few months, or take on a chronic course. The outcome often comes from intercurrent diseases in the body whose immune mechanisms are already definitively compromised (Rey, 2008).

Dermatological changes (alopecia, furfuraceous skin desquamation, seborrheic dermatitis, periorbital pyoderma, nodules that may or may not ulcerate, onychogryphosis), renal failure, gastrointestinal changes such as bloody diarrhea, ophthalmologic changes such as uveitis and glaucoma, and neurological changes such as tetraparesis, seizures, myoclonus, walking in circles, nystagmus, intention tremor, strabismus, jaw paralysis, and lip ptosis are frequent signs (IKeda et al., 2003; Feitosa, 2006).

Dogs also present a wide spectrum of clinical signs, from apparently healthy animals, through oligosymptomatic, to severe stages of the disease (Costa et al., 1999).

The canine clinical picture is characterized by lymphadenomegaly, irregular fever for long periods, anemia, conjunctivitis, progressive weight loss, and cachexia in its final stage. Dermatological changes are frequent and include hair loss, ulcerative lesions, intense itching, opaque skin and seborrheic dermatitis. In some cases, onychogryphosis (abnormal nail growth) is also observed associated with the presence of the parasite stimulating the nail matrix (Feitosa et al., 2000).

Diagnostic suspicion of VL should be based on epidemiological data and clinical and laboratory findings. However, the diagnosis of certainty can only be established through the direct microscopic identification of the parasites in smears obtained by puncture of lymph nodes, spleen and bone marrow, and the cultivation of this material can be used in different culture media to isolate the parasites (Neves, 2003).

THE state of Mato Grosso do Sul is geographically projected in a strategic region for the development of several diseases such as dengue and visceral leishmaniasis. Campo Grande, the capital of this state, suffers intense urbanization and expansion, generating a series of notifications about these pathologies.

Most of the studies related to this theme encompass clinical and diagnostic aspects. However, it is known that early diagnosis and appropriate and timely intervention reduce the chances of worsening this disease.

In view of the current situation of notifications and the intense academic training of physicians, it is important to evaluate the knowledge that these future professionals have about the subject and, thus, provide reflection and corrections based on the findings, contributing in the short and medium term to the formation of this public, as well as, in the long term, to SUS users.

METHODOLOGY

This is a quantitative, descriptive, cross-sectional and epidemiological study. The study was carried out in a private university in the municipality of Campo Grande, which is the capital of Mato Grosso do Sul, with an area of 8,096km², representing 2.26% of the total region of the state, its population is estimated at 766,461 inhabitants.

With the objective of organizing the care network of the municipal health system and ensuring the quality and access of the population to medium and high complexity primary care services, the Municipal Department of Public Health works in a regionalized way, having its territorial area divided according to the aforementioned land division.

Each of these has its own managerial headquarters and is responsible for monitoring and monitoring the health care performance of the units of its own network, in its area of coverage.

100% of the students who study Medicine, in the internship phase, were approached during the clinical discussions. Those on maternity leave and medical certificates were excluded.

Data collection occurred through a questionnaire via *google forms*, with a unified password for the corresponding collection period, prepared by the authors themselves, according to the base literature. The questionnaire was applied by signing the Informed Consent Form (ICF), via *google forms*.

Medical students in the internship phase (9th, 10th, 11th and/or 12th semester) of the aforementioned undergraduate course were surveyed, during the clinical sessions, which take place every Friday. In each clinical discussion, after authorization from the course coordination, the researcher entered the classroom, explaining the importance of the research. He sent the link to the research to the professor coordinating the clinical discussion, who forwarded it to the students at the exact moment and, those who agreed, filled out the questionnaire. The sample was for convenience, excluding those on maternity leave, medical certificate and who refused to sign the Informed Consent Form. Data collection took place individually, via *google forms*. The variables were: etiology, physiology, pathophysiology, epidemiology, clinical picture, diagnosis, differential diagnosis, and management. The methodology implemented by Andrade et al. (2008) was defined as a criterion to classify knowledge as the following concepts:

Insufficient: up to 24% of correct answers;

Regular: 25% to 49% of correct answers;

Good: 50% to 74% of correct answers; and

Great: 75% to 100% correct answers.

The research project was submitted to the coordination of the mentioned course, to the Ethics and Research Committee of Uniderp University, registered under CAAE number: 76992523.3.0000.0199, and opinion No. 6.737.229.

RESULTS

The results listed on the etiology, the 11th semester showed regular knowledge (37%), as well as the 9th semester (46, 12%) and the 12th semester (47.58%). The 10th semester showed good knowledge with 59.82% of correct answers;

Regarding physiology, all semesters presented regular knowledge, considering the 11th, 9th and 12th semesters with 27.16; 29.62% and 39.3%, respectively. While the 10th semester showed 49.1% of learning about this variable;

Regarding the pathophysiology, all semesters presented regular knowledge, considering the 11th, 9th and 12th semesters with 27.18%, 33.8% and 34.78%, respectively. While the 10th semester showed 43.64% of learning about this variable;

With regard to epidemiology, the 10th semester stands out with good knowledge (55.44%) and the others, remains classified as regular;

In the clinical variables, the following measurements are as follows: 11th semester presents regular knowledge about the clinical picture (37.36%), insufficient knowledge about diagnosis (24%), regular knowledge about differential diagnosis (41.14%), as well as treatment (33.96%) and management (41.88%); the 12th semester presents regular knowledge about the clinical picture (42.76%), as well as for diagnosis (35.84%), differential diagnosis (49.66%) and treatment (48.96%). However, the conduct had 65.54% of correct answers, being considered good; the 10th semester presents regular knowledge about the clinical picture (45.47%), as well as diagnosis (29.18%), differential diagnosis (46.28%). While treatment (57.28%) and conduct (73.64%) are considered good; the 9th semester presents regular knowledge about the clinical picture (37.82%), as well as differential diagnosis (34.36%), treatment (44.32%) and management (48.68%). For diagnosis (22.16%), it is considered insufficient.

In the global context, the 11th semester presented regular knowledge, with 33.66% of correct answers, as well as the 9th semester (37.68%) and the 12th semester (44.44%). The knowledge was attributed as good, in the 10th semester, as it obtained 51.09% of correct answers.

DISCUSSION

The improvement of VL control strategies has been carried out based on evidence found in the scientific literature and correcting operational flaws such as the lack of standardization of diagnostic methods for human and canine infection; the disagreement between studies that evaluate the impact of eliminating seropositive dogs on the prevalence of human infection; the demonstration that other reservoirs may be a source of L. *chagasi* infection, such as wild canids and marsupials; and the scarcity of studies on the impact of control actions directed against vectors (Gontijo and Melo, 2004), which is directly related to the urbanization process.

However, the control of this problem is not limited to technical knowledge, only the organization of the team's work process needs to be based on knowledge about the population's health problems, risk areas, social equipment, epidemiological situation, and other aspects related to the determinants and conditions of the health and disease process, in addition to comprehensive care, that actually meets the needs of the population, and this depends on the mastery that the team has over the territory and its peculiarities (Neta and Vasconcelos, 2020), including the medical professional.

The physician will be all the more useful the greater his knowledge about diseases as a whole (etiology, pathophysiology, pathogenesis, clinical manifestations, diagnosis, treatment and prognosis). If its culture covers a large number of diseases, it will be more competent and accurate in the clinical cases under its responsibility (Teixeira and Dantas, 1997).

The same authors also describe that the physician's perception of the disease is not homogeneous - and this depends in part on his professional training. If it is purely organicist, it will be able to recognize the disease from the concrete analysis of the data at its disposal. If he does not recognize it immediately, he will continue the investigation for a variable time, requesting complementary tests or opinions from other doctors, until a diagnosis compatible with the clinical condition in question emerges and that is - or will be - known to him (therefore, medical culture is fundamental).

The extreme specialization of the professionals who deal with these tropical diseases seems to have as a counterpart, with rare exceptions, an inability to perceive the problem holistically, as did the multivalent generation of Samuel Pessoa, Leônidas Deane and Joaquim Alencar, much more sensitive to the social and environmental determinants of leishmaniasis and other endemic diseases. And this is because disease is also a cultural event that depends on categories of thought and verbal constructs specific to a generation, which reflect the history of the medical field and the society that encompasses it (Benchimol et al, 2019).

The transformative debate can and should include all the actors involved in the problem, with strong participation of organized civil society and still that not represented by the traditional organizations that deal with the subject, to improve the panorama of acceptability and feasibility of any action that may be proposed. In this sense, it will be a priority to harmoniously value the practice of public health based on scientific evidence, which takes into account the participation of the affected communities in a constructive process of horizontalization of relationships, which allows progress in the construction of an increasingly participatory, plural and effective health system (Romero, 2016), in this sense,

cognitive knowledge, that sustains clinical practice, should be reinforced in undergraduate studies, collaborating with the reduction of underreporting and the expansion of the understanding of the dynamics of the disease.

In the latest National Curriculum Guideline for Medical Courses (2014), among the competencies and skills to be developed during graduation, health care highlights that such a professional must master basic scientific knowledge of the biopsychosocio-environmental nature and have critical reasoning in the interpretation of data, in the identification of the nature of problems and their resolution, in addition to correctly diagnosing and treating the main diseases of the human being in all phases of the cycle biological criteria, having as criteria the prevalence and morbid potential of diseases, as well as the efficacy of medical action, with generalist, humanistic, critical and reflective training. This professional must be able to act, based on ethical principles, in the health-disease process at its different levels of care.

CONCLUSIONS

It is concluded that there is a need to promote content that supports clinical-epidemiological diagnoses, since in Brazil, several municipalities have difficulties in responding quickly to laboratory tests. Clinical diagnosis is only possible through sanitary practice, adequate epidemiological investigation, situational diagnosis (as it contributes to the understanding of local endemicity) and symptomatological knowledge.

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THE EVOLUTION OF BURN TREATMENT: AN ANALYSIS OF SKIN GRAFTS AND THEIR ALTERNATIVES

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ABSTRACT

This article analyzes the evolution of burn treatment, focusing on skin grafts and their therapeutic alternatives. Burns, which can be caused by heat, chemicals, or electricity, cause significant damage to the skin and underlying tissues, often requiring surgical interventions such as skin grafting to promote healing and prevent complications. The research points out that autologous grafts and allografts improve recovery, with emphasis on the use of Nile tilapia skin as a promising alternative in superficial burns. In addition, the study addresses the impact of burns on skin sensitivity and quality of life in patients. The article also explores innovations such as dermal regeneration matrices (DRM) and the use of biological dressings, aiming to reduce costs and improve therapeutic outcomes. The systematic review, based on studies published between 2019 and 2023, provides a comprehensive overview of current clinical practices, identifying factors that influence graft success and potential complications. It is concluded that the treatment of burns must be holistic, integrating clinical and psychological care to ensure an effective and satisfactory recovery.

Keywords: Burns. Skin grafts. Quality of life. Therapeutic innovations.

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INTRODUCTION

Burns are skin injuries resulting from a variety of agents, including heat, chemicals, and electricity, causing damage that can compromise not only the skin but also the underlying tissues. According to the Brazilian Society of Burns, this tissue injury triggers intense suffering, reflected in the pain that persists in all phases of the trauma (Brazilian Society of Burns, 2020). Proper management of burns, especially second- and third-degree burns, often requires surgical interventions, such as skin grafting, which is crucial to promote wound closure and minimize associated complications.

Skin grafts are used to restore skin integrity, prevent infections, and reduce fluid loss. Studies show that the application of grafts, whether autografts or allografts, not only improves healing, but also decreases the length of hospital stay and improves the quality of life of patients (Xavier et al., 2023). The severity of burns, often associated with thermal agents such as direct flame and scalding, contributes to the depth of the lesions, leading to a greater need for grafts. Data indicate that approximately 38.04% of burns in studied populations are classified as major burns, with an average of 13% of body surface affected (Xavier et al., 2023).

Recently, alternatives to conventional grafts have been explored, such as the use of xenografts derived from the skin of Nile tilapia (*Oreochromis niloticus*). Studies have shown that this biomaterial has good adherence to the wound bed and satisfactory results compared to human skin in histological and biomechanical analyses (Miranda & Brandt, 2023). These xenografts offer a promising option for treating superficial burns and may aid in reducing the costs associated with treatment.

In addition, burns can cause significant changes in skin sensitivity, as nerve endings are often damaged. This can lead to an interruption in the sensory pathway, negatively impacting patients' quality of life (Lima et al., 2023). Assessing sensitivity in skin graft areas is therefore critical to understanding the long-term repercussions of injury and treatment.

In view of this scenario, this review article aims to compile and analyze the current literature on the use of skin grafts in burn patients, addressing their failure rates, factors that influence the success of the procedures, and new therapeutic alternatives. It is hoped that this analysis will contribute to a better understanding of the alternatives in skin grafts, based on the principles of the therapy used.

OBJECTIVES

GENERAL OBJECTIVE

To analyze and compare different approaches in the treatment of burns, with emphasis on the use of skin grafts, biological dressings, and dermal regeneration matrices (DRM), in order to identify the factors that influence therapeutic success, such as healing rate, pain control, infections, and graft adhesion.

SPECIFIC OBJECTIVES

2.1. To evaluate the failure rate of skin grafts and the factors that influence their adherence in burn patients, considering aspects such as infections, exudate, and serum albumin levels.

2.2. To analyze the efficacy of the use of dermal regeneration matrices (DRM) in the treatment of major burns in pediatric and adult patients, noting their contribution to future graft integration.

2.3. To compare the use of Nile tilapia skin with Aquacel Ag® hydrofiber with silver dressing in the treatment of 2nd degree burns, focusing on healing time, pain control and the need for dressing replacement.

2.4. To investigate the incidence of infections and other postoperative complications in patients undergoing grafting procedures and the use of biological dressings.

2.5. To explore the clinical applicability and long-term outcomes of innovative burn treatment techniques, such as the use of biological dressings based on aquatic materials.

2.6. To analyze the contribution of the use of dermal regeneration matrices and biological dressings to the reduction of mortality in patients with extensive burn areas and restriction of skin donor areas.

2.7. Evaluate changes in skin sensitivity, as well as impacts on quality of life, encompassing social stigmas.

METHODOLOGY

This is a Systematic Review that aims to analyze and compare skin graft procedures in patients with second- and third-degree burns, focusing on outcomes related to healing time, complications, and aesthetic results. This review seeks to consolidate recent evidence available in the literature, interpreting the data in a rigorous and systematic way.

The search for studies was carried out in the Virtual Health Library (VHL) database, covering works in Portuguese published between 2019 and 2023. To ensure the relevance

of the results, the descriptors "Burn" AND "Skin Transplantation" AND "Skin" were used, according to the DeCS (Health Sciences Descriptors) controlled vocabulary, applying the Main Subject "Skin Transplantation".

Six studies were found, two of which were discarded because they addressed skin transplantation exclusively in wild animals, so four studies were used in this review, one Case Report, one Clinical Study, one Prospective Cohort Study and one Cross-Sectional Study with convenience sample.

The inclusion criteria were rigorously established to select only original studies involving human patients of any age with second- and third-degree burns undergoing the skin graft procedure.

The data collection process took place in two stages. In the first stage, the titles and abstracts of the articles were screened to exclude those that did not meet the inclusion criteria. In the second stage, the selected articles were read in full, with the aim of extracting detailed information on the main outcomes, such as healing time, associated complications, and aesthetic results observed in the patients.

Data analysis was conducted using a qualitative approach, with the identification of recurring themes and variations in skin grafting techniques, as well as their implications for outcomes, correlating data and common goals discussed in the studies.

This systematic review provides a comprehensive analysis of the efficacy of skin grafting in second- and third-degree burns, highlighting not only objective outcomes but also patient experiences and challenges faced in clinical practice. The systematic approach made it possible to understand the factors that influence the success of the procedure, highlighting the importance of a careful analysis of the available evidence.

DISCUSSION

INTRODUCTION TO THE USE OF GRAFTS IN BURN PATIENTS

The use of skin grafts is a fundamental method in the treatment of burns, especially in third-degree lesions that compromise the entirety of the skin layers. The main function of the graft is to promote the coverage and healing of exposed areas, helping in the recovery and protection of injuries, in addition to preventing complications such as infections and loss of body fluids (MIRANDA; BRANDT, 2019). There are different types of grafts used in clinical practice, including autologous grafts (the patient's own skin), allogeneic grafts (from a donor), and xenografts (from other species). Each type has specific advantages and limitations, according to the patient's condition and the severity of the burn (XAVIER et al., 2023).

Overview of Burns and Morbidity Rates

Burns are one of the main causes of morbidity and mortality in hospital settings, representing a significant demand for medical resources, especially in cases of deep burns that require surgical interventions, such as skin grafts, to facilitate tissue regeneration and minimize complications (GUIMARÃES et al., 2019). Data indicate that patients classified as major burns have prolonged hospitalization rates, with a median of 30.5 days, reflecting the complexity and severity of the treatment (XAVIER et al., 2023).

These patients, due to the extent and depth of the burns, usually require multiple surgical procedures, including an average of 5.5 debridements before grafting, which contributes to increased hospitalization time and the risk of complications (XAVIER et al., 2023). In addition, the socioeconomic impact of these injuries is high, with costs associated with prolonged hospital treatment and patient rehabilitation (MIRANDA; BRANDT, 2019). Studies show that, in situations of severe burns, the length of hospital stay can vary between 24 and 47.5 days, depending on the extent of the injury and the response to treatment, indicating the severity and challenges faced during the management of these cases (XAVIER et al., 2023).

Factors Affecting Graft Success

The success of skin grafts depends on a number of factors, both local and systemic. Wound bed preparation is a key aspect, as the presence of infections, exudate, or necrosis can prevent proper adherence of the graft to the recipient bed. Patients who have infections, especially by multidrug-resistant microorganisms, are at higher risk of graft failure (XAVIER et al., 2023). In addition, nutritional factors such as hypoalbuminemia and the presence of exudate play a crucial role in wound healing and graft success (GUIMARÃES et al., 2019).

TYPES OF GRAFTS USED IN BURN PATIENTS

Treatment of severe burns often involves the use of skin grafts, which can be classified into autologous, xenografts, and dermal substitutes. Each of these types has distinct characteristics, with advantages and disadvantages that directly affect the healing process and the recovery of patients.

Autologous Grafts (patient's own skin):

Autologous grafts are considered the gold standard in the treatment of burns, as they use the patient's own skin as grafting material. This approach has significant advantages,

such as a lower probability of rejection and infection, since the tissue is compatible with the patient's body (LIMA et al., 2020). However, in patients with extensive burns, there may be a limitation in the available donor areas, which represents a significant challenge (XAVIER et al., 2023).

In addition, donor areas often behave like new wounds, which can result in intense pain and additional complications during the healing process (GUIMARÃES et al., 2019). This can impact the patient's overall recovery, increasing the length of hospital stay and the need for additional interventions. The study by Lima et al. (2020) highlights the importance of proper wound bed preparation and care of donor areas to optimize autologous graft outcomes and minimize complications.

Xenografts (such as the use of Tilápia skin):

Xenografts, such as tilapia skin, emerge as a promising alternative in the treatment of burns. Miranda and Brandt (2019) emphasize the role of tilapia skin as an effective biological dressing, presenting advantages such as: good adherence to the wound bed and the ability to promote healing. This type of graft has been shown to be advantageous in preventing graft loss, especially when compared to traditional synthetic dressings, such as hydrofiber with silver (Aquacel AG)® (MIRANDA; BRANDT, 2019).

In addition, xenografts offer the advantage of being widely available and less invasive, as they do not require the removal of skin from the patient. This is especially relevant for patients with large burns who do not have adequate donor areas. The use of tilapia skin is supported by studies that demonstrate its effectiveness in reducing pain and the number of dressing changes, contributing to a less traumatic and more efficient treatment (MIRANDA; BRANDT, 2019).

Dermal Substitutes (such as MatriDerm®):

Dermal substitutes, such as MatriDerm®, play an essential role in the treatment of extensive burns, especially in patients who require multiple debridement procedures prior to grafting. Guimarães et al. (2019) discuss the benefits of using dermal matrices, which provide a support structure for tissue regeneration, allowing for faster and more effective healing. These surrogates act as a viable alternative when donor skin areas are limited or compromised.

In addition, the use of dermal substitutes can significantly reduce graft failure, facilitating the integration of subsequent autologous grafts. Studies show that the application of MatriDerm® results in better results in terms of healing and a lower incidence

of complications, such as infections and graft necrosis (GUIMARÃES et al., 2019). This emphasizes the importance of considering dermal substitutes as a key part of the therapeutic arsenal available for the treatment of severe burns.

FACTORS RELATED TO GRAFT SUCCESS AND FAILURE

Clinical Factors

Hypoalbuminemia is one of the most significant clinical factors influencing the success of skin grafts. Studies indicate that patients with altered serum albumin levels have a significantly higher rate of graft failure. Albumin is crucial for the maintenance of oncotic pressure and for the appropriate inflammatory response; thus, its deficiency can compromise healing and increase the risk of complications, including graft failure (XAVIER et al., 2023).

Another relevant factor is the presence of exudate. Patients who have moderate or large amounts of exudate have a high frequency of graft failure. Purulent exudate, in particular, is associated with serious complications, as it indicates a possible infection that prevents adherence and proper integration of the graft to the recipient bed. The literature points out that the reduction of exudate is crucial for the success of the graft, since the presence of this fluid can hinder revascularization and healing (XAVIER et al., 2023).

The presence of bleeding at the graft site is also a critical factor that can lead to the failure of the procedure. When bleeding occurs, hematomas may form, which prevents efficient graft revascularization and, consequently, its adhesion to the wound bed. The analysis shows that the presence of bleeding increases the probability of graft failure by five times, underscoring the importance of proper site management during the procedure (XAVIER et al., 2023).

Aspects of Infection:

Aspects related to infection are critical in the analysis of the factors that impact the success of skin grafts. Infection with multidrug-resistant microorganisms, such as *Klebsiella pneumoniae* and *Acinetobacter*, was significantly associated with graft failure. Data show that patients whose tissue fragment cultures were positive for these pathogens had an elevated risk of graft failure, with an increased chance of up to 2.89 times compared to patients without documented infection (XAVIER et al., 2023).

In particular, colonization by *Klebsiella Pneumoniae Carbapenemase* (KPC) and *Acinetobacter* resulted in a 100% failure rate in the cases analyzed, indicating the severity of infection in these contexts (XAVIER et al., 2023). In addition, the presence of infection

not only compromises graft adhesion but also significantly prolongs the length of hospital stay and increases the need for additional interventions, such as new debridements (LIMA et al., 2020).

TECHNICAL ASPECTS OF SURGICAL PROCEDURES

Number of Debridements:

The number of debridements performed before skin grafting is a technical factor that directly impacts the success of the procedure. Patients who underwent five or more debridements had a success rate of 73.91%, compared to patients who had fewer debridements, whose success rate was only 41.18%. This highlights the relevance of a properly prepared wound bed for graft integration (XAVIER et al., 2023).

This finding reinforces the need for a meticulous approach during the wound bed preparation phase. The data show that when debridement is performed effectively and in sufficient numbers, healing is accelerated, with a median healing time of 21 days, compared to 30.5 days in patients who received fewer interventions. In addition, the rate of complications, such as infections and graft failures, was reduced from 58.82% to 26.09%, highlighting the importance of proper wound preparation (XAVIER et al., 2023).

Graft Type and Removal Site:

The type of graft used and the site of removal are fundamental technical aspects that directly influence the success of grafting. The predominant use of partial grafts, especially in the lower limbs, has been shown to be more effective, with a success rate of 82%, as observed in patients with extensive burns (XAVIER et al., 2023). These grafts are preferred because they are less invasive and provide better adaptation to the wound bed, especially in well-vascularized areas, such as the lower limbs and trunk (LIMA et al., 2020).

On the other hand, total grafts have a higher risk of failure, with a failure rate of up to 58% in places with compromised vascularization, such as joint regions and areas with bone exposure (LIMA et al., 2020). The main cause of this difference in success is the greater thickness of the total graft, which requires a more robust blood supply to ensure its survival. When the recipient bed is unable to provide the necessary vascularization, graft integration is impaired, resulting in a significant increase in complications and the need for surgical reinterventions (XAVIER et al., 2023).

These data suggest that the choice of graft type should be based not only on the extent and depth of the burn, but also on careful evaluation of the recipient site. Partial grafts offer a safer option in well-vascularized areas, while total grafts require greater care

in site selection, due to the increased risk of failure and the need for new procedures for correction.

NUTRITIONAL IMPACT ON GRAFT SUCCESS

Several studies point out that adequate nutritional status plays a crucial role in the success of skin grafting. Patients with major burns, who face a marked hypermetabolic response, have their caloric and protein needs increased, making nutritional support essential to optimize healing. Hypoalbuminemia, common in malnutrition, is associated with a higher rate of graft failure. Early enteral nutrition is often preferred due to its benefits, such as reducing infections and complications, while parenteral nutrition is an alternative in cases where enteral nutrition is not feasible, although it should be carefully monitored due to potential complications. Both nutritional approaches, when applied properly, favor healing and improve clinical outcomes, reducing the risk of failure and length of hospital stay (XAVIER et al., 2023).

Nutritional Status

The nutritional status of the patient is a critical determinant in the success of skin grafts. The diagnosis of malnutrition has been identified as a relevant factor in graft failure, especially in patients with major burns who face a marked hypermetabolic response (XAVIER et al., 2023). This condition leads to an increase in caloric and protein needs, making adequate nutritional support essential to optimize healing.

Studies have shown that hypoalbuminemia, often associated with malnutrition, is correlated with an increase in complication rates and graft failure. Therefore, ensuring a stable and adequate nutritional status can significantly improve the outcomes of surgical procedures and reduce the risk of complications (XAVIER et al., 2023). Thus, assessment of nutritional status should be a priority in the management of burn patients, with nutritional interventions implemented quickly to minimize the negative impact of malnutrition on recovery.

Enteral and Parenteral Nutrition

Enteral and parenteral nutrition is a vital approach to meeting the nutritional needs of burn patients, especially during the initial phase of treatment. The review of studies points out that early nutrition, through enteral interventions, can lead to significant benefits, such as the reduction of infections and graft failures (XAVIER et al., 2023). Enteral nutrition is

preferred whenever possible, as it provides a number of advantages, including maintaining bowel function and modulating the inflammatory response.

In addition, parenteral nutrition may be necessary in cases where enteral nutrition is not feasible. However, its use should be carefully monitored, as it can be associated with complications, such as infections and electrolyte imbalances. The combination of both approaches, when applied early and appropriately, is crucial to promote effective recovery and minimize the risk of graft failure in patients with major burns (XAVIER et al., 2023). This nutritional strategy not only supports wound healing but also contributes to the patient's overall recovery by reducing length of stay and improving clinical outcomes.

POST-GRAFTING OUTCOMES AND QUALITY OF LIFE

The outcomes of skin grafting procedures go beyond simple healing, extending to functional and psychological repercussions that affect patients' lives. Lima et al. (2020) highlight that graft failure, particularly in the upper limbs, is directly associated with poorer functional and sensory recovery, affecting patients' ability to perform daily activities and compromising their independence. In addition, Guimarães et al. (2019) emphasize the importance of considering the psychological complications resulting from grafting failure, which can impact body image and self-esteem, especially when there are visible scars and physical limitations.

The psychological impact discussed by Lima et al. (2020) will also be addressed, who emphasize the relationship between physical complications and the development of conditions such as depression and anxiety, which can lead to social isolation and decreased life satisfaction, highlighting the need for a multidisciplinary approach, as suggested by Miranda and Brandt (2019), that includes psychological support and rehabilitation therapies.

Functional Impact

Graft failure, especially in the upper limbs, is associated with impaired functional and sensory recovery, as highlighted by Lima et al. (2020). Loss of motor function and decreased sensation in the affected areas significantly compromise patients' ability to perform daily tasks such as dressing, eating, and manipulating objects. These physical limitations negatively impact patients' independence, resulting in restrictions on professional life and daily activities. It is also emphasized that patients who face these difficulties report a reduction in self-esteem and in their social interactions, demonstrating the need for

effective clinical management of grafts to minimize complications and promote better functional recovery.

Psychological Complications

In addition to the functional consequences, skin graft failure is strongly associated with psychological complications. Patients who are unsuccessful in grafting may face significant challenges regarding body image and self-perception, especially when they have to deal with visible scars and physical limitations, as described by Lima et al. (2020). These psychological aspects can contribute to the development of disorders such as depression and anxiety, affecting the general well-being of patients and impairing their ability to reintegrate socially and professionally. Negative perception of one's physical condition often results in social isolation and reduced life satisfaction.

According to Guimarães et al. (2019) and Lima et al. (2020), these psychological impacts are described qualitatively as significant, but were not quantitatively measured in the studies reviewed. Although they recognize the importance of these effects, the authors did not apply standardized instruments, such as depression or anxiety scales, to assess the degree of psychological distress of patients. Thus, the relationship between graft failure and psychological problems is discussed based on clinical observations and patient reports, without specific quantitative data that can measure the prevalence of these disorders.

Miranda and Brandt (2019) reinforce the need for a multidisciplinary approach to deal with these complications, recommending psychological support and rehabilitation therapies as essential components of treatment. This integrated approach is seen as key to helping patients accept their new physical conditions and improve their quality of life after the procedure. The inclusion of psychological interventions in the management of burn patients can minimize the adverse impacts of graft failure, promoting a more comprehensive recovery and greater satisfaction with life.

FINAL PERSPECTIVES

Treatment of burns with skin grafts requires a careful approach, including pre-grafting protocols that assess factors such as infection and nutritional status, in order to improve graft integration and reduce complications. In addition, innovations such as negative pressure therapy and advanced biomaterials have shown promising results, optimizing healing and patient recovery, especially in cases with limited donor areas. The combination of these strategies can significantly improve treatment outcomes.

Importance of Pre-Grafting Protocol:

Implementing pre-grafting protocols is critical to increasing the success rate of skin grafts in burn patients. It is suggested that these protocols carefully evaluate risk factors such as infection, nutritional status, and the presence of exudate before grafting (XAVIER et al., 2023). Identifying and mitigating these factors can significantly improve wound bed conditions, increasing the chances of graft integration and minimizing postoperative complications.

Studies indicate that proper assessment of patient conditions, including monitoring of nutritional status and the presence of infections, can lead to timely interventions that optimize treatment outcomes. In addition, the adoption of standardized protocols could promote a more systematic approach to burn management, favoring the health team in decision-making and the implementation of more effective treatment strategies (LIMA et al., 2020).

Innovations in Treatment

The discussion about innovations in the treatment of burns is essential for the evolution of care in the area. The use of emerging therapies, such as negative pressure therapy and new biomaterials, has shown promising results in optimizing burn treatment and improving graft adhesion (GUIMARÃES et al., 2019; XAVIER et al., 2023). Negative pressure therapy, for example, not only promotes healing but also improves graft perfusion, contributing to faster and more effective recovery.

In addition, the development and use of advanced biomaterials, which can offer structural and functional support to grafts, is an area of growing interest in regenerative medicine. These materials have the potential to reduce the failure rate of grafts and improve healing, providing a viable alternative in situations where donor areas are limited (GUIMARÃES et al., 2019). The integration of these new technologies with established clinical practices can result in more effective treatment and better outcomes for burn patients, reinforcing the importance of staying up-to-date on innovations in the field.

FINAL CONSIDERATIONS

The literature review on skin grafts in burn patients highlights the complexity of the challenges faced in this field, with an emphasis on failure rates and associated risk factors, as noted by Xavier et al. and Lima et al. Identifying variables such as burn severity, patient age, and postoperative care is crucial to understanding the underlying causes of complications. In addition, the analysis of sensitivity in grafted areas and its impact on

patients' quality of life emphasizes the need for a holistic approach in treatment, considering not only skin healing but also the emotional and functional well-being of individuals.

In addition to the clinical aspects, it is imperative to consider the biopsychosocial dimension of the patient. Physical pain, aesthetic scarring, and sensitivity in the grafted areas have a profound impact on quality of life, affecting emotional well-being and social reintegration. Thus, psychological support and rehabilitation must be integrated into treatment, ensuring that patients' emotional and social needs are met. This holistic approach can reduce the stigma and anxiety associated with the appearance and functionality of the affected areas.

Research on innovations, such as the use of dermal regeneration matrices and xenografts, also shows promise, suggesting new possibilities to improve clinical outcomes and reduce failure rates. Thus, the effective management of burns must involve a multidisciplinary team, focused on personalized strategies that integrate clinical and psychological aspects, in addition to the use of advanced technologies.

In conclusion, the continuity of research and the improvement of clinical practices are essential to optimize the results in the treatment of burns. Collaboration between healthcare providers and the development of evidence-based protocols are key to providing a more complete and satisfactory recovery for affected patients.

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SLEEP DEPRIVATION AND TEACHER HEALTH: A STUDY ON QUALITY OF LIFE AT WORK

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ABSTRACT

This study investigates the relationship between sleep quality and well-being among public school teachers. Several factors, such as the work environment, stress, and personal conditions, directly affect the health of teachers, with sleep being a central aspect for physical and mental balance. The study reveals that teachers with better sleep quality tend to have a higher perception of quality of life (QoL) and quality of life at work (QWL), while those with poor sleep demonstrate impairments in both aspects. Sleep deprivation affects several aspects of health, increasing vulnerability to diseases, such as mental and cardiovascular disorders, in addition to impairing performance and physical adaptation. The study, conducted in Passo Fundo, Rio Grande do Sul, used logistic regression analysis, showing that stress increases the chances of poor sleep among teachers by 3.32 times. In addition, those who reported good health are more likely to maintain quality sleep. The research reinforces the need for educational policies to reduce teacher stress, promoting the integral health of these professionals who play an essential role in the formation of society.

Keywords: Sleep quality. Teacher stress. Quality of life at work. Mental disorder.

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INTRODUCTION

The World Health Organization (WHO) defined, in 1946, health as a state of complete physical, mental and social well-being and not just the absence of disease or infirmity. As for the definition of quality of life (QoL), the WHO describes it as the "individual's perception of their position in life, in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards, and concerns." In relation to sleep, changes in its quality, quantity, and compliance can occur naturally or pathologically, leading to increased mortality, economic losses, and physical and mental impacts (Amaro; Dumith, 2018).

There may be many divergences in the environment, infrastructure, available resources or even the particular daily life of each institution and each teacher who works in it. However, what becomes the same in each of these realities is the importance of teaching as a career, as a relevant part of the life and health of the individual behind it. According to a study carried out with university professors, it is understood that the teaching career is made by effort and commitment, however some of its peculiarities interfere negatively in aspects related to health, with reflection on the quality of life (QoL) and quality of life at work (QWL) of the professor, such as low sleep quality, reduced number of leisure activities, low physical activity index and poor diet, specifically in sleep quality, both in relation to QoL and QoL. The teachers evaluated who reported having very good sleep had a significantly better perception of QoL and QoL, when compared to those who reported having regular or poor sleep quality, as well as those who said they had good sleep quality, presented a significantly better QoL, when compared to those with regular sleep and poor sleep, and sleep quality and quality of life are closely related (Crepaldi and Carvalhais, 2020; Sanchez *et al*., 2019).

Sleep, essential for organic balance, plays an important role in the body's homeostasis. When this regulation is compromised, mental disorders, decreased immunity, reduced physical performance, and adaptation difficulties arise, which increases the body's vulnerability (Quinhones and Gomes, 2011). Good sleep is essential for a healthy life, so it is possible to avoid the emergence of cardiovascular, endocrine, immunological, psychological and cognitive diseases, in addition to increasing life expectancy (Tworoger *et al*., 2003).

Therefore, it is important to investigate the perception of sleep quality in each individual, regardless of their particularities. However, this analysis is even more relevant when applied to education professionals, especially teachers. It is essential to understand whether these professionals are in good or bad health, taking into account the adequacy of

sleep, in terms of quantity and quality. In addition, it is important to recognize their contribution to the formation of citizens and the daily adversities faced, highlighting the human factor behind the profession and the daily consequences of being an educator in Brazil.

In this sense, the objective is to investigate the perception of sleep quality and sociodemographic characteristics, life habits, working conditions and the health status of teachers.

MATERIALS AND METHODS

This is a cross-sectional, descriptive and observational study, with a quantitative approach, carried out in the municipal and state school system in the city of Passo Fundo - RS.

This study is an excerpt from a research project on the theme "Health assessment of teachers in the public school system". Data collection was carried out from 06/01/2019 to 12/15/2019, through the Google *Forms form.* The project was approved by the Ethics Committee for Research with Human Beings of the UFFS, under opinion No. 3.314.996 (CAAE 11528919.0.0000.5564), carried out in accordance with Resolution 466/2012 of the National Health Council.

The initial contact with the school principals was made by telephone, with the aim of explaining the project in detail. Subsequently, face-to-face visits were made to the institutions. However, in some schools, due to the difficulty in scheduling visits, information about the project was provided by telephone, and both the data collection form and the Informed Consent Form (ICF) were sent by e-mail.

Sample size was calculated based on a 95% confidence level, a study power of 80%, an unexposed/exposed ratio of 2:8, an expected outcome prevalence of 30%, and an expected prevalence among the unexposed of 16.7%. Thus, the necessary number of participants was estimated at 376.

The dependent variable used was "How do you consider the quality of your sleep?", evaluated on a scale of 1 to 5, but categorized in a dichotomous way: (a) perception of poor sleep quality with answers 4 (poor) and 5 (very poor) and (b) perception of good sleep quality with answers 1 (excellent; 2 (good) and 3 (regular). The independent variables considered in the study were gender, age, alcohol consumption, smoking, physical activity, health perception, type 2 diabetes mellitus, systemic arterial hypertension (SAH), stress, anxiety, and depression.

The data collected in the survey were exported to the PSPP software (free version) to perform statistical analysis. Absolute and relative frequency distribution tables were elaborated based on the independent variables. To examine the relationship between the dependent variable and the independent variables, binary logistic regressions were performed, including univariate and multivariate analyses. In these analyses, the *Odds Ratio* (OR), the confidence interval (CI) and the chi-square test (p) were calculated. In all tests, an error α of 5% and a 95% confidence interval (95%CI) were considered, and values of $p < 0.05$ were considered statistically significant.

THEORETICAL FRAMEWORK

QUALITY OF LIFE

According to the World Health Organization (WHOQOL Group, 1995), quality of life is defined as the individual's perception of the degree of satisfaction of their needs and the opportunities to achieve happiness and self-fulfillment, regardless of their physical state or socioeconomic conditions. This concept goes beyond physical health and involves emotional, social, and environmental aspects that directly influence the individual's well-being.

The quality of life of the teacher includes physical health, the balance between work, leisure and social relationships. In this sense, Rea and Parker (2014) highlight that these elements are linked to human development, while Nahas *et al.* (2009) argue that the positive balance between health, job satisfaction, the search for leisure and spirituality are essential for teachers to have a satisfactory quality of life.

According to Machado, Andrade and Gurgel (2023), the quality of life of teachers needs more attention, especially in the domains of social relations, environmental conditions and stress. The reduced levels of satisfaction and care with quality of life show the need to rethink public policies for workers' health and the characteristics of the teaching work.

The literature points out that different neuropsychiatric disorders are observed in elementary school teachers, such as: stress, anxiety, depression and *Burnout* syndrome, due to excessive workload, decreased leisure time and social interaction (Krug *et al.,* 2019). From this perspective, Machado, Andrade, and Gurgel (2023) point out that the quality of life of teachers requires greater attention, especially in the domains of social relations, environmental conditions, and stress levels, which indicates the need to rethink public policies aimed at workers' health and the specific conditions of teaching work. Krug *et al.* (2019) argue that the pressure for results and professional overload negatively affect the mental health of teachers, compromising their quality of life and well-being.

Thus, it is important to understand that the quality of life of teachers is related to working conditions and the school environment. Machado, Andrade, and Gurgel (2023) suggest that the implementation of measures that favor work-life balance, as well as the creation of healthier work environments, can have a positive impact on the quality of life of these professionals.

The quality of life of teachers also concerns the quality of their sleep, since sleepless nights can amplify stress and physical and emotional exhaustion, which impairs their professional performance

SLEEP QUALITY

The quality of sleep plays an important role in maintaining wakefulness and the proper functioning of the body. When sleep is compromised, it can result in cognitive, behavioral, and psychomotor changes, in addition to negatively affecting mood and increasing levels of stress, tiredness, and discouragement, which, in turn, compromises the individual's overall health and quality of life (Kim; Tufik; Andersen, 2017).

Araújo *et al.* (2016) and Vale (2011) converge in highlighting the impact of stress on the quality of teachers' sleep, directly affecting their physical and mental health. Araújo *et al.* (2016) underline that stress creates a vicious cycle that compromises the emotional health of teachers, further aggravating stress levels and impairing their quality of life. Similarly, Vale (2011) emphasizes that stress manifests itself in difficulties falling asleep, sleep interruptions and, in prolonged cases, chronic insomnia, which highlights the need for effective stress management strategies to improve sleep and professional performance. Several factors contribute to the spread of this condition, especially affecting educators, who are among the most affected professionals.

The studies by Santos and Vidal (2017) highlight that stress is one of the main health challenges, severely affecting the teaching class, due to the intense dedication to work, often unrecognized, generating negative effects on the quality of teaching, physical and mental health. Similarly, Tostes *et al.* (2018) point out that the devaluation of the role of the teacher, reduced to an instrument for employability, has emptied the meaning of professional practice, harming their health.

STRESSORS

Cabral (2016) highlights that teaching in Basic Education is influenced by several factors that, together, are essential to ensure quality education and contribute to social development. Among these factors are: the number of students per class, the availability of

pedagogical materials, school infrastructure, teaching methodologies, the presence of laboratories and the appreciation of teaching professionals. Each of these aspects has its own meaning and importance, integrating the scenario of a public school suitable for teaching.

Lucena and Freitas (2020) report that the physical structure of the school plays an important role in the well-being of teachers, as pointed out by 6 out of 10 teachers interviewed, who identified the lack of air conditioning and overcrowding of classrooms as the main stress factors. These aspects make the work environment uncomfortable, with temperatures reaching 40°C, which hinders the ability of teachers to teach their classes effectively, controlling the concentration of students, who are also affected by excessive heat. The authors highlight that the emotional challenges faced by teachers are recurrent behaviors, such as student indiscipline, noise, out-of-turn conversations, name-calling, and lack of respect for colleagues and teachers. Added to this is the lack of commitment of students to their subjects and the absence of responsibility of parents in relation to school demands, which intensifies the emotional overload of educators.

These factors, according to Lucena and Freitas (2020), result in a work environment in constant stress. Teachers often feel devalued and held responsible for not being able to meet the numerous demands imposed on them.

IMPLICATIONS OF STRESS IN THE TEACHING-LEARNING PROCESS

Studies show that the school environment contributes to the emergence of occupational stress in teachers, affecting the teaching-learning process. Webber and Vegani (2010) highlight that the lack of structure, class overload and the fatigue generated by the routine cause dissatisfaction, harming health and teaching performance. The physical and emotional exhaustion generated by this tension can lead to the emergence of depressive conditions and feelings of dissatisfaction with one's own work, as added by Batista *et al*. (2016), this scenario is especially worrisome in the educational context, as teachers under constant stress tend to have a reduced performance in the classroom, which can harm the teaching-learning process.

Work overload, combined with stress, can generate physical and emotional symptoms in teachers, as highlighted by Webber and Vegani (2010). The authors mention that problems in the digestive and circulatory systems, as well as tiredness, fear, anger and anxiety, compromise performance in school activities, making it difficult to maintain a balanced life. Lucena and Freitas (2020) add that stress negatively affects teaching and learning, making teachers less effective in the classroom.

STRESS COPING STRATEGIES (COPING)

According to the approach of Folkman and Lazarus (1980), the coping process involves four main characteristics: the constant interaction between the individual and his environment; the focus on managing the stressful situation rather than mastering it; the evaluation of the situation to cognitively interpret and represent its impact on the individual's life; and the mobilization of efforts through cognitive and behavioral actions to manage the internal or external demands that arise in this interaction. Ryan-Wenger (1992) emphasizes that coping strategies are intentional and conscious actions that can be acquired, applied, and abandoned as needed, with the primary goal of working with perceived stress.

In conclusion, it is important to emphasize that the quality of life of teachers is related to their physical, mental and emotional health. When teachers experience high levels of stress and a lack of restful sleep, their emotional and physical capacities are impaired, interfering with the quality of education offered to students.

RESULTS

From the sample data, composed of 225 teachers, 91.1% are female, and 64.4% were in the age group of 31 to 50 years. It was found that 71.1% of the teachers consumed alcoholic beverages occasionally, while the majority (86.7%) stated that they did not smoke. Regarding physical activity, 44.4% practiced it occasionally and 18.2% performed it frequently. With regard to sleep quality, 48.4% of the teachers reported having poor sleep, while 51.6% considered their sleep to be of good quality.

Regarding self-reported health status, 56% of the professors considered their health to be good, 37.3% classified it as regular and 6.7% indicated poor health. In terms of health conditions, 8% of the professors reported having type 2 diabetes *mellitus*, while 25.9% mentioned systemic arterial hypertension. Regarding mental health, the data revealed that 76.4% of the professors had stress, 31.6% reported depression and 64% indicated suffering from anxiety.

The results of the binary logistic regression, when analyzed in univariate terms, indicated statistically significant associations between the variables stress (p=0.001), depression (p=0.006), anxiety (p=0.005), regular practice of physical activity (p=0.017) and the perception of good health (p=0.001). However, in the multivariate analysis, the final model identified two variables as significant predictors of sleep quality: stress (p=0.002) and the perception of good health (p=0.003).

In the univariate analysis, it was observed that teachers who reported stress were 5.06 times more likely to have poor sleep quality compared to teachers who did not report

stress (OR=5.06, 95% CI 2.44 – 10.48, p=0.000). Teachers with depression were 2.23 times more likely to have poor sleep quality than those who did not suffer from depression (OR=2.23, 95% CI 1.25 – 3.97, p=0.006). Similarly, teachers who reported anxiety were 2.24 times more likely to have poor sleep quality compared to those who did not report anxiety (OR=2.24, 95% CI 1.28 – 3.93, p=0.005). The variables regular (always) (OR=0.39, 95% CI 0.18 – 0.85, p=0.017) and occasional (sometimes) (OR=0.53, 95% CI 0.30 – 0.96, p=0.037), as well as good perception of health (OR=0.03, 95% CI 0.18 – 0.85, p=0.017) and regular perception of health (OR=0.14, 95% CI 0.02 – 1.14, p=0.067) were not shown to be predictors of sleep quality. Both had lower odds of influence, with confidence intervals lower than 1, except for the variable regular health perception, which had a confidence interval higher than 1, which suggests that this variable may not be a determining factor for sleep quality.

In the multivariate model, only the stress variable stood out as a significant predictor of sleep quality. Although the variable perceived health had a significant "p" value (0.014), its confidence interval (95% CI 0.01 – 0.58) lower than 1 suggests that it does not have a clear predictive effect on sleep quality. This indicates that stress is the main influential factor in this context. Based on the adjusted values of the multivariate analysis, teachers who reported stress were 3.32 times more likely to have poor sleep quality compared to those who did not report stress. On the other hand, those who indicated a good perception of health were significantly less likely to experience poor sleep quality when compared to those who rated their health as poor.

DISCUSSION

This study aims to explore the perception of sleep quality among participants, revealing that 48.4% of the sample indicated a poor or regular perception of sleep. Comparatively, in a population-based study, Gajardo *et al.* (2021) identified a lower percentage (14.9%) of the Brazilian population reported difficulties with sleep. In another study carried out at a Federal Institution in Bahia, Freitas *et al.* (2021) found a higher prevalence, with 61.3% of participants reporting poor sleep quality. These variations indicate that the perception of sleep quality is influenced by multiple factors, including the geographic context, for example, in regions with less noise pollution, sleep quality may be better; In areas where the population has better socioeconomic conditions with access to quality health services and lower stress index, the perception of sleep quality can be more positive, among others.

In the present study, no association was found between the variable gender and poor sleep quality, despite the predominance of women in the sample (91.1%). Carvalho (2018) had already observed this trend in basic education teachers, with a slight inclination towards gender balance. In another study, Milagres *et al.* (2014) reported a prevalence of 75.3% of female participants. However, Gajardo *et al.* (2013) identified that poor sleep quality was more common among women, with 45.3% reporting poor or regular sleep.

When analyzing the relationship between sleep quality and age group, no statistically significant differences were found. However, most of the study participants were in the age group of 31 to 50 years, representing 64.4% of the sample. According to Carvalho (2018), there is a trend of aging among teachers, with an increase in the percentage of teachers over 50 years old, which went from 15% in 2009 to 21% in 2017. This data reveals that the pace of renewal of the teaching staff has not kept up with the aging of professionals who are approaching retirement.

The prevalence of alcohol consumption among the professionals in this study was 71.1% (occasional consumption), a value significantly higher than that recorded by Santos and Marques (2013) in a survey with 414 municipal teachers in Bagé/RS, where alcohol consumption of 21.6% was observed. It is noteworthy that approximately half of the teachers who reported consuming alcohol also mentioned having poor or regular sleep quality. This data is supported by the literature, which suggests that frequent alcohol consumption or dependence can increase the frequency of nocturnal awakenings and the time to fall asleep, which ends up reducing total sleep time (Garcia and Salloum, 2015).

Smoking among teachers was low, with only 2.7% reporting being smokers and 10.7% indicating that they were former smokers. These numbers are lower than the estimate of the Vigitel Telephone Surveillance Survey (2019), which points out that 9.8% of the Brazilian population is a smoker (Brasil, 2019). Nicotine, being a caffeine-like stimulant, should be avoided to promote good sleep hygiene (Buysse, 2013). In addition, smoking tends to decrease as the level of education increases, which corroborates the percentages observed in the present study.

The practice of physical activity demonstrated a statistically significant association with sleep quality. Among individuals who exercise regularly, the prevalence of poor or regular sleep was 36.6%, increasing to 44.0% among those who exercise occasionally, and reaching 59.5% among those who do not perform any physical activity. These data indicate that the regular practice of physical activity plays a protective role against poor sleep quality. In addition, those who engage in leisure activities also had less negative impact on sleep quality. Buysse (2013) supports this relationship, stating that regular exercise, especially

when performed at least six hours before bedtime, contributes to adequate sleep hygiene.

In the present study, the variable "perception of health" was statistically significant (p=0.001), indicating a relevant association with sleep quality. Of the teachers evaluated, 44% classified their health as regular, bad or very bad. In comparison, a study conducted by Santana and Peixoto (2016) with professors from a federal university in Minas Gerais revealed that 24.5% of the participants did not consider their health to be good. Similarly, Silva and Silva (2013), in a survey of preschool teachers from the municipal and state schools of Pelotas/RS, found that 18.9% of the teachers did not evaluate their health as good, results lower than those observed in the present study. The data also show that the worse the health assessment, the higher the prevalence of poor sleep. Among faculty members who reported having excellent or good health, only 31% indicated a negative perception of their sleep quality. However, this percentage jumped to 66.7% among those who classified their health as regular, and reached 93.3% among those who considered themselves to be in poor or very poor health.

In the present study, SAH had a prevalence of 25.9% among teachers. In comparison, Mota Junior *et al.* (2020) reported a slightly higher prevalence, with 29.3% of teachers reporting the presence of SAH. On the other hand, the study by Amaro and Dumith (2018), carried out with university professors, recorded a lower prevalence of 17.4%. Despite this, SAH was not associated with the perception of sleep quality, since 41.8% of hypertensive teachers reported poor sleep perception, compared to 49.7% among those without the condition, suggesting that other factors may more significantly influence sleep quality in this population, including excessive workload and occupational stress.

Stress was reported by 76.4% of the teachers in this study, and was identified as a factor associated with the perception of sleep quality (p=0.001). In a study conducted by Zille and Cremonezi (2013) in a state public school system in Belo Horizonte/MG, 69.1% of the teachers interviewed also had some degree of stress. The main sources of stress included the students' indiscipline, low pay, fast pace of life, the need to work on Saturdays, lack of time for personal issues, and the overload of simultaneous activities. Similarly, Silva *et al.* (2018) observed that 58% of teachers suffered from stress, attributing it to violence in schools and excessive workload, with many working two shifts or more.

Teaching, especially in the context of Brazilian public education, has become increasingly challenging, facing difficulties such as precarious infrastructure and episodes of school violence, which contributes to increased stress among educators. These conditions directly affect their physical and mental health, compromising their professional and personal performance. However, it is important to consider the specifics of each work environment to avoid generalizing stress as an inherent condition of all educators. Factors such as the perception that teachers have of their responsibilities, the resources and

working conditions available, the ability to adapt to daily challenges and possible changes in work dynamics are essential to determine whether stress will become a constant part of teaching life (Silveira *et al.,* 2014). This highlights the need for an individual approach.

In this study, depression was identified in 31.6% of the teachers, presenting a statistically significant association with the perception of sleep quality (p=0.008). In the literature, however, the rates vary. In a cross-sectional study with elementary and high school teachers in Londrina/PR, the prevalence of depression was 15.4% (Meier, 2016). In the study by Ferreira-Costa and Pedro-Silva (2019), 30.5% of teachers had some degree of depression, evidencing the high prevalence of adverse emotional conditions among educators. Batterham *et al.* (2012) reinforce this relationship, associating sleep disorders with inflammatory factors, anxiety and depression, which corroborates the relevance of these conditions in the lives of teachers.

In this study, 64% of the teachers reported anxiety, and a statistically significant association was observed between this variable and the perception of regular or poor sleep quality (55.6%, p=0.010). In a survey by Meier (2016), 25.1% of public school teachers had anxiety, and among those with poor sleep, the prevalence reached 75%. Another study with early childhood education teachers, from the early years in public schools in Vale do Paraíba/SP, found that 41.9% of teachers manifested some level of anxiety, impairing their educational action and quality of life (Ferreira-Costa and Pedro-Silva, 2019). Anxiety, present in the daily life of any individual, is exacerbated in dynamic environments such as school, where social interactions and demands are intense. In this context, some level of anxiety is expected, but the challenge is to identify more severe conditions that negatively affect the perception of sleep quality and, consequently, the general well-being of teachers.

In the univariate logistic regression analysis, which compared statistically significant variables in isolation, stress was identified as a significant risk factor for poor sleep quality (OR=5.06, p=0.001). The use of sleep medications was also relevant (OR=3.30, p=0.002). In addition, teachers who reported depression had a considerable increase in the chances of having unsatisfactory sleep quality (OR=2.23, p=0.006), as well as those who reported anxiety (OR=2.24, p=0.005). On the other hand, the practice of physical activity (OR=0.39, p=0.017) and positive health perception (OR=0.03, p=0.001) were associated with a lower probability of reporting poor sleep quality, functioning as protective factors. These findings are in line with the study by Gajardo *et al.* (2021), which also identified sedentary behavior as a contributing factor to poor sleep quality, with a prevalence of 17.1% among sedentary individuals, compared to 14.0% among those who exercised regularly (p<0.01). This

reinforces the importance of healthy habits for maintaining good sleep quality, as well as highlighting the negative impact of emotional and mental health factors.

In the multivariate logistic regression analysis, which simultaneously evaluated the dependent variable "sleep quality" in relation to the independent variables, significant associations with poor sleep quality were identified. Stress was one of the variables that remained significant (OR=2.90, p=0.010), evidencing its negative impact. On the other hand, teachers who reported a good perception of health were significantly less likely to have poor sleep (OR=0.07, p=0.014). After adjusting the model, stress continued to stand out as a predictor of sleep quality, with an increase in the odds of poor sleep (OR=3.32, p=0.002). At the same time, those who reported good health were even less likely to have poor sleep quality (OR=0.05, p=0.003). These results corroborate the findings of Vertanen-Greis *et al.* (2020), who also identified stress at work as a significant factor for poor sleep quality (OR=6.53; 95% CI: 4.31−9.90), highlighting the importance of the work environment and perceived health in the well-being of teachers.

The results of this study suggest that teachers in the public school system are vulnerable to factors that compromise sleep quality, such as excessive demands, high work demands, pressures for results and self-demand. These conditions are aggravated by the expectations imposed by society on the role of teachers, increasing physical and emotional exhaustion, harming the well-being of these professionals.

This study has some limitations that should be considered. First, the minimum number of participants was not reached, which may compromise the robustness of the results. In addition, the self-administered nature of the questionnaire may introduce information biases, affecting the accuracy of the responses. The sample may also not be representative of the entire teaching population, which limits the generalization of the findings. It is essential to highlight the relevance of sleep quality for the physical and mental health of teachers, since these professionals often face a stressful work environment, characterized by high demands and emotional challenges. Therefore, the investigation of the relationship between factors such as stress, mental health and sleep quality should be prioritized in future research, aiming to promote the well-being of educators and improve working conditions in the school environment.

CONCLUSIONS

The sample was predominantly composed of female teachers (91.1%), with a mean age between 31 and 50 years (64.4%). Regarding sleep quality, 51.6% considered their sleep good, while 48.4% reported poor sleep quality.

Logistic regression analysis identified that the main factors associated with sleep quality were stress and perceived health. It was observed that teachers with stress are 3.32 times more likely to report poor sleep. Among the participants, 98 teachers with poor sleep also had elevated levels of stress. On the other hand, teachers who rated their health as good were less likely (OR=0.05) to report poor sleep, with 87 participants in this category.

These findings reinforce the need to intensify the development of educational health policies, with a special focus on mental health. Emotional well-being is fundamental for the quality of life of teachers, and also for their performance in the educational environment and in student learning. Unmanaged stress can severely affect mental balance, causing sleep disturbances, as well as physical and mental fatigue.

Therefore, it is essential for educational institutions to implement psychological support programs and promote self-care initiatives, offering resources that help teachers manage stress and improve perception with mental health. The study indicates the need for interventions, focusing on prevention and improvement of working conditions.

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FORECAST OF VEHICLE PRODUCTION IN BRAZIL USING ZHANG'S HYBRID MODEL

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ABSTRACT

This study presents the application of Zhang's hybrid model to predict vehicle production in Brazil. The model combines wavelets, ARIMA, and LSTM neural network techniques to provide more accurate and robust predictions. The results demonstrate the effectiveness of the proposed model, highlighting its application in planning and decision-making in the automotive sector.

Keywords: Vehicle production. Forecast. Zhang model. Wavelets. ARIMA. LSTM.

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INTRODUCTION

Vehicle production is one of the most important indicators of a country's economic performance, especially in emerging economies like Brazil. Accurately forecasting production volumes is essential to aid in strategic decision-making by businesses and policymakers. This paper applies Zhang's hybrid model, which combines wavelets, ARIMA, and LSTM neural networks, to address this problem innovatively and efficiently.

GENERAL OBJECTIVE

Apply Zhang's hybrid model to predict vehicle production in Brazil.

SPECIFIC OBJECTIVES

- To evaluate the effectiveness of Zhang's hybrid model compared to traditional models.- To demonstrate the integration of wavelets, ARIMA, and LSTM techniques for time series forecasting.
- Provide useful insights for managers and policymakers in the automotive sector.

THEORETICAL FOUNDATION

Zhang's hybrid model integrates the following techniques: wavelet decomposition, ARIMA modeling, and LSTM neural networks. Wavelet decomposition (level 1 to 10 Daubechies) is used to disaggregate the time series into high- and low-frequency components. ARIMA is applied to the low-frequency components, whereas LSTM networks model the high-frequency components. The general equation of the model can be expressed as:

$$Y(t) = W(t) + A(t) + L(t)$$

Where:

Y(t) represents the final forecast,

W(t) is the component modeled by the wavelets,

A(t) is the ARIMA component,

L(t) is the component of the LSTM network.

METHODOLOGY

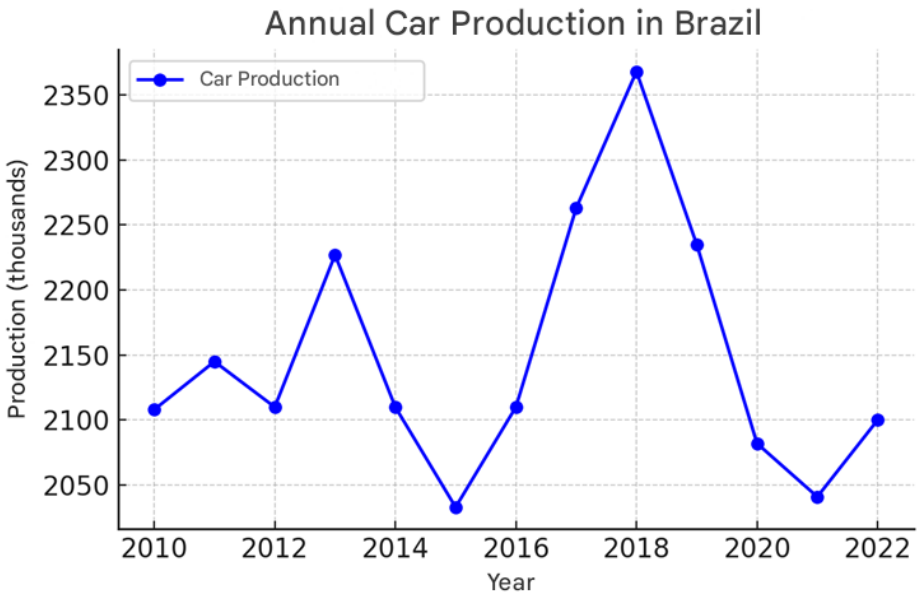
Vehicle production data in Brazil was collected between 2020 and 2022. The methodology followed the following steps:

1. Time series decomposition using wavelets.
2. Modeling of low-frequency components with ARIMA.
3. Modeling of high-frequency components with LSTM networks.
4. Combination of the predictions to obtain the final result.

RESULTS AND DISCUSSION

The results include graphs and tables detailing the predictions and comparison with traditional models.

Figure 1: Annual car production in Brazil between 2010 and 2022.



SECTION 2: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

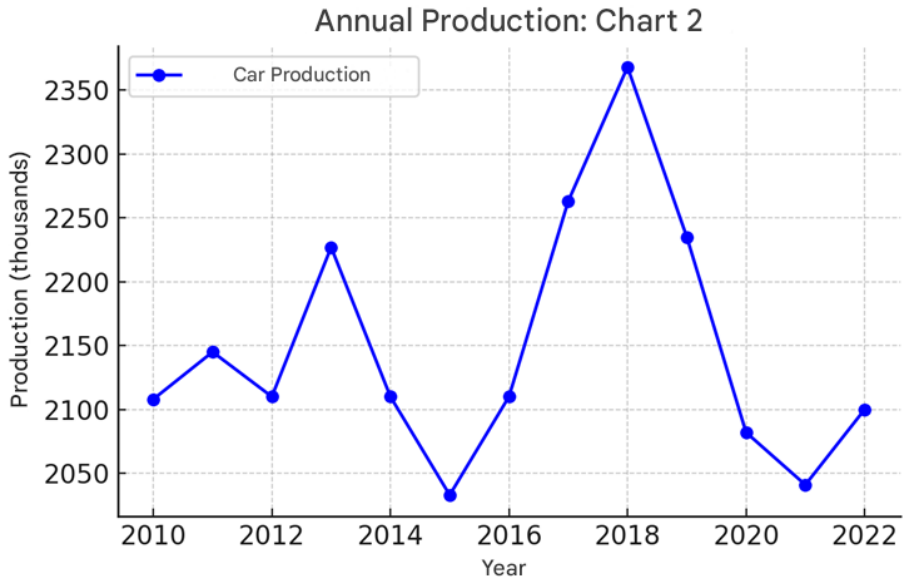
The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t),$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2063
2011	2145	2146
2012	2110	2085
2013	2227	2240
2014	2110	2157
2015	2033	2041
2016	2110	2115
2017	2263	2271
2018	2368	2387
2019	2235	2217
2020	2082	2084
2021	2041	2012
2022	2100	2070

Figure 2: Detailed annual production - Section 2.



SECTION 3: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t),$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2127
2011	2145	2164
2012	2110	2063
2013	2227	2270
2014	2110	2134
2015	2033	2044
2016	2110	2121
2017	2263	2306
2018	2368	2412
2019	2235	2208
2020	2082	2086
2021	2041	1999
2022	2100	2052

SECTION 4: DETAILED ANALYSIS

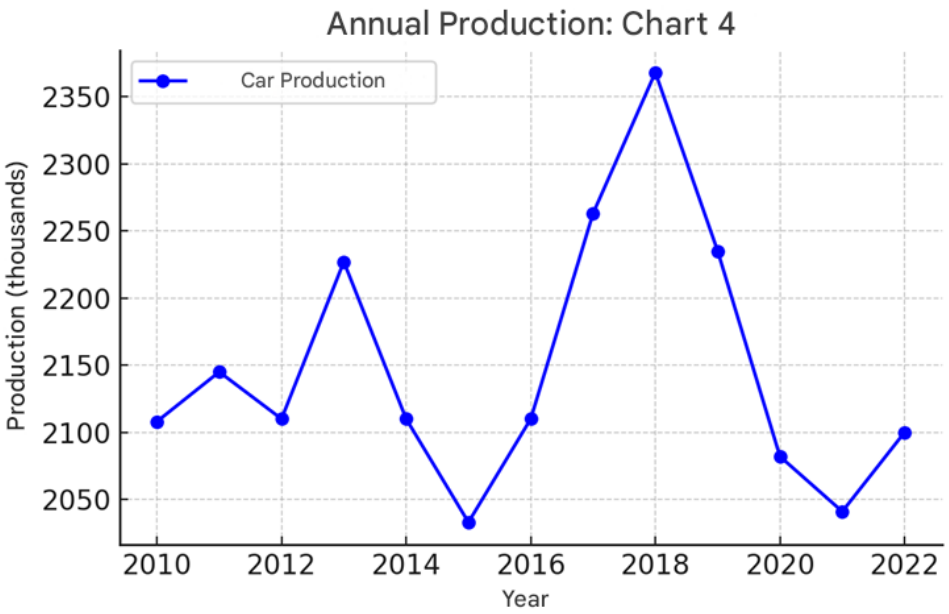
In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil. The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t),$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2088
2011	2145	2134
2012	2110	2095
2013	2227	2200
2014	2110	2154
2015	2033	1988
2016	2110	2125
2017	2263	2296
2018	2368	2409
2019	2235	2259
2020	2082	2035
2021	2041	2069
2022	2100	2055

Figure 4: Detailed annual production - Section 4.



SECTION 5: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t),$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2151
2011	2145	2145
2012	2110	2121
2013	2227	2233
2014	2110	2125
2015	2033	2061
2016	2110	2134
2017	2263	2220
2018	2368	2343
2019	2235	2235
2020	2082	2076
2021	2041	2034
2022	2100	2054

SECTION 6: DETAILED ANALYSIS

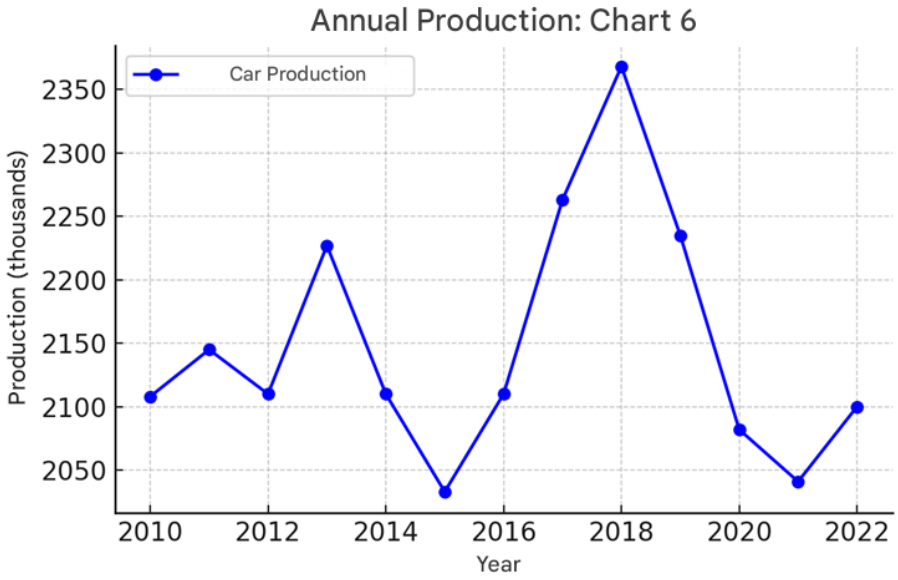
In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil. The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t),$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2127
2011	2145	2120
2012	2110	2127
2013	2227	2195
2014	2110	2143
2015	2033	2079
2016	2110	2079
2017	2263	2224
2018	2368	2364
2019	2235	2185
2020	2082	2121
2021	2041	2004
2022	2100	2113

Figure 6: Detailed annual production - Section 6.



SECTION 7: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil. The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t),$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2095
2011	2145	2131
2012	2110	2070
2013	2227	2276
2014	2110	2136
2015	2033	1985
2016	2110	2092
2017	2263	2218
2018	2368	2367
2019	2235	2194
2020	2082	2036
2021	2041	2013
2022	2100	2059

SECTION 8: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

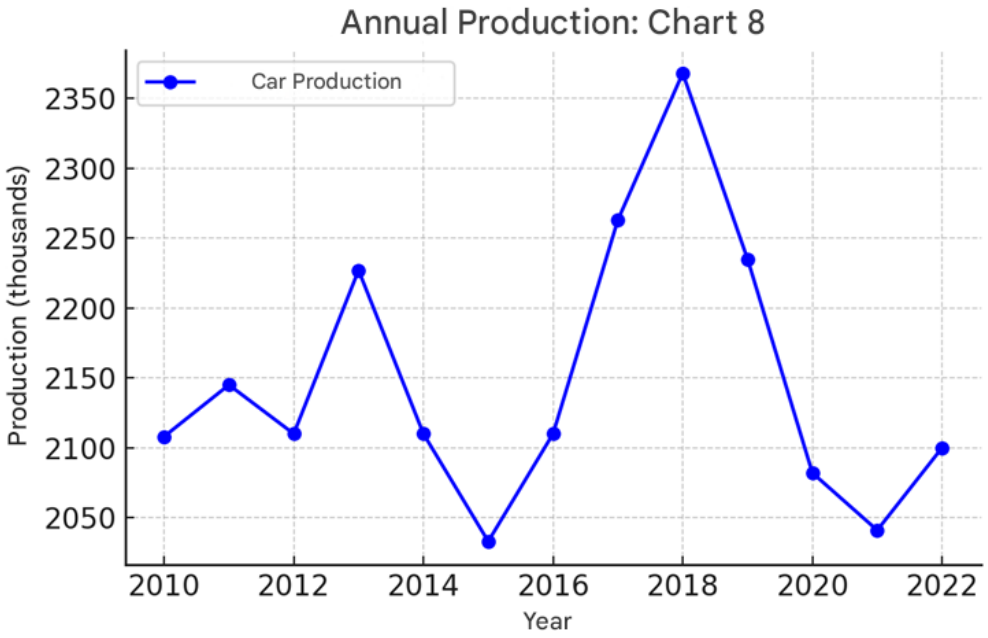
The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t)$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2101
2011	2145	2096
2012	2110	2072
2013	2227	2216
2014	2110	2061
2015	2033	2066
2016	2110	2124
2017	2263	2275
2018	2368	2390
2019	2235	2201
2020	2082	2040
2021	2041	2065
2022	2100	2064

Figure 8: Detailed annual production - Section 8.



SECTION 9: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t)$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2081
2011	2145	2132
2012	2110	2094
2013	2227	2270
2014	2110	2154
2015	2033	2031
2016	2110	2128
2017	2263	2274
2018	2368	2377
2019	2235	2234
2020	2082	2109
2021	2041	2065
2022	2100	2058

SECTION 10: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

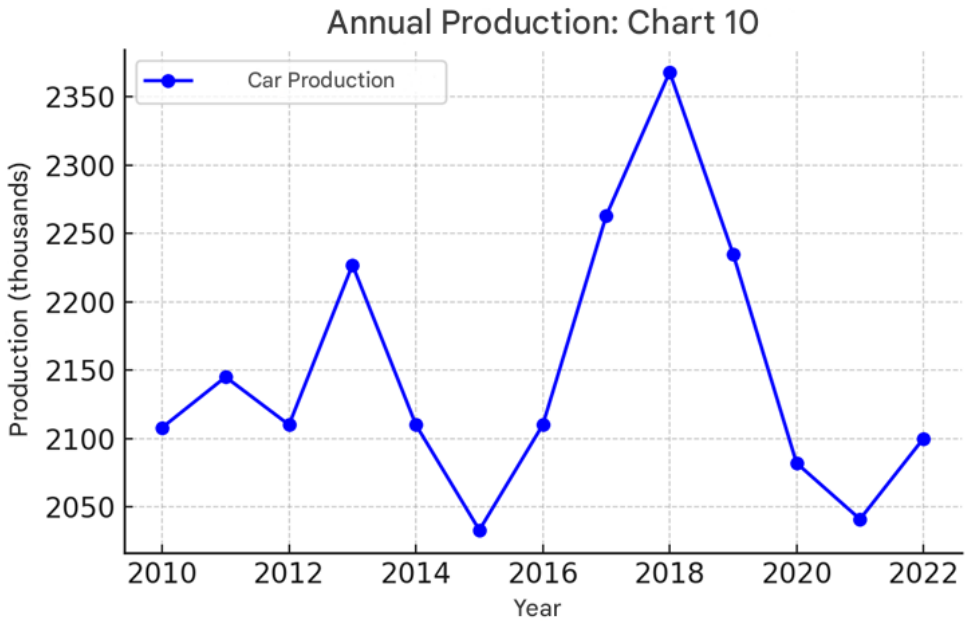
The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t),$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2091
2011	2145	2170
2012	2110	2158
2013	2227	2211
2014	2110	2060
2015	2033	2022
2016	2110	2123
2017	2263	2234
2018	2368	2377
2019	2235	2248
2020	2082	2124
2021	2041	2062
2022	2100	2060

Figure 10: Detailed annual production - Section 10.



SECTION 11: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t),$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2071
2011	2145	2154
2012	2110	2089
2013	2227	2211
2014	2110	2144
2015	2033	2019
2016	2110	2064
2017	2263	2295
2018	2368	2395
2019	2235	2210
2020	2082	2093
2021	2041	1994
2022	2100	2138

SECTION 12: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

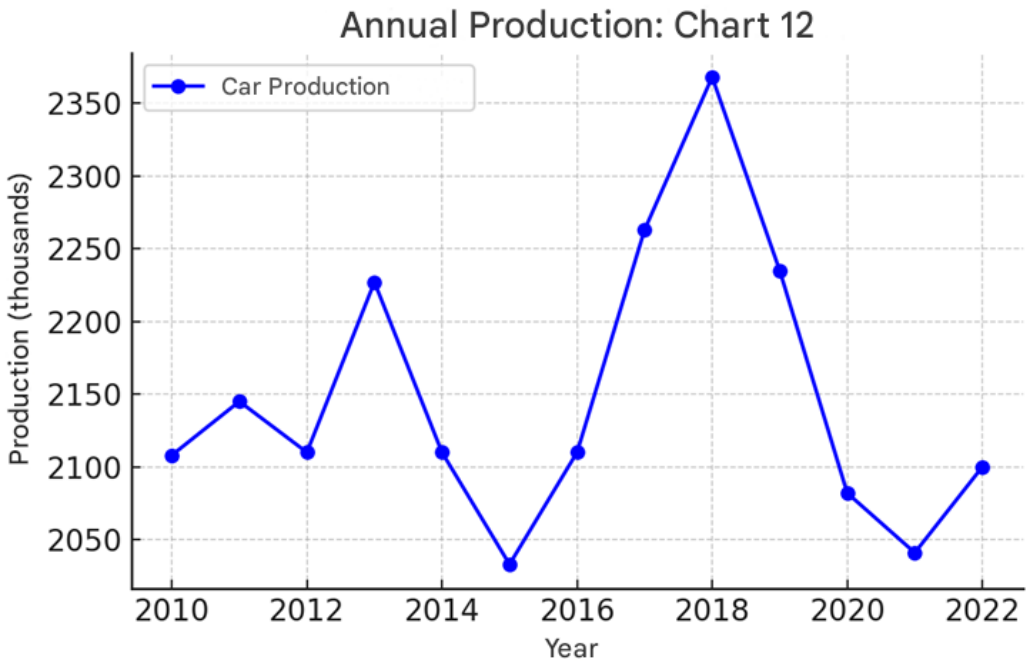
The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t)$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2099
2011	2145	2183
2012	2110	2077
2013	2227	2216
2014	2110	2131
2015	2033	2021
2016	2110	2073
2017	2263	2244
2018	2368	2368
2019	2235	2222
2020	2082	2128
2021	2041	2013
2022	2100	2112

Figure 12: Detailed annual production - Section 12.



SECTION 13: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t)$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2072
2011	2145	2191
2012	2110	2084
2013	2227	2193
2014	2110	2156
2015	2033	2048
2016	2110	2137
2017	2263	2265
2018	2368	2368
2019	2235	2223
2020	2082	2082
2021	2041	2060
2022	2100	2055

SECTION 14: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

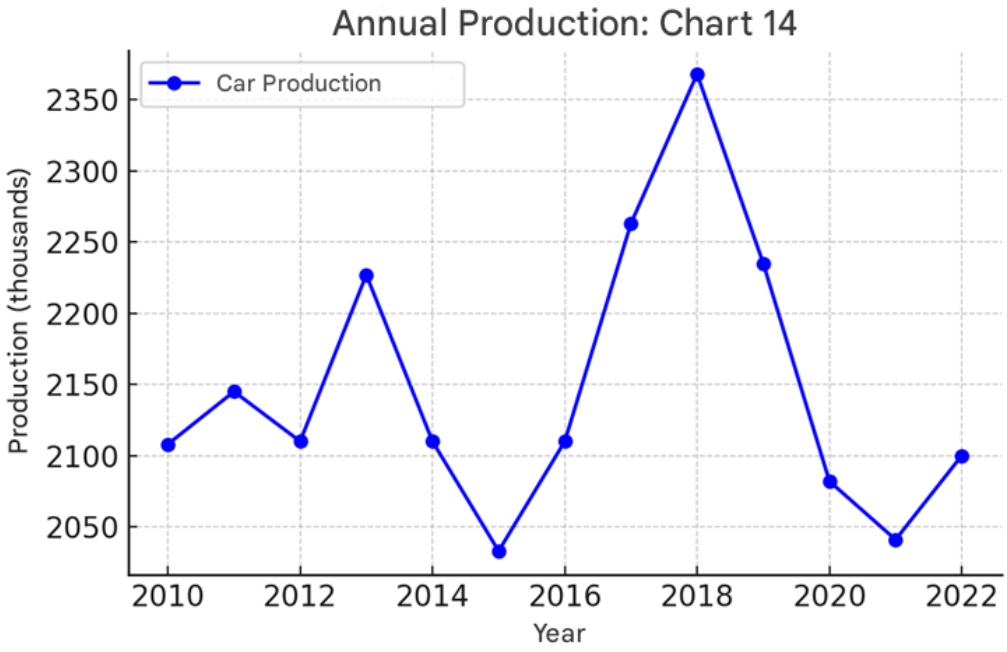
The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t)$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2124
2011	2145	2101
2012	2110	2110
2013	2227	2248
2014	2110	2101
2015	2033	2046
2016	2110	2074
2017	2263	2241
2018	2368	2350
2019	2235	2278
2020	2082	2058
2021	2041	2026
2022	2100	2078

Figure 14: Detailed annual production - Section 14.



SECTION 15: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil. The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t),$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2095
2011	2145	2151
2012	2110	2156
2013	2227	2203
2014	2110	2114
2015	2033	2015
2016	2110	2127
2017	2263	2298
2018	2368	2383
2019	2235	2194
2020	2082	2036
2021	2041	2064
2022	2100	2146

SECTION 16: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

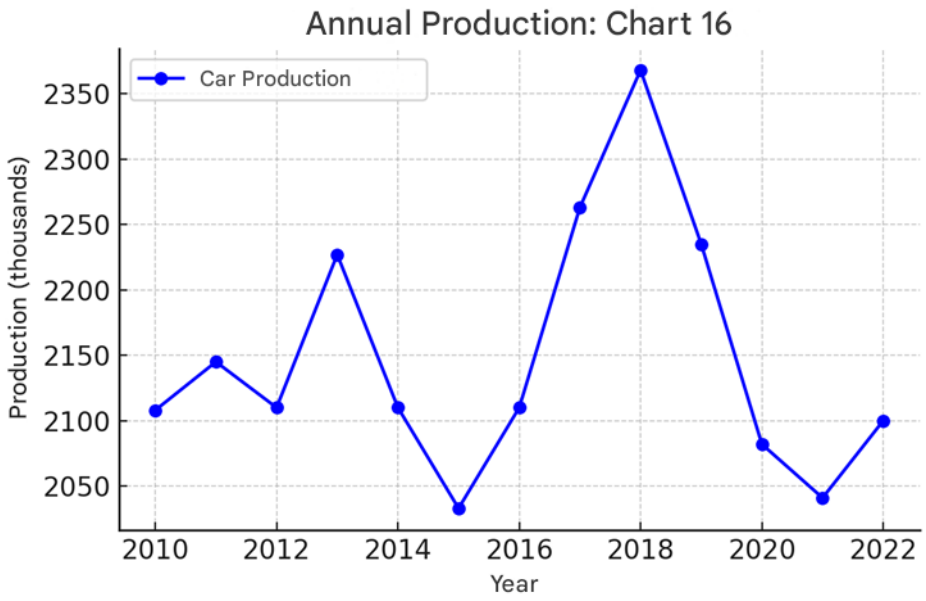
The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t)$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2095
2011	2145	2107
2012	2110	2090
2013	2227	2223
2014	2110	2159
2015	2033	2070
2016	2110	2111
2017	2263	2268
2018	2368	2332
2019	2235	2213
2020	2082	2039
2021	2041	1995
2022	2100	2078

Figure 16: Detailed annual production - Section 16.



SECTION 17: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t)$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2104
2011	2145	2162
2012	2110	2135
2013	2227	2221
2014	2110	2061
2015	2033	2009
2016	2110	2154
2017	2263	2248
2018	2368	2353
2019	2235	2210
2020	2082	2074
2021	2041	2017
2022	2100	2118

SECTION 18: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

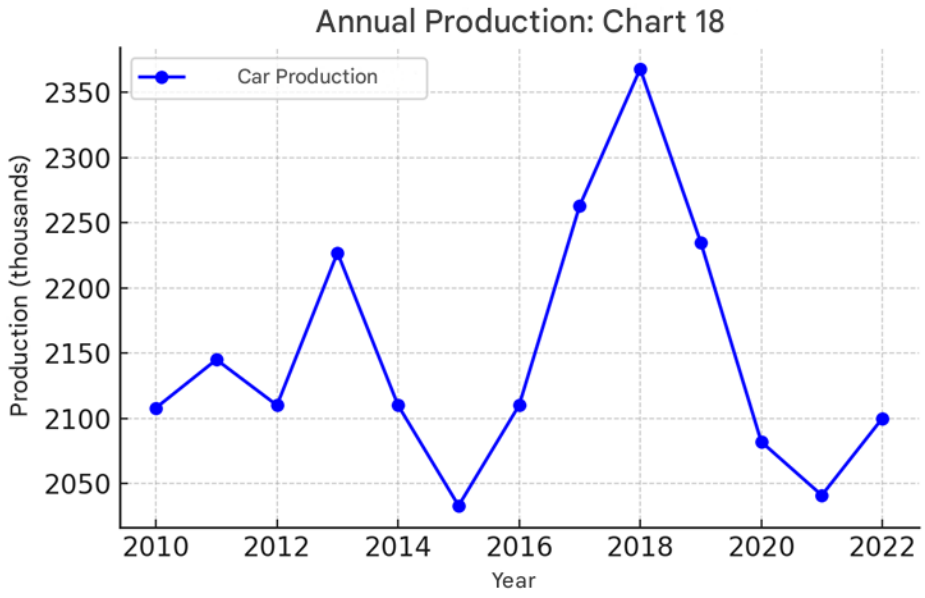
The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t),$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2077
2011	2145	2105
2012	2110	2133
2013	2227	2214
2014	2110	2065
2015	2033	2054
2016	2110	2082
2017	2263	2259
2018	2368	2407
2019	2235	2230
2020	2082	2043
2021	2041	2080
2022	2100	2062

Figure 18: Detailed annual production - Section 18.



SECTION 19: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t)$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2119
2011	2145	2176
2012	2110	2148
2013	2227	2273
2014	2110	2119
2015	2033	2025
2016	2110	2135
2017	2263	2312
2018	2368	2385
2019	2235	2189
2020	2082	2068
2021	2041	2062
2022	2100	2141

SECTION 20: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

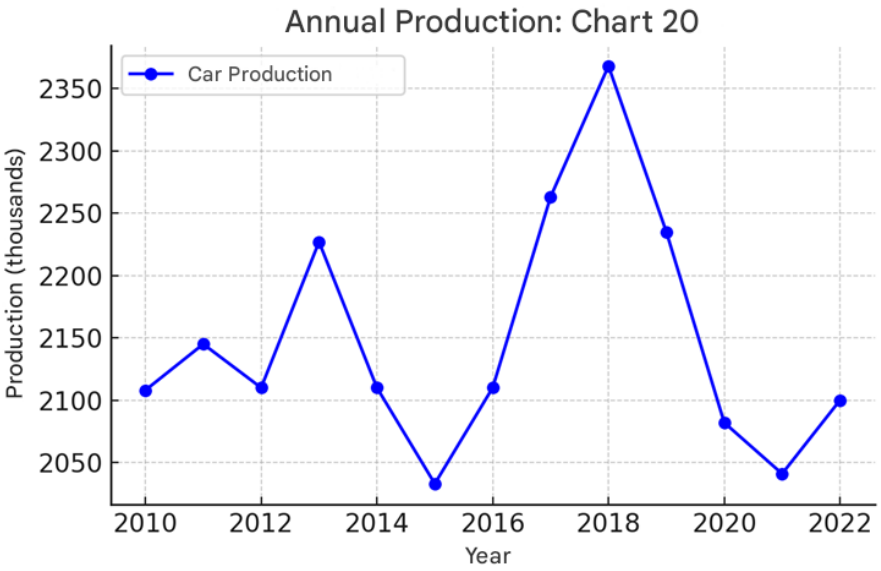
The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t)$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2088
2011	2145	2103
2012	2110	2110
2013	2227	2205
2014	2110	2137
2015	2033	2022
2016	2110	2100
2017	2263	2298
2018	2368	2328
2019	2235	2207
2020	2082	2032
2021	2041	2036
2022	2100	2070

Figure 20: Detailed annual production - Section 20.



SECTION 21: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t)$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2147
2011	2145	2130
2012	2110	2113
2013	2227	2263
2014	2110	2116
2015	2033	1983
2016	2110	2122
2017	2263	2266
2018	2368	2372
2019	2235	2224
2020	2082	2046
2021	2041	2011
2022	2100	2096

SECTION 22: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

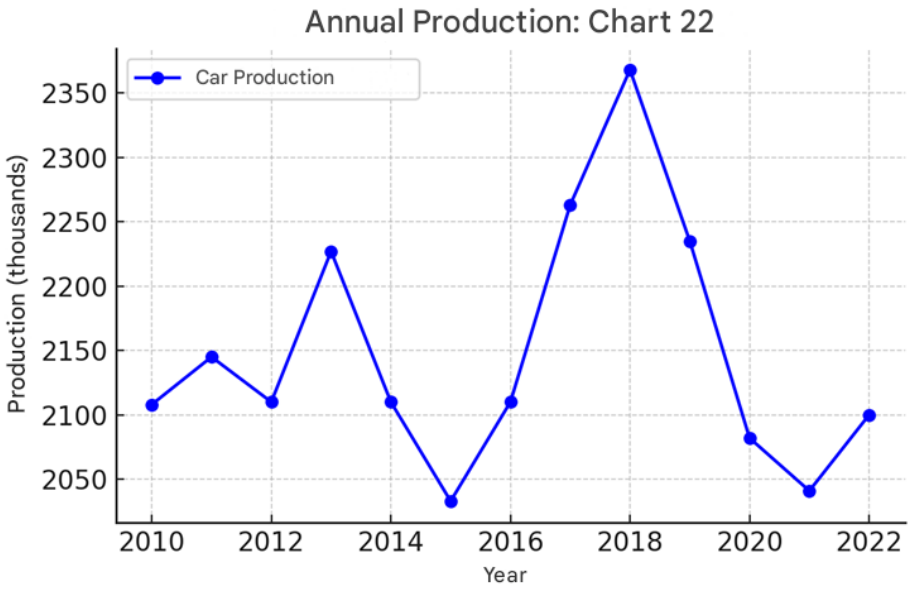
The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t)$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2130
2011	2145	2147
2012	2110	2068
2013	2227	2250
2014	2110	2111
2015	2033	2039
2016	2110	2085
2017	2263	2253
2018	2368	2352
2019	2235	2247
2020	2082	2056
2021	2041	2080
2022	2100	2124

Figure 22: Detailed annual production - Section 22.



SECTION 23: DETAILED ANALYSIS

In this section, we deepen the time series analysis and use Zhang's hybrid method, which combines Wavelets, ARIMA, and LSTM, to predict future car production in Brazil.

The general equation of the method can be described as:

$$Y(t) = W(t) + ARIMA(t) + LSTM(t)$$

where each component represents a specific contribution to the model.

Year	Observed Production	Expected Production
2010	2108	2095
2011	2145	2096
2012	2110	2066
2013	2227	2258
2014	2110	2150
2015	2033	2016
2016	2110	2150
2017	2263	2229
2018	2368	2360
2019	2235	2243
2020	2082	2082
2021	2041	2044
2022	2100	2073

CONCLUSION

Zhang's hybrid model proved to be an effective approach for forecasting vehicle production in Brazil. The integration of wavelets, ARIMA, and LSTM neural networks provides robust and accurate predictions, with potential for application in other economic sectors.

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SCHISTOSOMIASIS: EPIDEMIOLOGICAL ANALYSIS IN THE FIVE REGIONS OF BRAZIL

https://doi.org/10.56238/sevened2024.037-046

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ABSTRACT

Schistosomiasis is a parasitic disease caused by the helminth Schistosoma mansoni, which affects approximately 240 million people globally, with Brazil being the most affected country in the Americas, with 1.5 million infected people. The prevalence of this disease is associated with unfavorable socioeconomic conditions and poor basic sanitation. This study aimed to evaluate the epidemiological profile of cases of S. mansoni infection in five regions of Brazil (Northeast, North, South, Southeast and Central-West) between 2010 and 2021. Data from the Schistosomiasis Control Program Information System (PCE) and the Notifiable Diseases Information System (SINAN) were used to analyze variables such as sex, age group, race and incidence by region. The results revealed that schistosomiasis is more common in Northeast, where the combination of unfavorable economic conditions and the presence of snails of the genus Biomphalaria contribute to its spread. In contrast, South and parts of Southeast a lower incidence, which was attributed to better sanitary conditions. The infection predominantly affects men, especially those involved in activities in contact with potentially contaminated aquatic environments, such as fishing and agriculture, who seek medical care less frequently. The most affected age group varies in North, between 40 and 59 years old, and in Northeast, this age group stands out between 2015 and 2021. These data highlight socioeconomic inequalities in the prevalence of the disease, with a higher incidence among people of mixed race in North, Northeast, Southeast and Central-West in South the prevalence is higher among whites. The persistence of schistosomiasis in Brazil highlights the need for control strategies according to the regional epidemiological profile. Schistosomiasis continues to be an important public health problem in Brazil, requiring strategies that prioritize basic sanitation, health education, treatment and epidemiological surveillance to reduce transmission and improve the quality of life of affected populations.

Keywords: Public health. Parasitic disease. Epidemiological data. Brazilian regions.

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Federal Fluminense University - Natural Products Technology Laboratory, Mário Viana Street 523, Zip Code 24241-002, Niteroi, RJ, Brazil.
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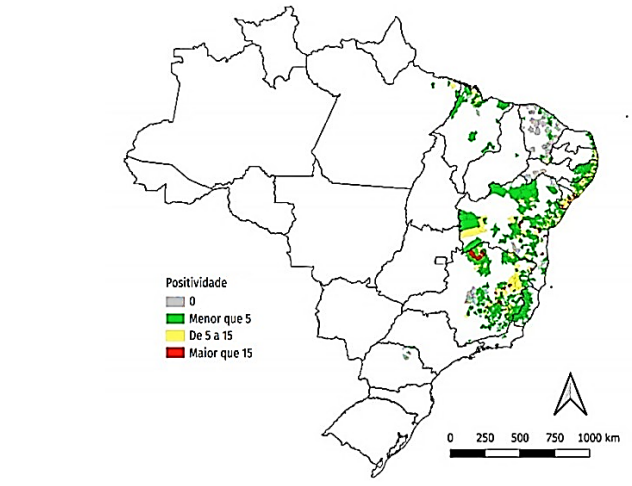
INTRODUCTION

The emergence of parasitic diseases is directly related to the precarious conditions of the population, especially the lack of adequate basic sanitation. Parasitic diseases are a problem for public health, as they affect thousands of people worldwide (Melo et al., 2019). Schistosomiasis is the second most important parasitic disease worldwide, behind only malaria (Rocha et al., 2016).

It is popularly known as schistosomiasis, water belly or snail disease (Rangel et al., 2023). Schistosomiasis was introduced into Brazil through the slave trade originating from the west coast of Africa, which entered the country mainly through the ports of Recife and Salvador to work on sugarcane plantations (Melo et al., 2019). According to the World Health Organization, schistosomiasis affects almost 240 million people worldwide, and more than 700 people live in endemic areas (WHO, 2024).

This disease is found mainly in Africa and the Eastern Mediterranean and affects Nile Delta regions and countries such as Egypt and Sudan. In the Americas, it affects South America, with emphasis on the Caribbean region, Venezuela and Brazil (Ministry of Health, 2024). Brazil is the most affected country in the Americas, with 1.5 million infected people (Figure 1) (Ministry of Health, 2014; Paz et al., 2021).

Figure 1: Distribution of schistosomiasis in Brazil in 2020 according to percentage of positivity by municipality. Brazil, 2009–2020. Source: Schistosomiasis Control Program Information System ISPCE/SVS/MS. Accessed on: 08/24/2021.



Fonte: Sistema de Informação do Programa de Controle da Esquistossomose – ISPCE/SVS/MS.

The Northeast Region and the state of Minas Gerais were the first endemic areas of schistosomiasis mansoni in Brazil. In Southeast, isolated foci have appeared in Rio de Janeiro, Espírito Santo and São Paulo. The northern region of Paraná, which is in southern Brazil, has also become an endemic area. Three other foci of the disease were recently described in two other southern states: two in Santa Catarina and one in Rio Grande do Sul

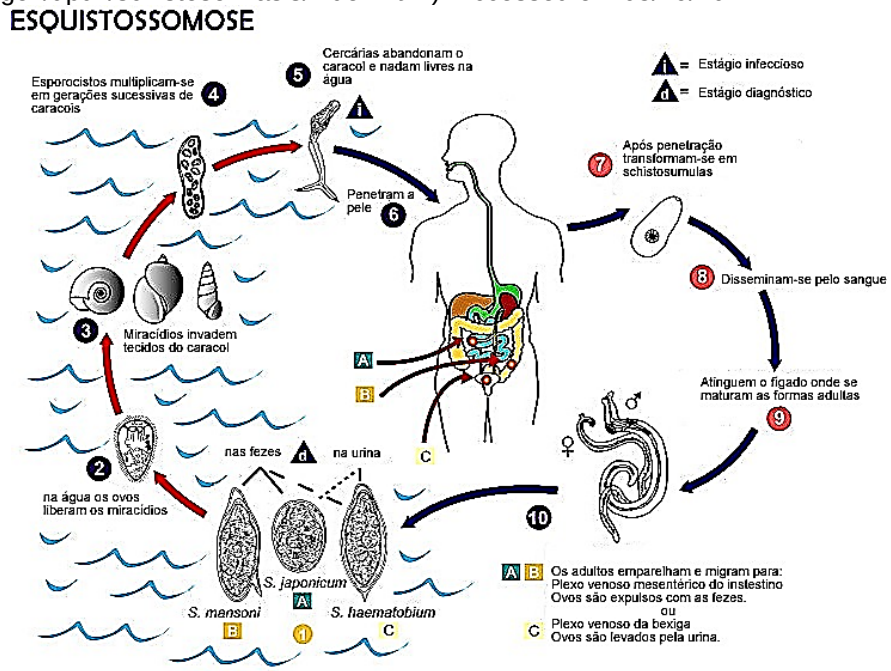
(Katz and Almeida, 2003).

In 2015, Nascimento and collaborators began a study on the costs of schistosomiasis caused by *S. mansoni* in Brazil. For the analysis, they used data from the Unified Health System (SUS).

The neurological and hepatosplenic forms of the disease, severe cases and those that resulted in death were analyzed (Nascimento et al., 2019). The parameters for analyzing the costs of this endemic disease were medical records and interviews with hospital patients; scientific literature; the management system for procedures, medications, prostheses and special devices of the Unified Health System; the price database of the Brazilian Department of Health; the websites of the Planning Secretariat, the Health Secretariat, the State and Municipal Health Secretariats; Public Acquisition Offers; and clinical protocols. Through these parameters, some authors estimated the total cost of this disease in Brazil at US$ 41.7 million, with 94.61% of these costs being indirect (Nascimento et al., 2019).

The schistosomiasis life cycle involves two hosts, the intermediate being the mollusk and the definitive being the human (Adekiya et al, 2019). The definitive host releases eggs in feces or urine into the aquatic environment, which gives rise to miracidia, known as the first larval stage of the parasite. The miracidia infect the intermediate host (snail), where they develop until the second larval stage. The cercariae, known as the second larval stage, penetrate the skin of the definitive host (human), transform into schistosomula and spread through the blood, reaching the mesenteric tract, where the worms mature to the adult stage (Figure 2) (Adekiya et al, 2019; Aula et al., 2021).

Figure 2: Schistosomiasis cycle. Source: Center for Disease Control and Prevention (https://www.cdc.gov/dpdx/schistosomiasis/index.html). Accessed on: 03/19/2024.



This endemic disease presents itself in acute and chronic forms. In the acute form, it may be asymptomatic or symptomatic. In some cases, the asymptomatic form makes diagnosis difficult, as it can be confused with other diseases. The symptomatic form may present symptoms such as cercarial dermatitis or itching, characterized by erythematous and pruritic micro papules such as insect bites, and contact eczema (Ministry of Health, 2014). In the chronic form, embolism may occur in the liver and spleen (Carbonelletal., 2021).

The World Health Organization (WHO) has recommended the use of an anthelmintic drug called praziquantel (PQZ) for the treatment of this endemic disease (Aula et al., 2021). Praziquantel is a pyrazine-isoquinoline product that is a colorless powder with a bitter taste. This drug is commercially known as Biltricide® (Klohe et al., 2021).

Tesfie and collaborators (2020) conducted a study at Sanja General Primary School from March to April 2017 involving 245 school-aged children (6 to 18 years) infected with *S. mansoni*. After 4 weeks of treatment, new samples were collected to assess the effectiveness of the treatment because of the cure rate. Before treatment with praziquantel, the prevalence of infection was 83.3%, with 26.5% in the mild form, 37.3% in the moderate form and 36.3% in the severe form. After 4 weeks of treatment, this prevalence decreased to 10.8%.

In 2014, Papazian et al. conducted a study in which the therapeutic efficacy of praziquantel (PZQ) was evaluated in school-aged children in Brazil in relation to *S. mansoni* infection. The results indicated that PZQ was highly effective, with an egg reduction rate of

93.4%, which confirms its effectiveness in reducing the parasite load. However, the study also revealed variations in the efficacy of PZQ, possibly due to the different Schistosoma species analyzed. This variability highlights the importance of continuous monitoring of treatment efficacy. The data obtained provide a valuable basis for comparisons in future studies on the efficacy of PZQ in Brazil and other countries, allowing the early detection of any reduction in the efficacy of the drug, which could be due to the emergence of resistance.

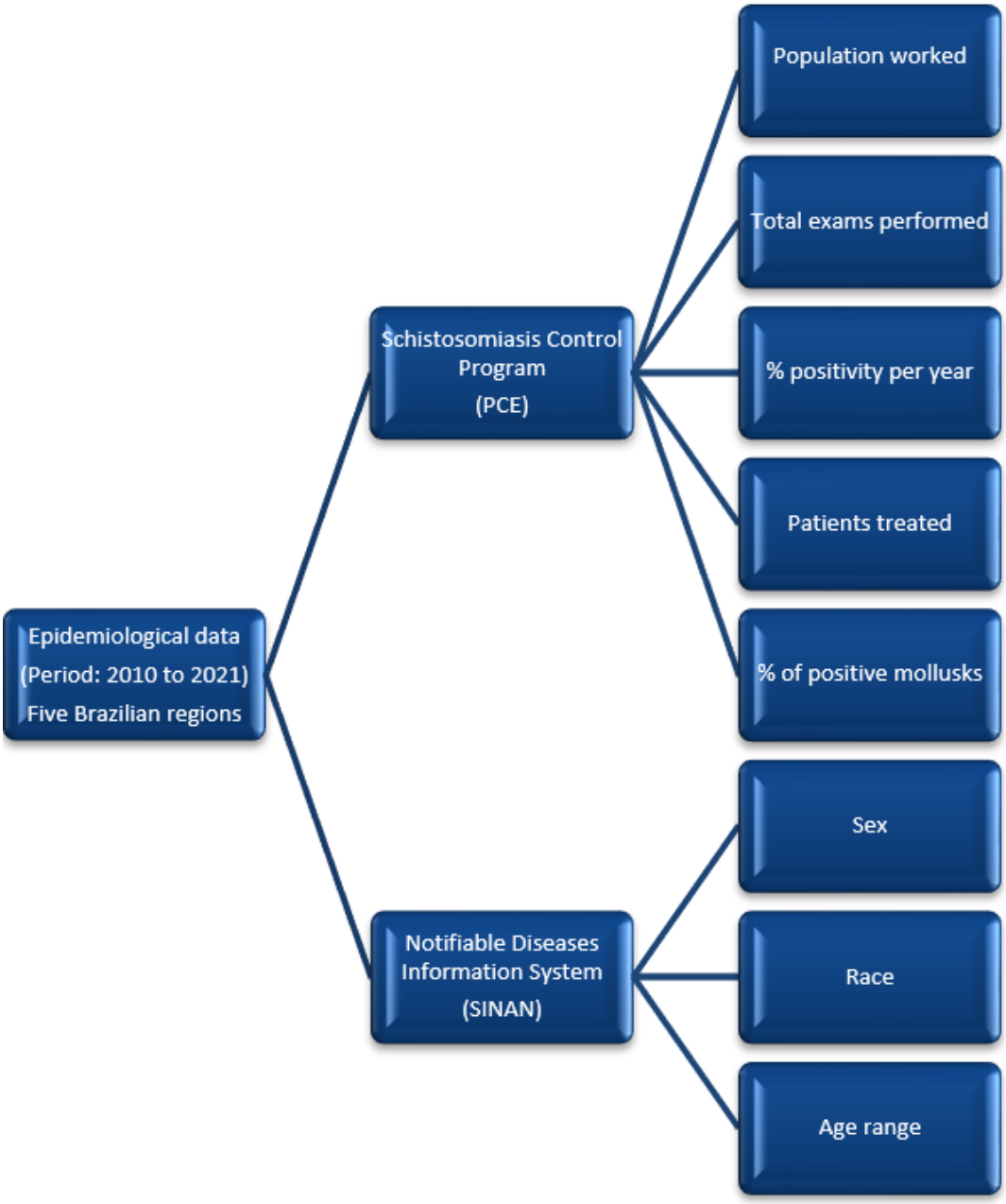
Despite continued efforts to administer mass-administer praziquantel (PZQ), the standard treatment for decades, schistosomiasis persists owing to limitations such as PZQ's ineffectiveness against juvenile forms of the parasite and its inability to prevent reinfection. These shortcomings highlight the urgent need for complementary control strategies, including the development of an effective vaccine. As discussed by Molehin (2020), the integration of a viable vaccine into current control measures represents the best opportunity to achieve long-term elimination of schistosomiasis. Although vaccine development has faced significant challenges, advances in preclinical research and human clinical trials provide an optimistic outlook for the future of immunization against this disease.

Scientific contributions to the understanding of schistosomiasis have been significant, but there is still a clear need for further studies, especially in endemic regions, to assess local conditions, functions and results of control measures. This study aims to evaluate the epidemiological profile related to positive cases of *Schistosoma mansoni* infection in five Brazilian regions (Northeast, North, South, Southeast and Central-West) from 2010--2021, analyzing the incidence of reported cases and the impact of the schistosomiasis control program in the five regions of Brazil.

METHODOLOGY

This descriptive, quantitative study was carried out with data from the Schistosomiasis Control Program Information System (PCE) and the Notifiable Diseases Information System (SINAN). The data collection included independent variables such as the number of people studied, positive cases, number of people treated, and malacological information from 2010--2021. The prevalence of schistosomiasis was also included, which was based on factors such as sex, age group, and race, and a study was realized during the same period (Figure 3).

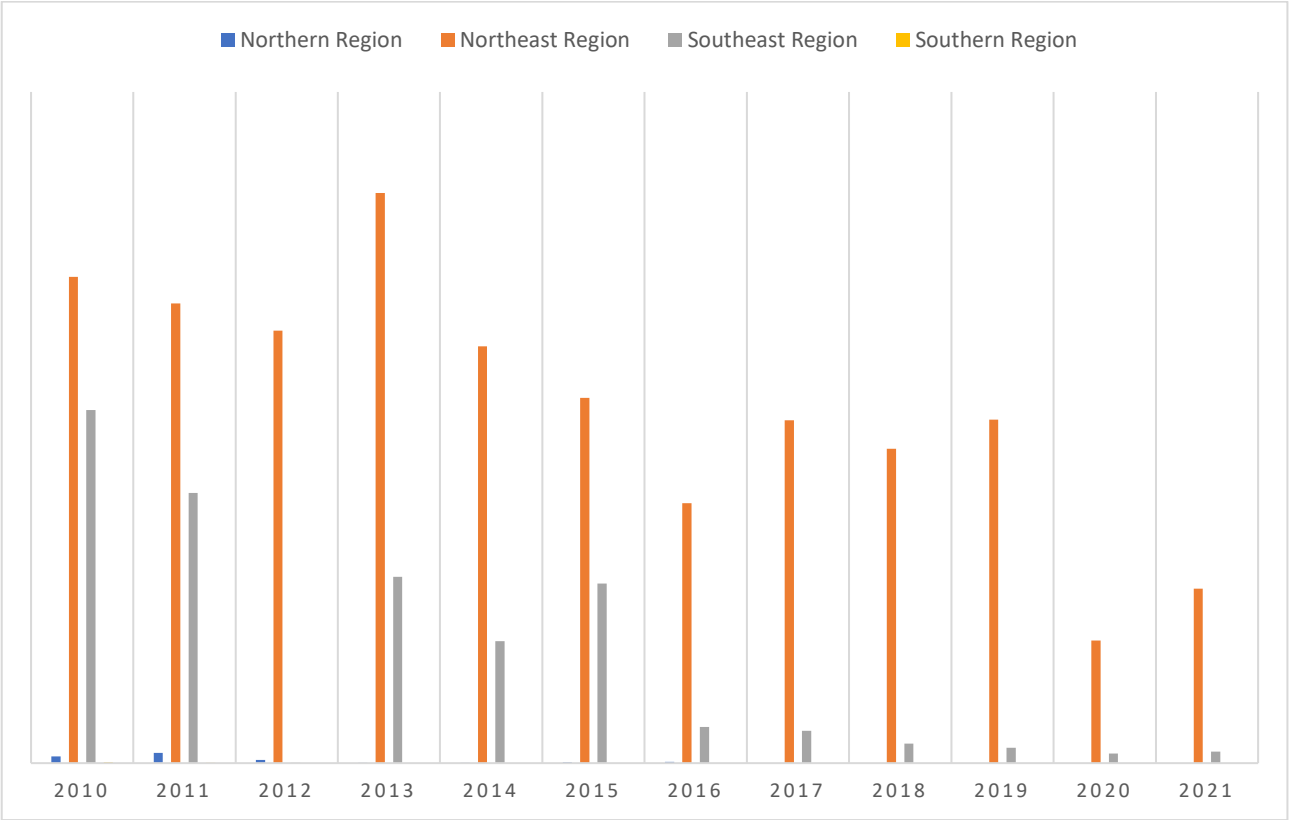
Figure 3: Descriptive organizational chart of the selection process in the databases of the Schistosomiasis Control Program (PCE) and the Notifiable Diseases Information System (SINAN).



RESULTS AND DISCUSSION

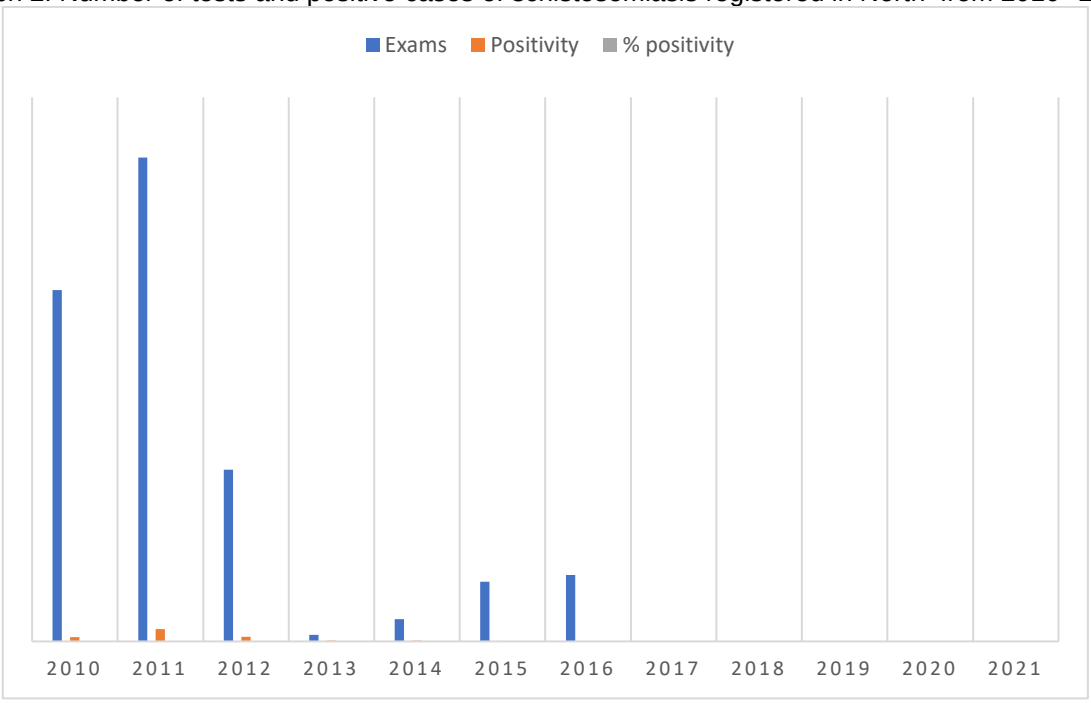
Epidemiological results of schistosomiasis in Brazil reveal a high incidence of the disease in certain regions of the country. According to data from DATASUS, in 2013 and 2010, the regions with the highest prevalence of reported cases were the Northeast Region, with more than one and a half million cases, and the Southeast Region, with almost 948 thousand cases (Graph 1). As shown in the following graph:

Graph 1. Number of reported cases of schistosomiasis registered in the four Brazilian regions from 2010--2021.

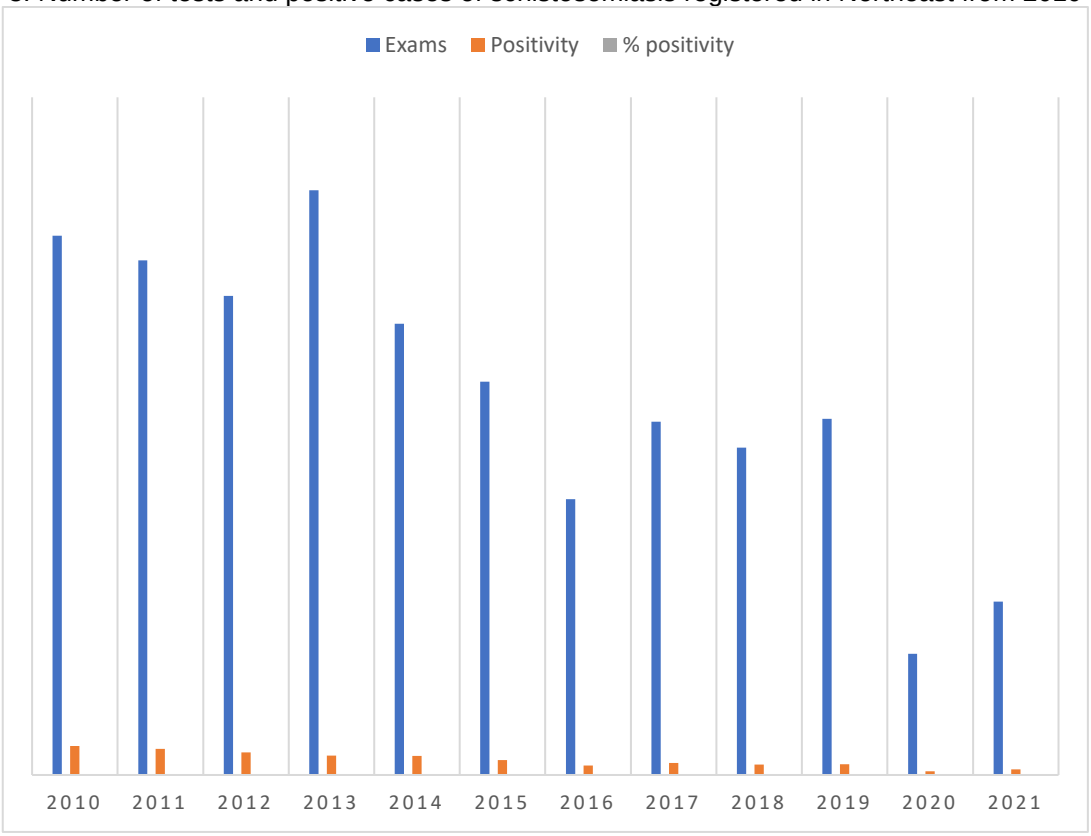


Diagnostic methods used to detect schistosomiasis in Brazil include stool analysis to identify the eggs of the parasite *Schistosoma mansoni* in the collected samples. The positivity of this test may vary according to the geographic region and the epidemiological profile of the population examined, as seen in the graphs (Graph 2, 3, 4, 5):

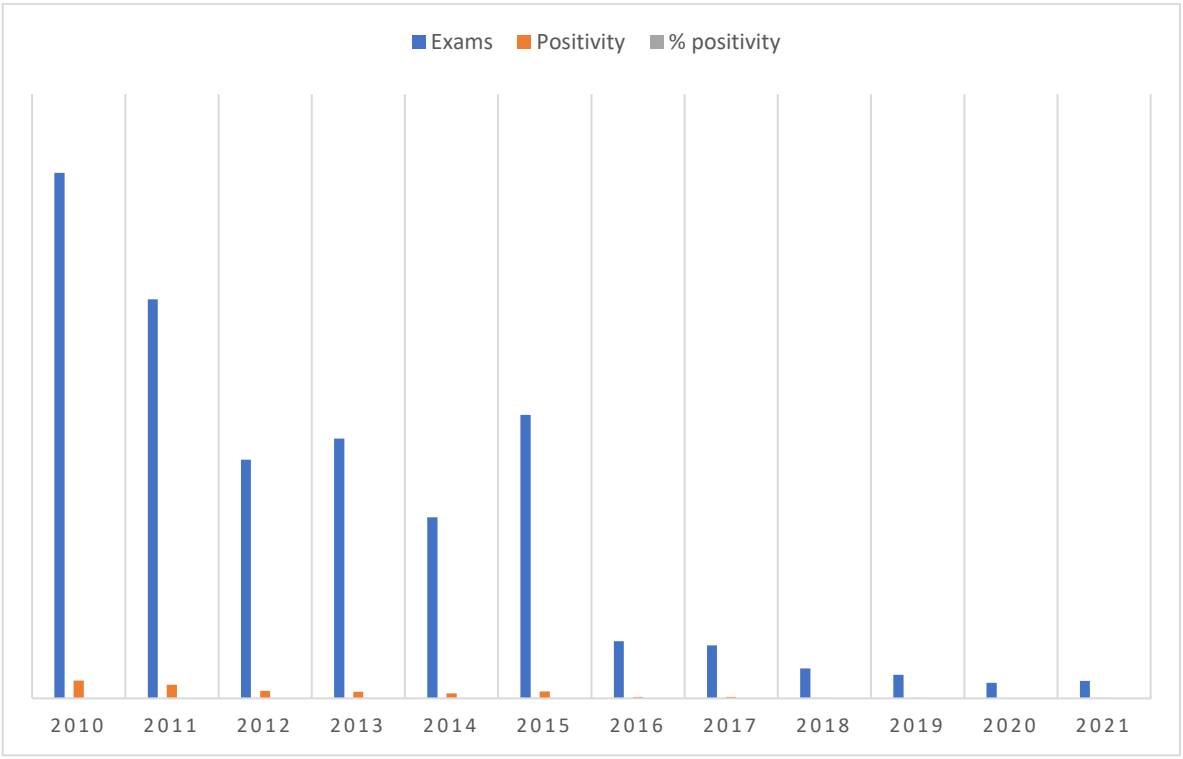
Graph 2. Number of tests and positive cases of schistosomiasis registered in North from 2010--2021.



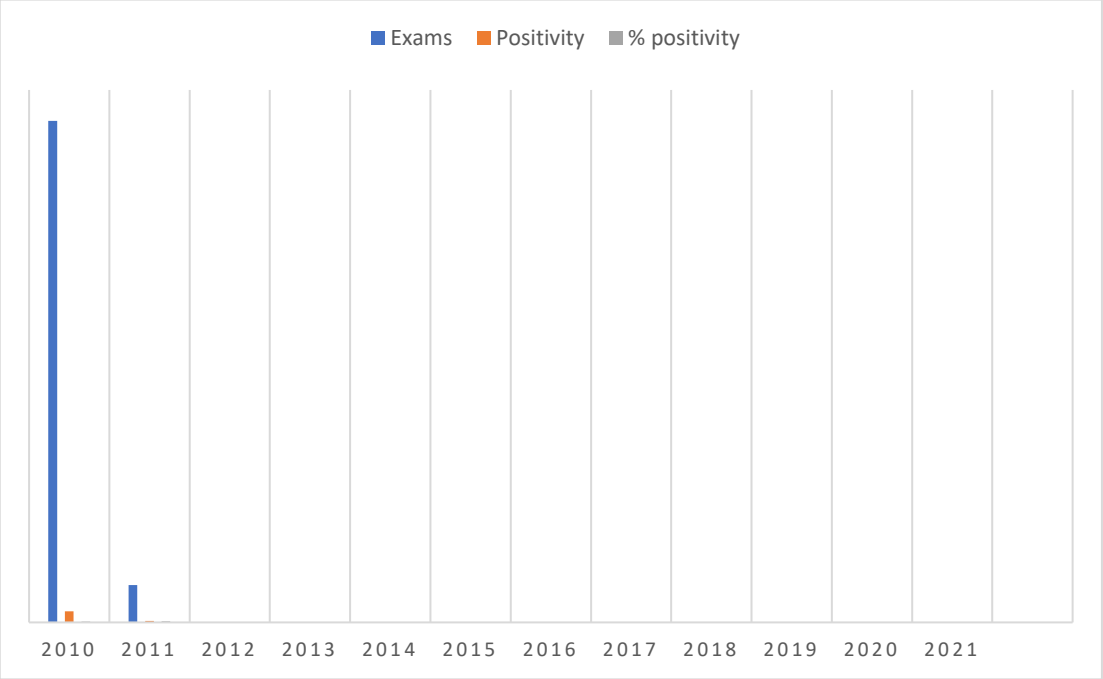
Graph 3. Number of tests and positive cases of schistosomiasis registered in Northeast from 2010--2021.



Graph 4. Number of tests and positive cases of schistosomiasis registered in Southeast China from 2010--2021.



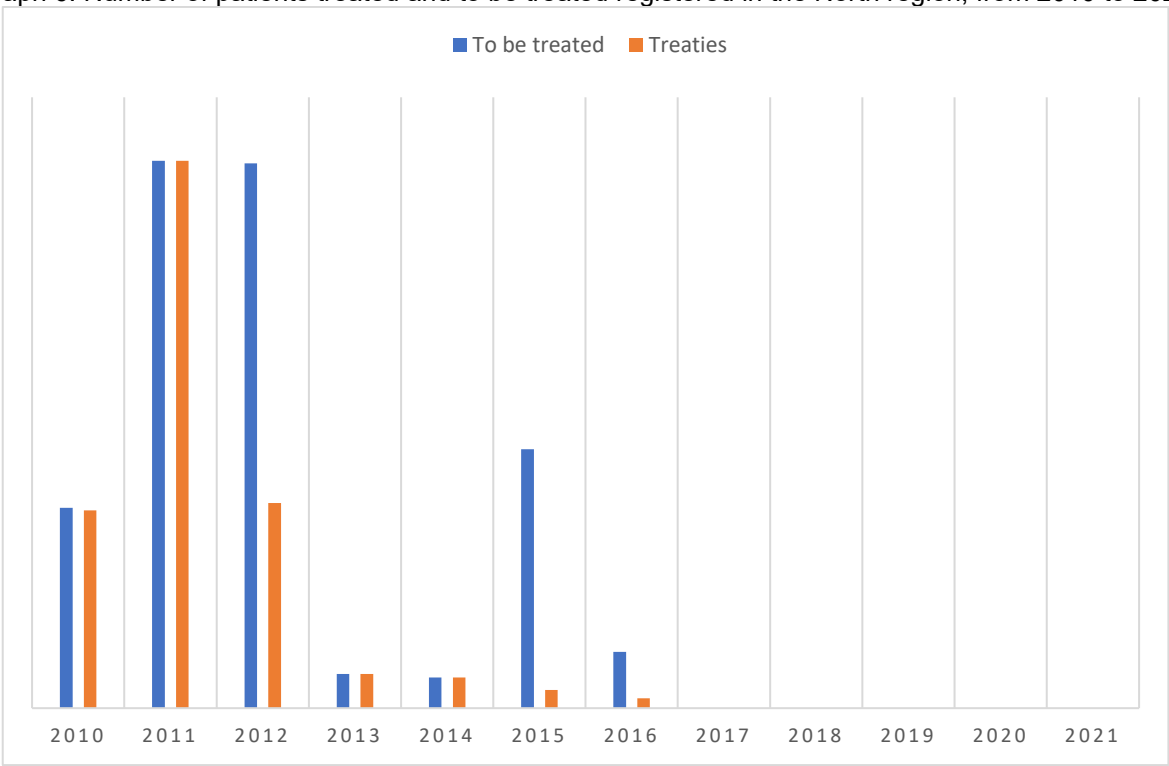
Graph 5. Number of tests and positive cases of schistosomiasis registered in the southern region from 2010--2021.



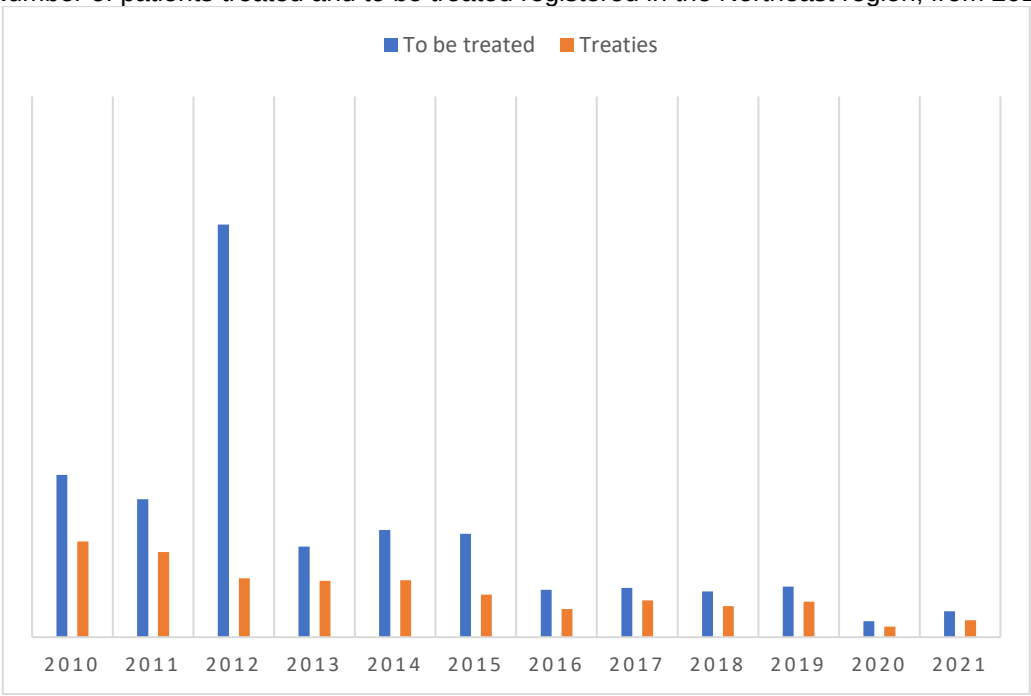
In 2010, the Northeast Region had more than nine hundred thousand tests performed and almost 52 thousand positive results, and 2013 was the year with the highest incidence, with the same region having more than one million cases and almost 35 thousand positive results. However, in all regions, both the number of tests performed and especially the number of confirmed cases have been decreasing. In some regions, there are no cases, such as South and North.

With respect to patients treated and to be treated, Brazil implements schistosomiasis control programs that aim to serve both patients who have already been diagnosed with the disease and those who are in endemic areas and are considered at risk of infection (Graph 6, 7, 8, 9). Let us see the following graphs:

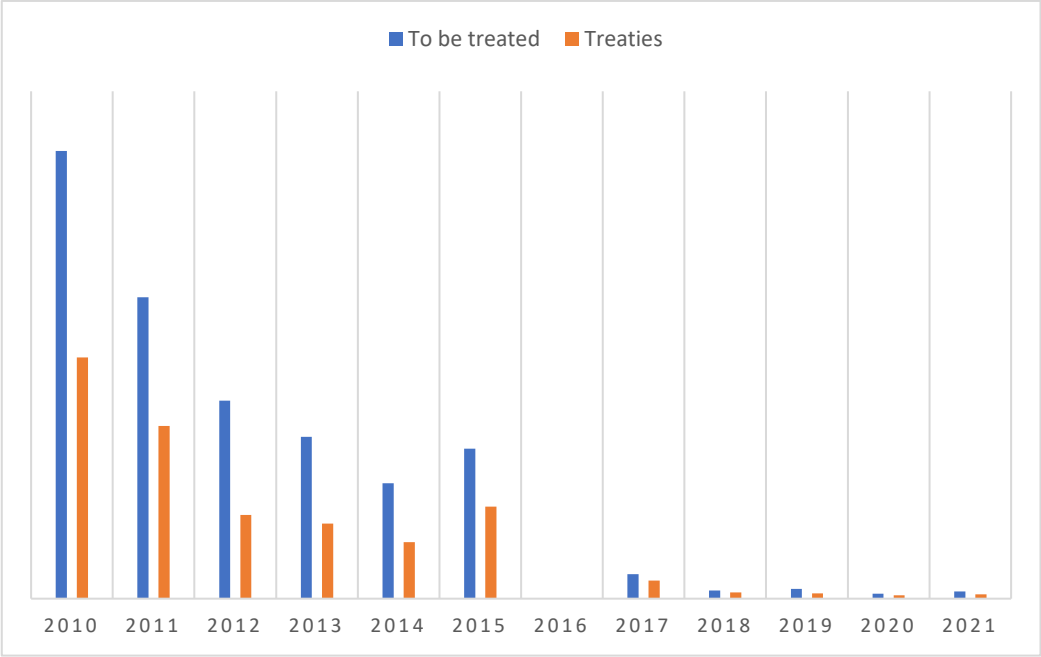
Graph 6. Number of patients treated and to be treated registered in the North region, from 2010 to 2021.



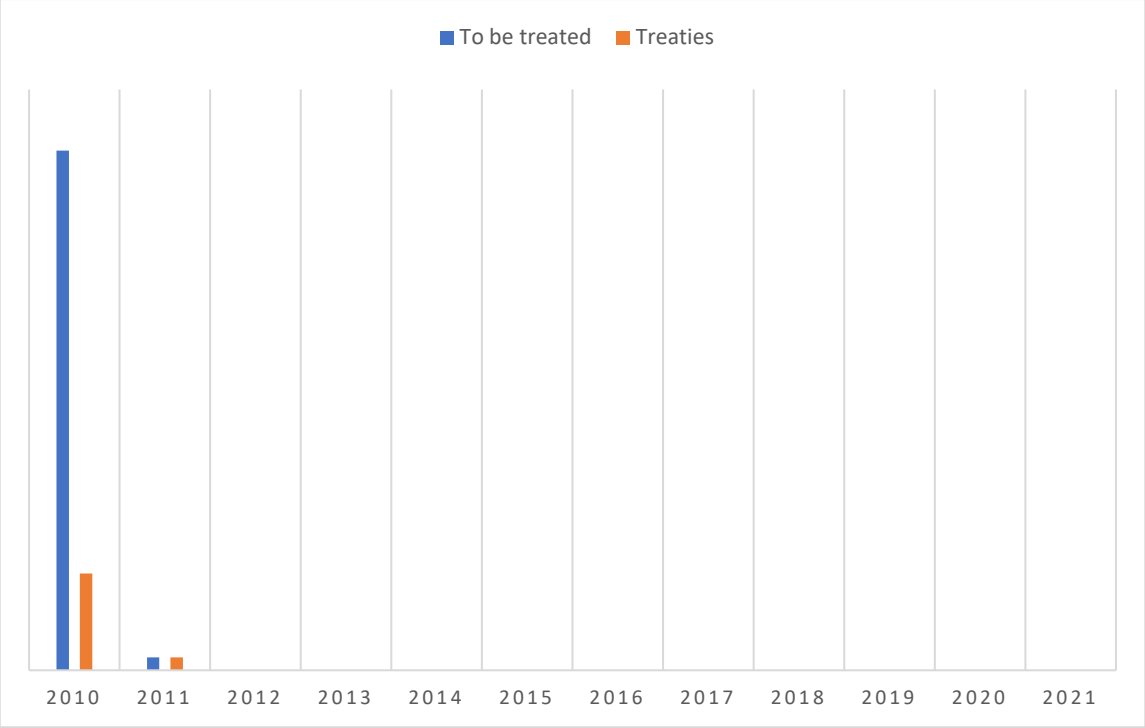
Graph 7. Number of patients treated and to be treated registered in the Northeast region, from 2010 to 2021.



Graph 8. Number of patients treated and registered treatments in the Southeast region, from 2010 to 2021.



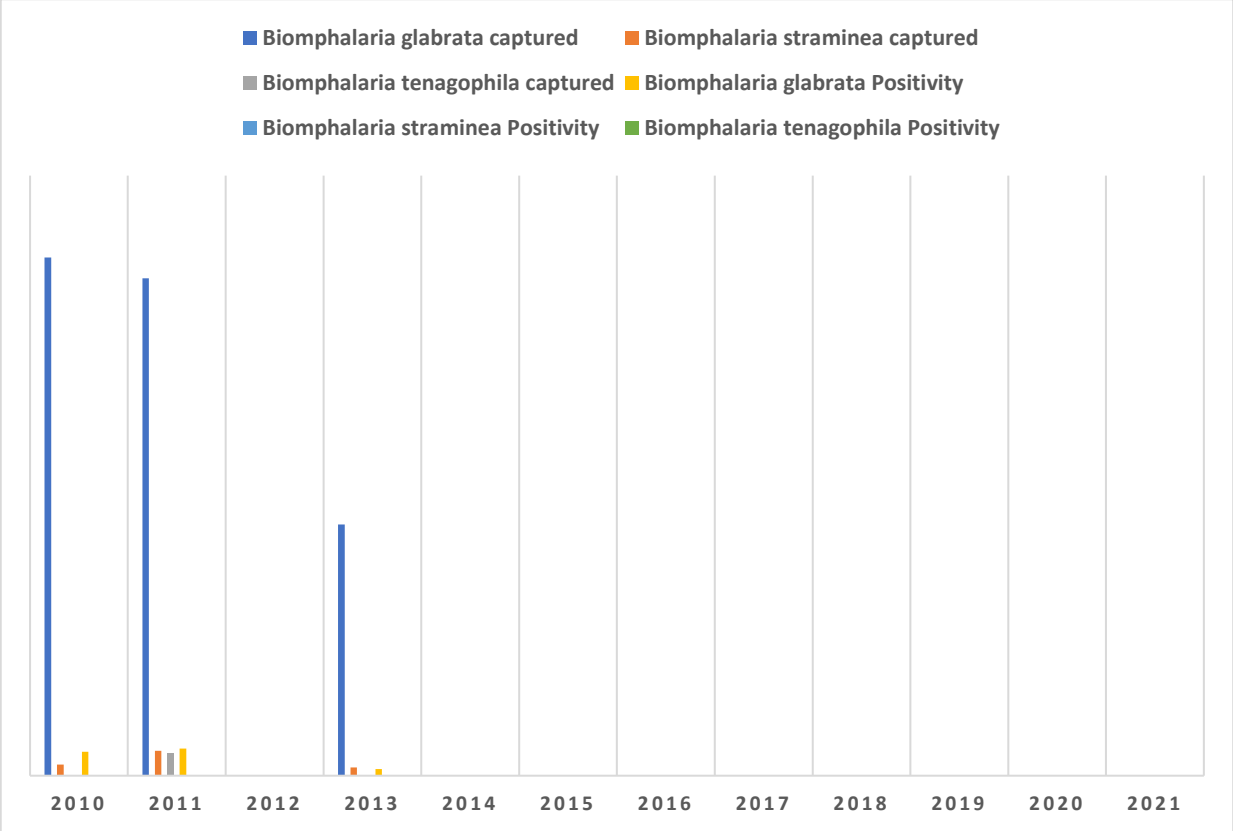
Graph 9. Number of patients treated and to be treated registered in the South region, from 2010 to 2021.



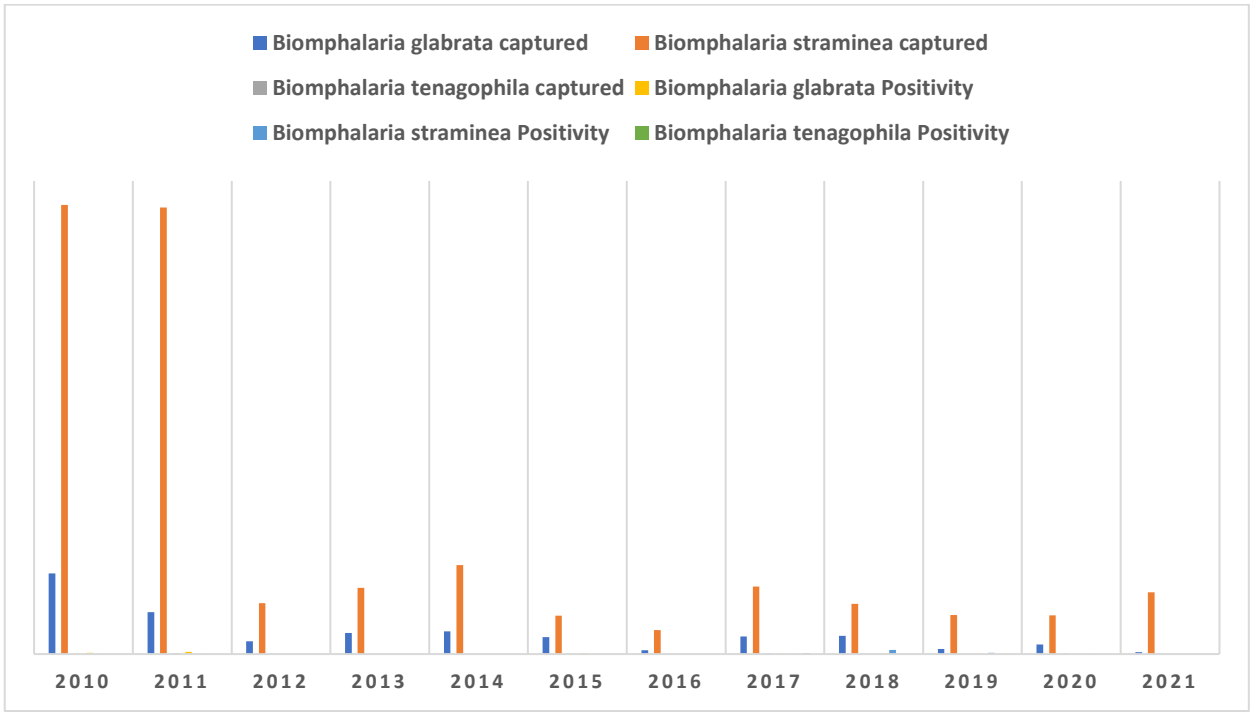
As described in the graphs, in 2010, 44126 patients were treated in the Southeast Region, with 23,764 patients treated. In 2012, the largest number of patients to be treated was in the Northeast Region, with over 190,000 patients and almost 28,000 already treated. Similar to the number of positive cases, the number of patients undergoing treatment has been decreasing over the years. In the North and South regions, no patients are receiving treatment for this disease.

The mollusks of the genus Biomphalaria (*Biomphalaria glabrata*, *Biomphalaria straminea* and *Biomphalaria tenagophila*) act as intermediate hosts for *Schistosoma mansoni* and are distributed in several regions of Brazil, especially in places with fresh water and environmental conditions conducive to its development (Graph 10, 11, 12). Let us look at the graphs to determine the number of captures and positivity of these species:

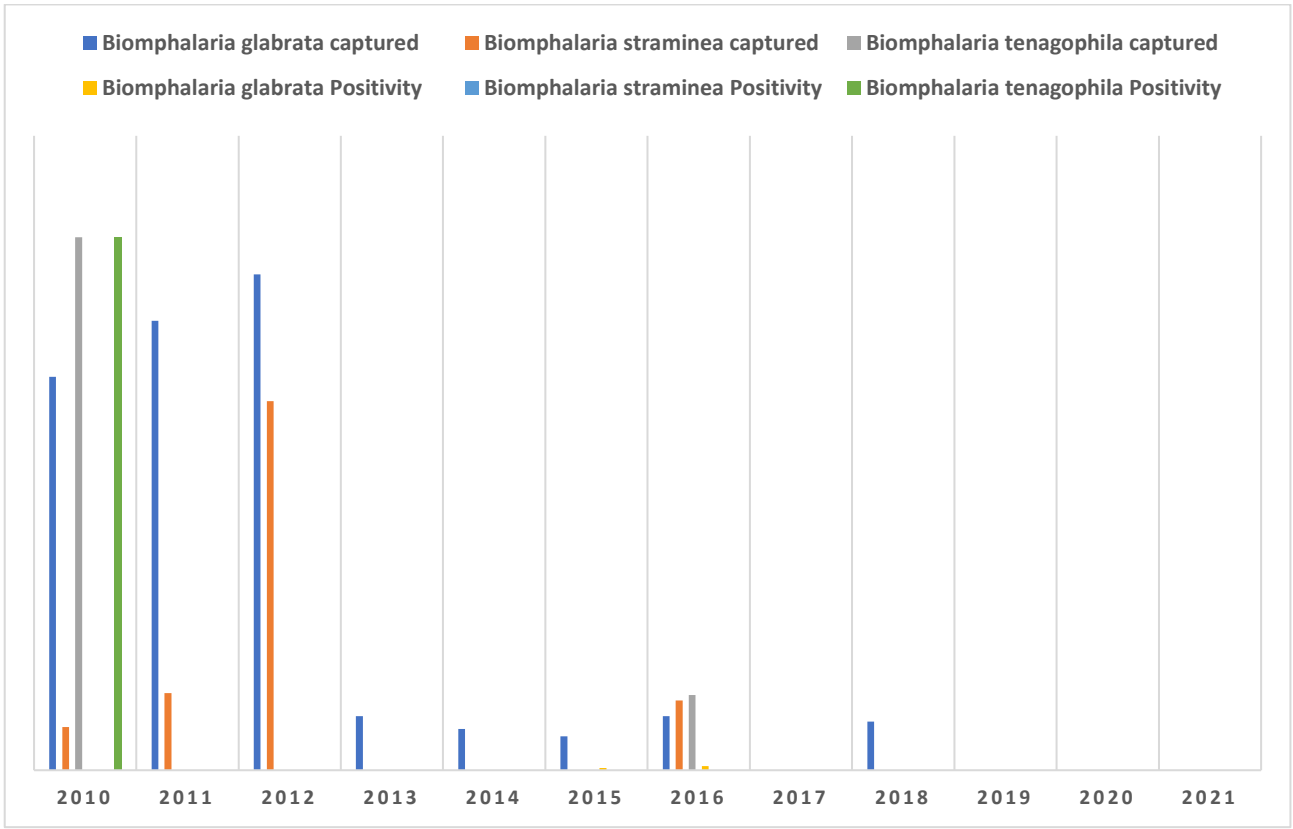
Graph 10. Number of Biomphalaria captured and positives registered in the North region, from 2010 to 2021.



Graph 11. Number of Biomphalaria captured and positives registered in the Northeast region, from 2010 to 2021.



Graph 12. Number of Biomphalaria captured and positives recorded in the Southeast region, from 2010 to 2021.



The presence of positive cases of schistosomiasis in Southeast Brazil, even with the reduction or absence of Biomphalaria species, the main intermediate host, can be explained by epidemiological and behavioral factors, in addition to challenges in controlling

transmission. A common hypothesis is that many of these infections may be the result of the migration of people from endemic areas, who arrive in Southeast and are already infected and manifest symptoms later. Studies indicate that the Southeast and Northeast Regions are strongly connected in terms of population displacement, which facilitates the maintenance of cases, even in places where Biomphalaria is not currently detected (Gomes et al., 2016).

In addition, in areas where the Biomphalaria population has been reduced, persistent transmission may occur due to favorable environmental conditions and the adaptation of some parasites to changes. Controlling actions and monitoring of local environmental conditions, such as water quality and basic sanitation, play crucial roles in preventing the transmission cycle from resuming. These environmental conditions are often mentioned as variables that facilitate or hinder the transmission of parasitic disease.

Finally, it is important to highlight that, while direct transmission via other intermediate hosts is not known in schistosomiasis, there is a continuous need for monitoring to detect possible adaptations, as well as educational efforts to inform populations about prevention, especially in risk areas.

According to Moura et al. (2020), data collected by SINAN indicate that many cases registered in Southeast may be imported because of temporary migrations and travel between regions. These data suggest that, despite the absence of active foci of Biomphalaria in some areas of Southeast, the flow of people from endemic regions results in new local diagnoses of schistosomiasis, which are reported regionally.

In 2010, the Northeast Region had the highest percentage of *Biomphalaria glabrata* captured, with a total of 8,526 snails, 147 of which tested positive for the disease, and a total of 47,459 snails of the species *Biomphalaria straminea*, 2 of which tested positive. In 2010, 504 *Biomphalaria tenagophila* snails were found in the Southeast Region, with 504 tests positive for schistosomiasis. In the southern region, there are no data for the period studied. In addition to the Northeast Region, the other regions also presented a reduction in the number of mollusks captured. This finding may indicate the absence of positive cases, as there are no infected mollusks to transmit the disease.

The prevalence of schistosomiasis varies in different regions of Brazil due to socioeconomic and environmental factors. In areas with poor sanitation, such as Northeast, the disease is more common, as the conditions favor the transmission of the parasite. However, it is essential to maintain control programs and facilitate access to treatment throughout the country, thus reducing the impact of schistosomiasis on public health. An epidemiological analysis revealed the significant prevalence of schistosomiasis in several

regions of Brazil, especially Northeast Brazil, corroborating information from Barreto and Lobo (2021), who described the distribution of cases of this endemic disease from 2010--2017.

Despite advances in reducing epidemiological indicators, the effectiveness of the schistosomiasis control program (PCE) needs to be reassessed. The stability of the indicators may not fully reflect reality because of the possible underreporting of cases. A more integrated and sustained approach is recommended to improve surveillance, diagnosis, treatment and control strategies for schistosomiasis in Brazil (Silva&Wanderley, 2022).

A study by Cruz et al. (2020) on schistosomiasis in Sergipe revealed a worrying picture, with an increasing trend in cases and a high parasite load between 2008 and 2017. During this period, there was a significant decrease in adherence to the Schistosomiasis Control Program (PCE) and in the number of tests performed, indicating a reduction in the program's actions and a possible underreporting of cases. This scenario contrasts with the broader analysis presented in this research, which addresses epidemiological data between 2010 and 2021, showing that, despite the efforts of the PCE, the Northeast Region and Southeast Region of Brazil still record the highest incidence of cases, reflecting ongoing challenges in the management and control of the disease.

It is important to emphasize, however, that the program faces significant challenges, including the need to maintain and strengthen surveillance and control measures to sustain the objectives achieved. The decrease in operational action after 2007 is a point of concern, as it may compromise the progress made to date. Therefore, developing strategies to overcome these challenges, such as strengthening epidemiological surveillance, developing health education programs and implementing more effective basic sanitation policies, is crucial.

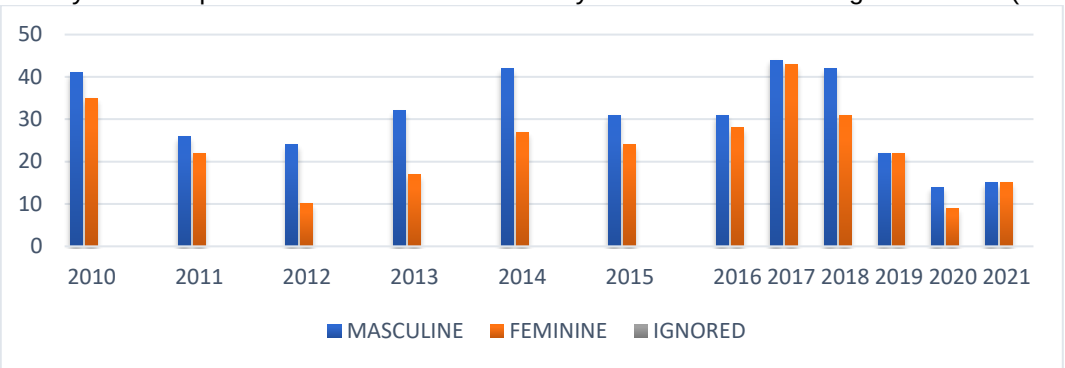
When analyzing data from the Notifiable Diseases Information System (SINAN) on the prevalence of schistosomiasis, it is possible to observe significant variations on the basis of factors such as sex, age range, and race. This information is essential for identifying inequalities and guiding public health strategies that more effectively meet the needs of different population groups.

The prevalence of schistosomiasis is greater among males (Graph 13, 14, 15, 16, 17). As highlighted by Costa e Silva Filho (2021), this prevalence is largely because men often engage in activities such as fishing and agricultural work, which increases their contact with contaminated water. In addition, they tend to adopt risky behaviors, such as swimming in rivers and lakes without proper precautions, and seek medical care less

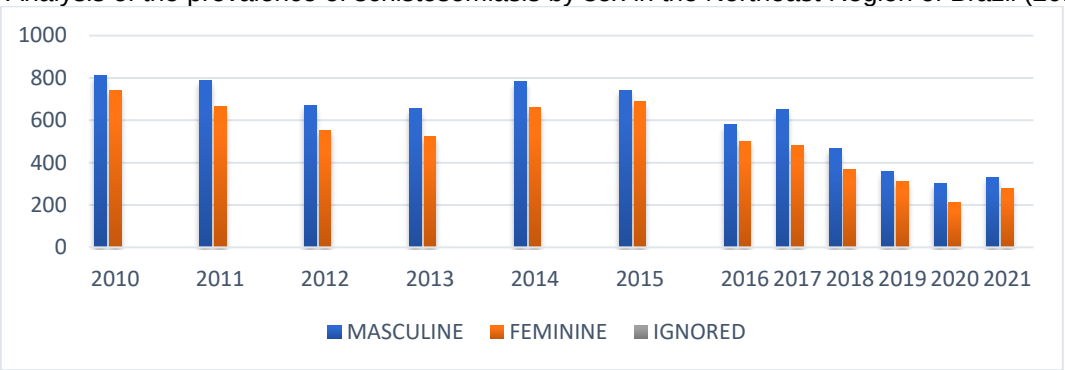
frequently, which can lead to late diagnoses.

This pattern suggests the need for further investigation into the reasons behind this gender disparity, including biological, behavioral, and socioeconomic factors that may contribute to men's greater vulnerability to schistosomiasis. This information is critical for developing prevention and treatment strategies that consider sex differences.

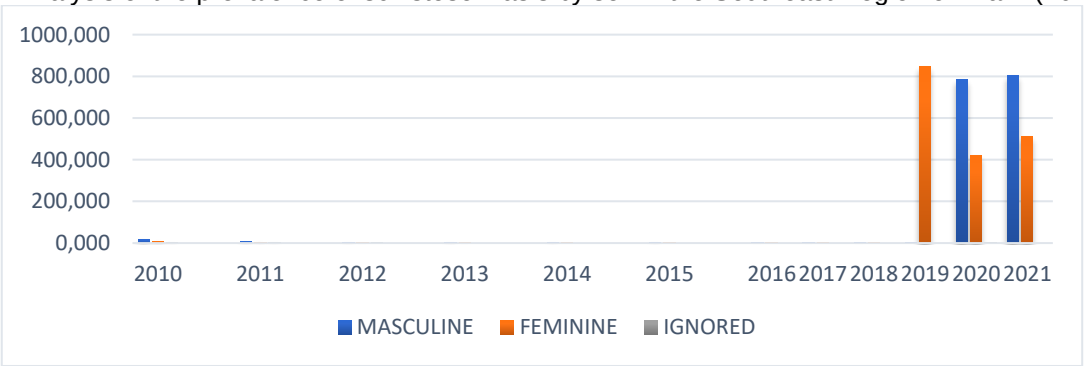
Graph 13. Analysis of the prevalence of schistosomiasis by sex in the northern region of Brazil (2010--2021).



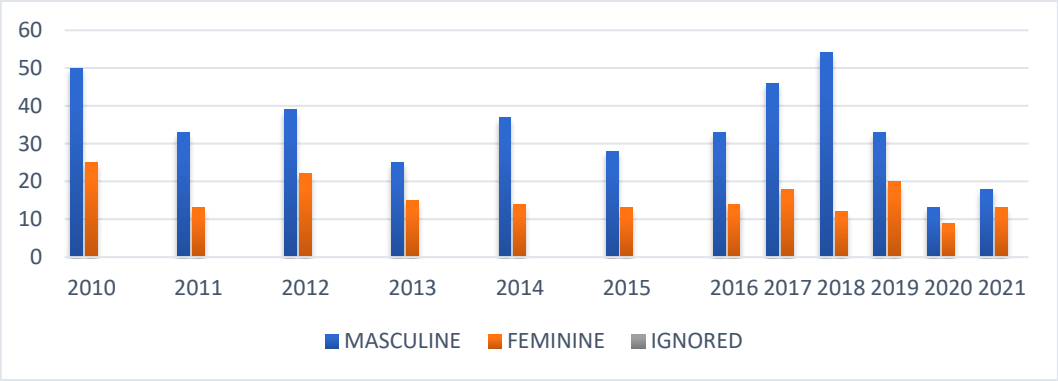
Graph 14. Analysis of the prevalence of schistosomiasis by sex in the Northeast Region of Brazil (2010--2021).



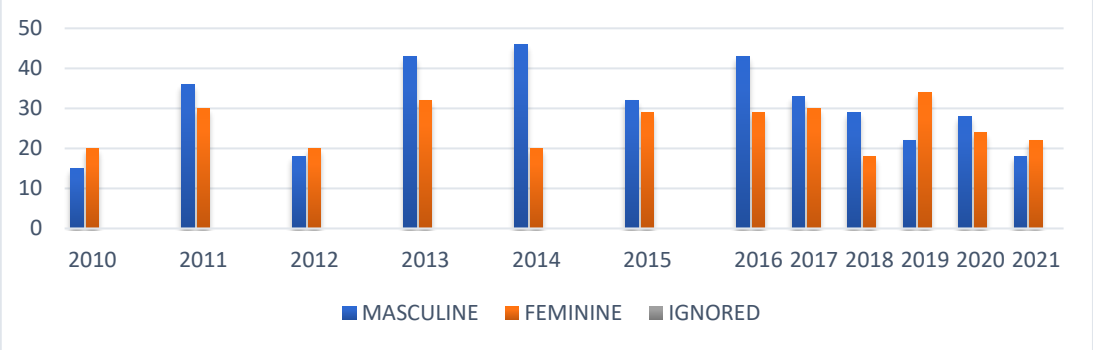
Graph 15. Analysis of the prevalence of schistosomiasis by sex in the Southeast Region of Brazil (2010--2021).



Graph 16. Analysis of the prevalence of schistosomiasis by sex in the southern region of Brazil (2010--2021).



Graph 17. Analysis of the Prevalence of Schistosomiasis by Sex in the Midwest Region of Brazil (2010--2021).



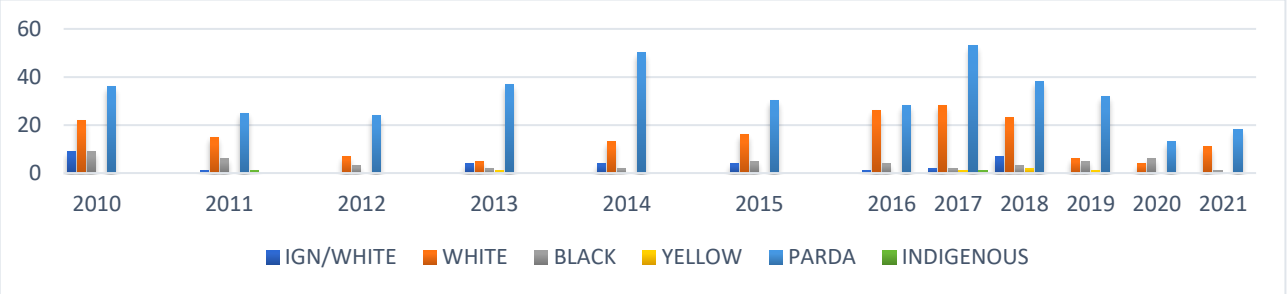
According to the data obtained, the disease was predominantly found among people of mixed race in the North, Northeast, Southeast and Midwest Regions. Mixed race populations often face challenges related to poverty, such as limited access to health services, basic sanitation and inadequate housing, which increases their vulnerability to schistosomiasis. In contrast, in the southern region, the prevalence was greater among white people (Graph 18, 19, 20, 21, 22).

With respect to the South region, there is a certain discrepancy between the data from the Notifiable Diseases Information System (SINAN) and the Schistosomiasis Control Program (PCE), concerning positive cases. As previously described, according to the Schistosomiasis Control Program (PCE), data collected for positive cases of schistosomiasis were collected up to 2011. However, when we consulted the Notifiable Diseases Information System (SINAN), cases in 2021 referred to the gender variable, which resulted in failure in the communication of the systems, making it difficult to accurately understand the epidemiology of schistosomiasis. While SINAN focuses on reporting cases of various diseases and its data are subject to review, the PCE focuses on specific control actions, resulting in data that may not reflect the reality of the disease in certain regions. This lack of alignment prevents the formulation of effective public health policies and the implementation of appropriate interventions.

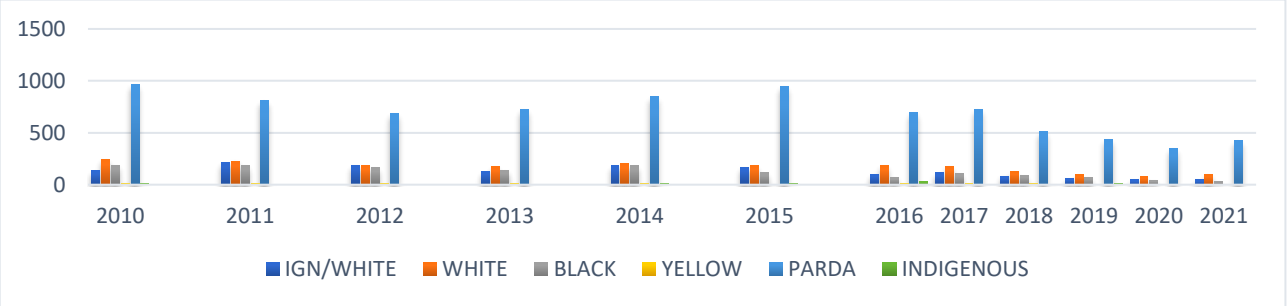
These data suggest significant regional variation in the distribution of disease, which

may indicate the influence of socioeconomic, environmental, or genetic factors specific to each region (Andrade et al., 2022).

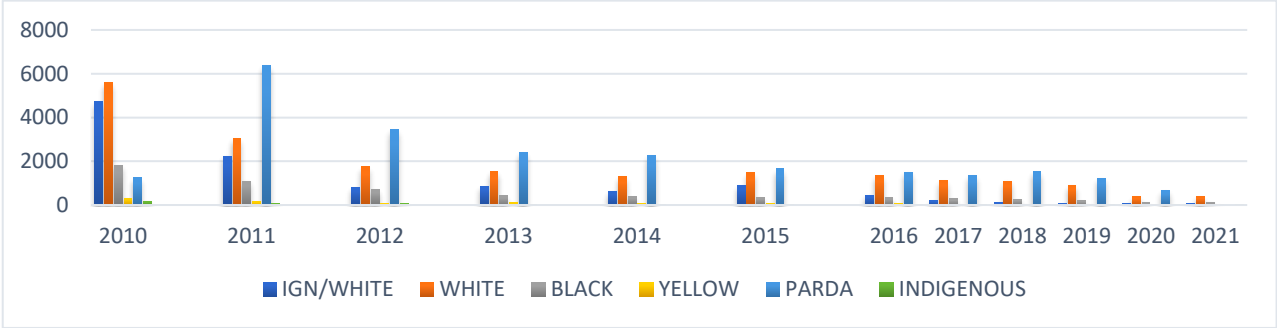
Graph 18. Analysis of the prevalence of schistosomiasis by race in the northern region of Brazil (2010-2021).



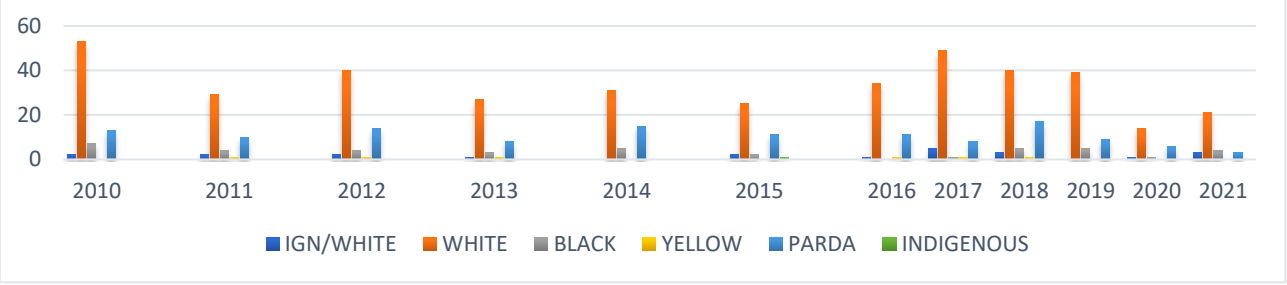
Graph 19. Analysis of the prevalence of schistosomiasis by race in the Northeast Region of Brazil (2010--2021).



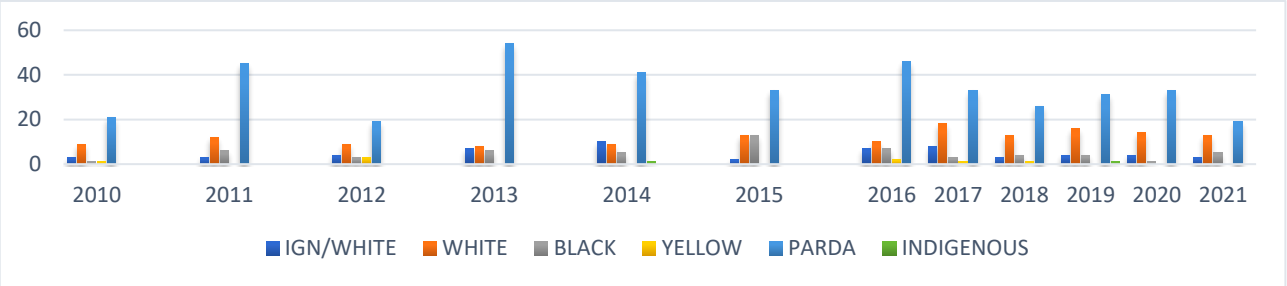
Graph 20. Analysis of the prevalence of schistosomiasis by race in the Southeast Region of Brazil (2010--2021).



Graph 21. Analysis of the prevalence of schistosomiasis by race in the southern region of Brazil (2010--2021).



Graph 22. Analysis of the Prevalence of Schistosomiasis by Race in the Midwest Region of Brazil (2010--2021).



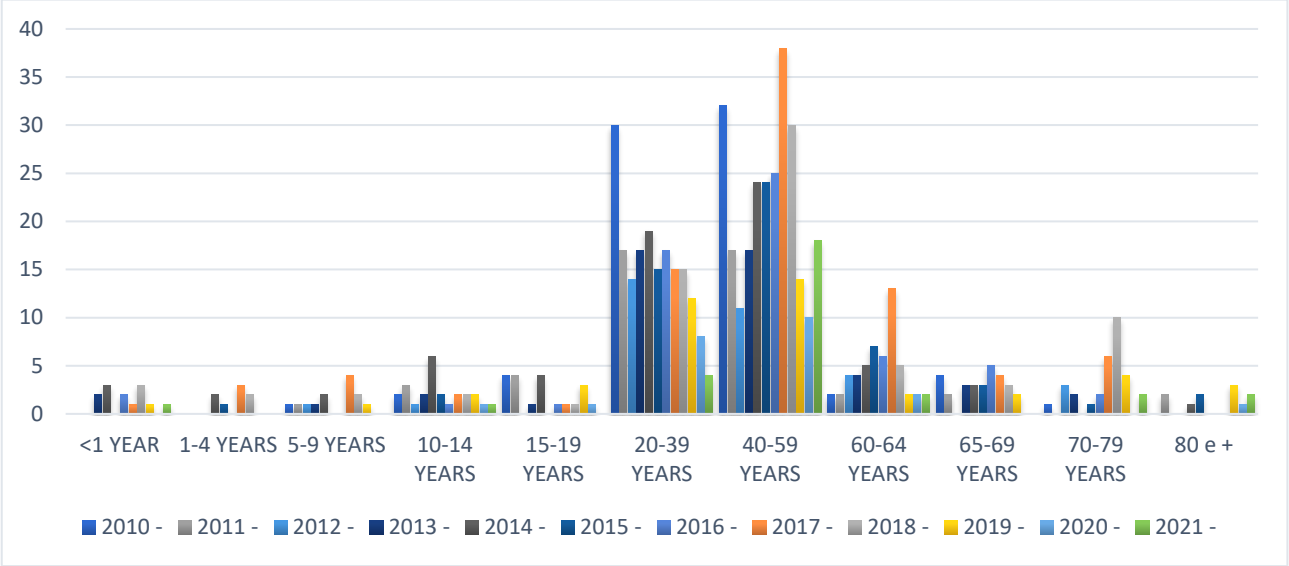
The age range of schistosomiasis patients presents significant regional differences. In the North Region, the predominant range is 40-59 years old, suggesting a concentration of cases in a more mature age group. This situation may be related to greater accumulated exposure to the parasite throughout life, especially in rural areas, where the population frequently interacts with contaminated bodies of water (Graph 23, 24, 25, 26, 27).

In Northeast, the age distribution has changed over time. Until 2015, the predominant range was 20--39 years of age, but between 2015 and 2021, there was a transition to the 40--59 years of age. This change may indicate an evolution in the demographics of cases or changes in risk factors over the years, resulting in an increase in incidence among older people.

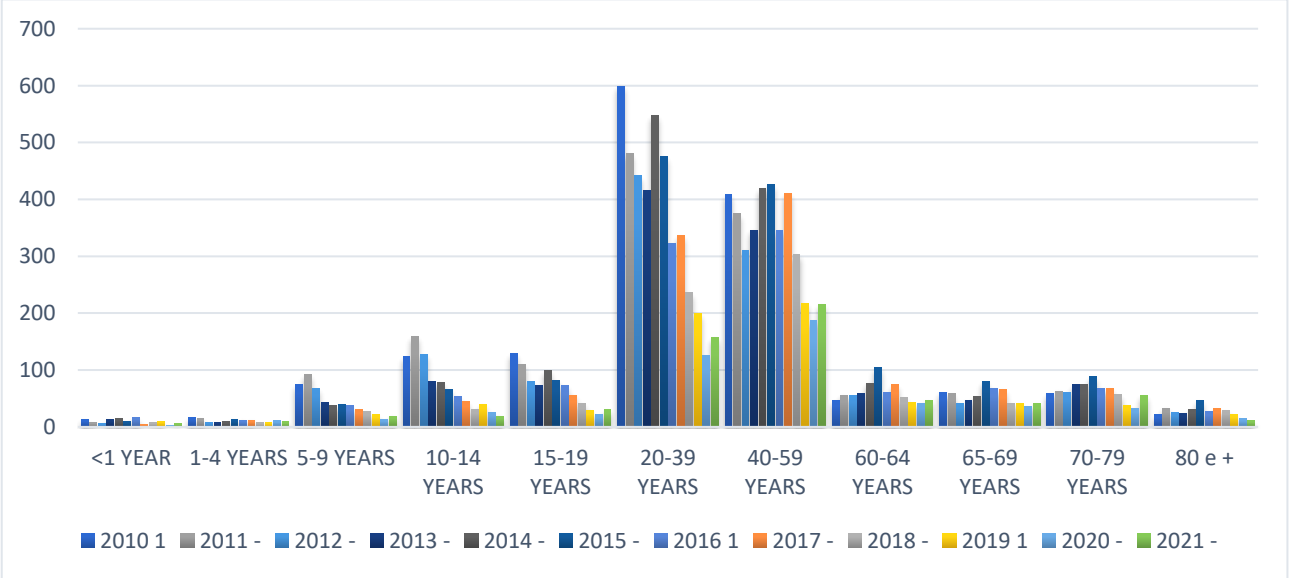
In the Southeast, South and Central-West Regions, the most affected age group is 20--39 years, which suggests that young adults are more exposed to activities that favor infection, such as agricultural work, the use of contaminated water and recreational practices in affected areas (Costa e Silva Filho, 2021).

Furthermore, the detection and treatment of schistosomiasis may be more common among younger people in some regions, whereas older adults may not seek medical care until the disease becomes more severe. The relationship between socioeconomic conditions and health also influences the prevalence of schistosomiasis, as factors such as education, access to information and health services vary between regions and age groups.

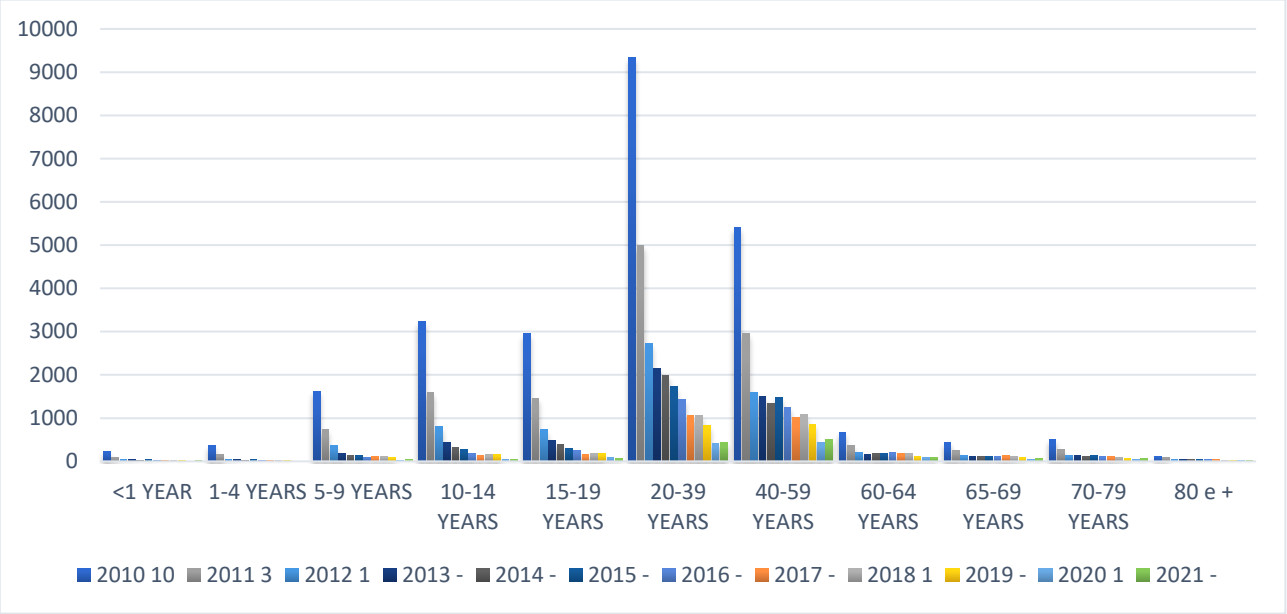
Graph 23. Analysis of the Prevalence of Schistosomiasis by Age Group in the Northern Region of Brazil (2010--2021).



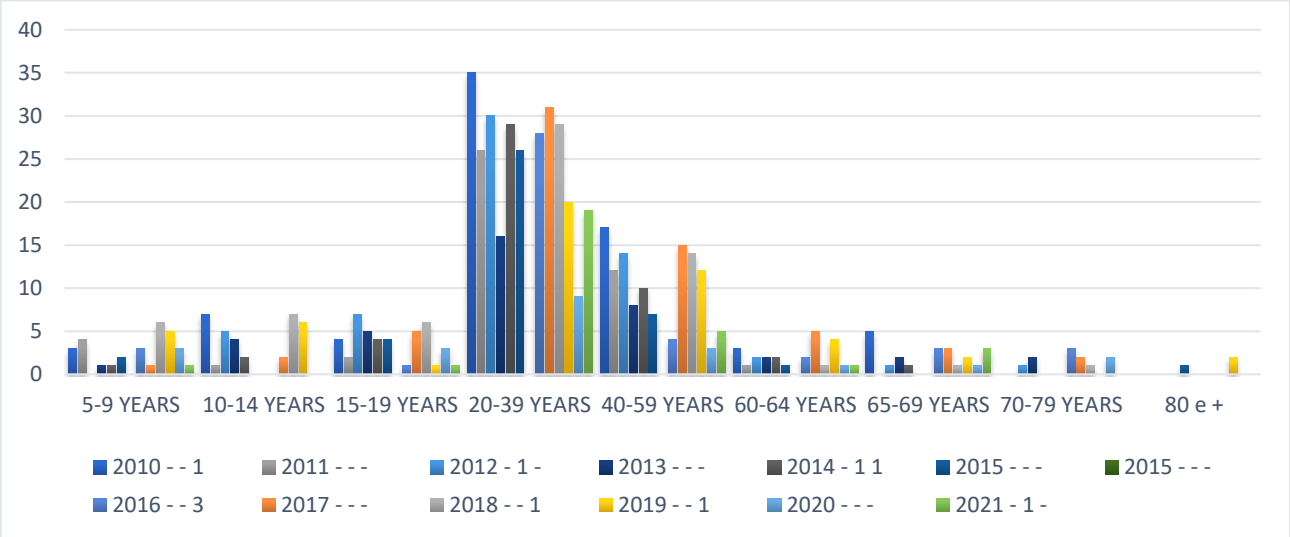
Graph 24. Analysis of the Prevalence of Schistosomiasis by Age Group in the Northeast Region of Brazil (2010--2021).



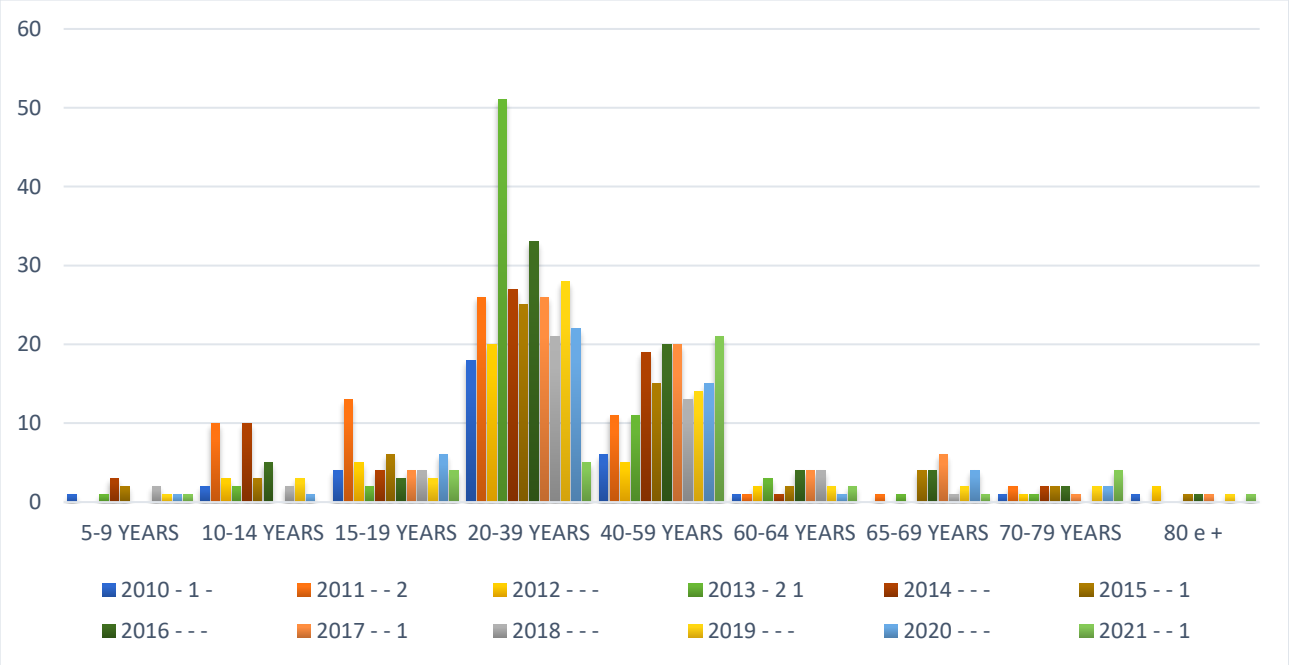
Graph 25. Analysis of the Prevalence of Schistosomiasis by Age Group in the Southeast Region of Brazil (2010--2021).



Graph 26. Analysis of the Prevalence of Schistosomiasis by Age Group in the South Region of Brazil (2010--2021).



Graph 27. Analysis of the Prevalence of Schistosomiasis by Age Group in the Midwest Region of Brazil (2010--2021).



In 2010 and 2013, the regions with the highest prevalence of reported cases of schistosomiasis were Northeast, with more than one million and five hundred thousand cases, respectively, and Southeast, which recorded approximately 948 thousand cases. The high prevalence in Northeast is directly related to the contact of the population with water contaminated by the larvae of the parasite Schistosoma, which develops in snails in aquatic environments. Many of these affected areas are rural or located near urban centers, where the population uses rivers and lakes for leisure and hygiene activities, thus facilitating the transmission of the disease. Although the Southeast Region is more developed than other parts of Brazil are, there are still areas with poor sanitation conditions that favor the spread of the disease. The presence of rural areas on the outskirts of large cities, where people can access contaminated bodies of water, also contributes to the spread of schistosomiasis. Furthermore, the migration of individuals from endemic regions to Southeast in search of better living conditions may have introduced the disease into areas where the prevalence was historically low.

Agricultural activities that depend on water from rivers and lakes increase the risk of infection, especially in regions with snail hosts. Finally, social inequality can affect access to health information and medical services, resulting in late diagnosis and higher case reporting.

Between 2010 and 2017, Brazil recorded a worrying trend in cases, with specific regions of the country, such as Northeast, being the most affected. The variations in the numbers reflect not only environmental conditions but also social inequalities that influence

the population's exposure to the disease. Inadequate control of water sources and lack of basic sanitation are key factors that contribute to the persistence of the disease. According to a study on the epidemiological profile of schistosomiasis in Brazil between 2010 and 2017, the data highlight the importance of regional monitoring to understand the concentration of cases and direct appropriate control actions (SILVA et al., 2019).

The period analyzed reveals that, despite surveillance and control efforts, schistosomiasis continues to be a public health challenge. The distribution of cases often follows geographic patterns related to the presence of rivers and flood areas, where snails proliferate. Furthermore, there is a significant impact on health systems due to the chronicity of the disease and its complications, which can include hepatomegaly and liver fibrosis in advanced stages.

The data collected by the SINAN described above indicate that men were the most affected by schistosomiasis during the period analyzed. This pattern may be associated with occupational activities typically carried out by men in rural and peri-urban areas, such as agriculture and fishing, which involve greater contact with contaminated bodies of water. Although there is a male predominance, it is essential that public health policies consider both sexes, considering their different forms of exposure to the disease.

The age group also significantly varied in terms of the prevalence of cases. This study revealed that most of the reported cases involved children and young adults, especially those in the 5–14 years age group, who tend to have more contact with contaminated aquatic environments. This group is considered more vulnerable since the infection can compromise long-term development. In adults, the 20--39 age group also presented high rates, indicating that work activities in rural areas continue to be a significant risk factor.

With respect to the race/color variable, schistosomiasis disproportionately affects individuals who self-identify as black or brown. This reflects the socioeconomic disparities in Brazil, since these populations often live in areas with inadequate infrastructure and without adequate access to basic sanitation. These studies reinforce that these groups face greater exposure to the disease and have less access to preventive care and treatment, which exacerbates health inequalities.

Therefore, it is essential to consider these variables when developing more effective and fair control strategies that recognize the differences in exposure and vulnerability to schistosomiasis among different population groups.

CONCLUSION

It can be concluded that the prevalence of schistosomiasis varies significantly among the different regions of Brazil and is influenced by a series of socioeconomic, environmental and structural factors. The North and South regions have been less affected by the disease and show a tendency to continue without reported cases. In contrast, the Southeast and Northeast have recorded increasingly lower numbers of infections.

The mollusks that transmit schistosomiasis are not found in the North or South Region, and their presence in Southeast is decreasing. In Northeast, although the population of transmitting snails has decreased, it remains stable, which may explain the persistence of positive cases in the region.

In terms of race, sex and age, schistosomiasis shows distinct patterns. Individuals of mixed races are more affected in several regions, whereas in South, the prevalence is higher among whites, reflecting socioeconomic inequalities. Men have a relatively high infection rate, possibly due to work activities that expose them to contact contaminated water.

In terms of age, the disease is more common among adults aged 40--59 years in North and among young people aged 20--39 years in Southeast, South and Central, which may be related to the activities performed by these groups. In Northeast, there is a change in the age parameter, with an increase in cases among older people.

The most affected regions, especially Northeast, face challenges related to contaminated water and inadequate sanitation conditions. Even in Southeast, which is more advanced in development, there are still vulnerable areas. Therefore, it is crucial to implement public health strategies that consider these regional and demographic differences, aiming to combat schistosomiasis effectively and sustainably.

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THE LEGAL PROTECTION OF PEOPLE WITH ASD: AN ANALYSIS OF TOPIC 1082 OF THE STJ AND THE BRAZILIAN LEGAL SYSTEM

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ABSTRACT

This article addresses the legal protection of people with Autism Spectrum Disorder (ASD) in Brazil, analyzing Theme 1082 of the Superior Court of Justice (STJ) and its relationship with the Brazilian legal system. Through a literature review and analysis of current legislation, we seek to understand the advances and challenges in the recognition and guarantee of the rights of people with ASD, especially in the context of inclusive public policies and the responsibility of the State to ensure adequate care. Topic 1082 of the STJ, which discusses the mandatory provision of therapies for people with ASD by health plans, is analyzed from the perspective of fundamental rights and the dignity of the human person. The article highlights the relevance of a legal approach that promotes the inclusion, equality, and protection of people with ASD, in accordance with constitutional principles and international regulations ratified by Brazil.

Keywords: Autism Spectrum Disorder (ASD). Legal protection. Inclusive public policies. Fundamental rights.

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INTRODUCTION

Brazil has one of the largest health care programs in the world, the SUS, despite this it is known that the operation of the program is far from ideal. Because of this, people have, more and more, sought private health care programs, health plans.

Operators, in turn, as companies that they are, always aiming at the highest possible profit, as a rule draw up contracts that, because they are adhesion, privilege their own interests, placing consumers in a situation of flagrant vulnerability. It is not uncommon for the operator, in view of the cost of the treatment to which the consumer needs to be submitted, to deny authorization or even terminate the contract in order to evade coverage. And this type of situation has become routine in cases of treatment of people with ASD (Autism Spectrum Disorder).

Autism Spectrum Disorder is a neurological condition that affects development completely, with more emphasis on the areas of **communication**, **social interaction** and **behavior, covering** a wide range of manifestations, which can vary from person to person, from mild cases, in which the person is able to lead a relatively independent life, to severe cases, that require specialized care throughout life.

Precisely because of the specificity of the disorder, its treatment is **multidisciplinary** and personalized, taking into account the needs of each individual, including Applied Behavior Analysis (ABA), occupational therapy, speech therapy, psychology, cognitive-behavioral therapy (CBT), educational interventions, school tutoring, hippotherapy, art therapy, music therapy, as well as medical and medication follow-up to control **anxiety**, **hyperactivity**, or even **aggressiveness. It is, therefore, an expensive and long-term treatment; This has motivated the unilateral termination of many health care contracts by operators.**

With an eye on this, the Superior Court of Justice, when judging REsps. Nos. 1,842,751/RS and 1,846,123/SP under the system of repetitive appeals, issued Topic No. 1082, bringing an important understanding for the protection of health plan users, prohibiting the interruption of collective health plan contracts where people who are hospitalized or undergoing continuous medical treatment appear, until the respective discharge.

However, health plan operators have argued that this understanding does not apply to people with Autism Spectrum Disorder (ASD), under the justification that autism is a permanent condition and, therefore, there is no possibility of medical discharge.

Regarding specific legislation aimed at people with Autism Spectrum Disorder (ASD), the National Congress had already enacted Federal Law No. 12,764/2012, which

establishes the National Policy for the Protection of the Rights of Persons with Autism Spectrum Disorder and promotes an amendment to § 3 of article 98 of Law No. 8,112, of December 11, 1990. This legal provision is commonly known as the Berenice Piana Law. Subsequently, Federal Law No. 13,977/2020 modified this legislation, creating the Identification Card for Persons with Autism Spectrum Disorder (Ciptea), receiving the name Romeo Mion Law. Several other rules have been enacted and are part of the legal set intended for the protection of the rights of people with ASD, which will be discussed throughout this work.

These legal provisions emerged as fundamental mechanisms to guarantee the rights of people with ASD, while meeting not only the fundamental objectives of the nation, as described in the Federal Constitution, but also the country's own structuring principles, highlighting, in particular, the appreciation and protection of the dignity of the human person, according to article 1, item III, of the Federal Constitution.

Currently, it is recognized that there is a great challenge in ensuring the effectiveness of the rights of people with ASD. The difficulties associated with this challenge are not merely circumstantial. Historically, humanity has tended to move away from members who, for whatever reason, do not fit into the prevailing social patterns. Although this distancing, in many situations, has ensured collective survival, it has also resulted in the exclusion of individuals who most need acceptance to achieve a dignified life, with freedom and justice.

Therefore, this article seeks to refute this argument, defending the understanding that people with ASD are indeed benefited by Theme No. 1082 of the STJ, in the light of several legal norms and constitutional and infra-constitutional principles, notably the "Berenice Piana Law", the Statute of the Child and Adolescent, the UN Convention on the Rights of Persons with Disabilities, the Consumer Protection Code, among others.

TOPIC NO. 1,028 OF THE SUPERIOR COURT OF JUSTICE

It is necessary to clarify that the issuance of Topic No. 1082 by the Superior Court of Justice (STJ) did not come "out of nowhere", but rather because of the need to establish a uniform understanding about the continuity of collective health plan contracts in specific situations, with a focus on the protection of consumer rights. This decision has become essential due to the numerous legal disputes involving health plan operators and their beneficiaries, often motivated by the abrupt interruption of essential treatments, generating an imminent risk to the health and lives of users. Exactly for this reason, the thesis established is so direct, leaving no room for distorting interpretations:

> The operator, even after the regular exercise of the right to unilateral termination of the collective plan, must ensure the continuity of the care prescribed to hospitalized users or those in full medical treatment to guarantee their survival or physical safety, until effective discharge, provided that the holder bears the full consideration due. (STJ)

The teleological interpretation of the content of the judgment leaves no doubt that the spirit of the judges was directed to guarantee the right to health as a fundamental right, enshrined in the Federal Constitution. Article 6 of the Constitution lists health as one of the primordial social rights, ensuring its protection through a series of legal provisions that aim to protect the well-being of the population. In this context, the STJ, by establishing a clear and objective thesis, sought to avoid abuses by health plan operators, ensuring that the continuity of health treatment was not compromised by merely contractual or commercial issues.

In addition, the relevance of the thesis established by Topic No. 1082 is emphasized by the socioeconomic context in which many Brazilians depend on collective health plans to access quality medical services. Group plans, unlike individual plans, are commonly signed by companies, associations or class entities and, due to this nature, are usually unilaterally terminated by operators. These terminations, in many cases, occur without proper protection for beneficiaries who are in critical health situations, which motivates the Judiciary to act in the protection of consumers.

A central point in the judgment is the emphasis on the principle of contractual good faith, which permeates all consumer relations, including health insurance contracts. Good faith, as provided for in article 422 of the Civil Code, requires that the parties act with loyalty, transparency and respect for each other's legitimate interests. In the context of health plans, this means that operators have the obligation to respect the legitimate expectations of consumers, especially in cases involving the health and life of users.

The thesis established by the STJ reinforces this obligation by establishing that the operator must ensure the continuity of the care prescribed to hospitalized users or in full medical treatment guaranteeing their survival or physical safety, even after the regular exercise of the right to unilateral termination. This decision seeks to balance the contractual relationship, preventing economic interests from overriding the fundamental rights of consumers. However, for the processing to continue, it is necessary that the holder fully bears the consideration due, which also demonstrates an attempt to balance the interests of the parties involved.

The right to health is widely protected both by constitutional norms and by infra-constitutional legislation. Article 196 of the Federal Constitution is a clear example of this,

when it establishes that "health is a right of all and a duty of the State, guaranteed through social and economic policies aimed at reducing the risk of disease and other health problems and universal and equal access to actions and services for its promotion, protection and recovery". Based on this premise, the Judiciary has a fundamental role in ensuring that the guarantees of health protection are effectively respected, both by the government and by private entities, such as health plan operators.

The STJ's decision in Topic No. 1082 is a manifestation of this protective role, ensuring that ongoing treatments are not abruptly interrupted. According to Sestelo (2017), the interruption of medical treatments, especially in cases of chronic or serious diseases, can cause irreparable damage or even lead to the death of the patient. Therefore, the continuity of treatment is a measure of justice and protection of the dignity of the human person, a fundamental principle of our Constitution.

The Health Plans Law (Law No. 9,656/1998) is an important regulatory framework in Brazil, establishing guidelines for the operation of operators and the provision of services to beneficiaries. Although the law includes several consumer protections, there are still gaps that the Judiciary needs to fill, especially when it comes to contract terminations and the continuity of essential treatments. Article 35-C of this law, for example, obliges operators to cover urgent and emergency care, but does not specify what happens when there is a unilateral termination of collective contracts, generating the need for interventions such as that of the STJ.

The judgment of Topic No. 1082 is not isolated; It adds to a series of precedents that reinforce the protection of consumers in situations of vulnerability. In previous decisions, the STJ had already expressed itself in the sense of protecting the continuity of health treatments, even in cases of default, based on the principle of human dignity and the preservation of life. Such decisions reiterate the commitment of the Judiciary to ensure that fundamental rights are not sacrificed for economic reasons.

According to Nunes (2000), the jurisprudence of the STJ has been a bulwark in the defense of the rights of health plan users, especially in situations involving the termination of collective contracts. The author points out that the STJ's performance is crucial for the construction of a legal system that effectively protects consumers, since sectoral regulation is not always sufficient to guarantee these rights.

The establishment of the thesis by Theme No. 1082 has direct and practical impacts on the lives of thousands of Brazilians. On the one hand, it ensures that patients undergoing treatment are not left helpless, guaranteeing the right to continuity of medical care, as long as the established conditions are met. On the other hand, this decision

imposes a burden on health plan operators, who must maintain the treatment even after contract termination, which may generate debates about the economic sustainability of the sector.

However, experts point out that health protection must always prevail. According to Sestelo (2017), the STJ's decision represents a significant advance in the protection of consumer rights and sets an important precedent for future legal issues. The author argues that, although operators may face difficulties, it is the duty of the State and society as a whole to ensure that the right to health is effectively respected. In addition, the decision also influences the way collective health plan contracts are drafted. With the need to ensure the continuity of treatments, operators should adopt more transparent and responsible measures in the management of these contracts, which, in the long term, can contribute to greater stability and confidence in the sector. In this way, the thesis established by Topic No. 1082 not only strengthens the existing legislation, but also serves as a basis for future legal interpretations, consolidating health as a right that must be respected and protected in all circumstances.

THE BERENICE PIANA LAW AND THE PROTECTION OF THE TREATMENT OF PEOPLE WITH ASD

Law No. 12,764/2012, known as the "Berenice Piana Law", represents a historic milestone in the defense of the rights of people with Autism Spectrum Disorder (ASD) in Brazil. This legislation established the "National Policy for the Protection of the Rights of Persons with Autism Spectrum Disorder", officially recognizing autism as a disability, as expressed in article 1, paragraph 2, which ensures people with ASD the same rights attributed to other people with physical or psychological disabilities. Thus, access to appropriate health services adapted to their needs has become a guaranteed and inalienable right (BRASIL, 2012).

Among the most significant aspects of the "Berenice Piana Law" is the guarantee of comprehensive and continuous care for people with autism. According to Costa (2013), continuity in treatment is essential for the progress and quality of life of patients with ASD. The abrupt or arbitrary interruption of this care can severely impair the development already achieved, causing stagnation or even regression. Therefore, the law recognizes the importance of continuous and specific treatments, ensuring that the personal and social development of these people is not interrupted without medical justification.

In addition, the "Berenice Piana Law" is directly aligned with the principle of full protection, reinforced by Theme 1082 of the Superior Court of Justice (STJ), which

determines the continuity of medical care for health plan users until medical discharge is granted. According to Rotta et al. (2006), autism, as it is a permanent condition, has no prospect of conventional medical discharge, which makes any justification for contractual termination based on this premise an affront to the rights established by current legislation. The interpretation of the rule shows that continuous and specialized treatment is indispensable, and the permanent condition of autism cannot be used as an argument to suspend essential care.

The commitment of the Berenice Piana Law to the protection of people with ASD reflects a legislative awareness of the importance of continuous support. The legislation recognizes that the development of people with autism is gradual and depends on therapeutic interventions that meet the specific needs of each individual. Thus, interrupting these essential services violates not only the development of the patient, but also the principles of dignity and fundamental rights enshrined in Brazilian legislation (BRASIL, 2012).

The relevance of this law extends beyond the specific measures it offers, promoting a change of perspective in the treatment of people with ASD. The recognition of the importance of continuous treatments and specialized support points to the need for an inclusive and accessible health system, which values quality of life and human development. Thus, as Costa (2013) points out, the great challenge is to ensure that these legal achievements are effectively implemented, ensuring that all people with ASD receive the necessary care to live with dignity.

THE STATUTE OF THE CHILD AND ADOLESCENT (ECA) AND FULL PROTECTION

In Brazil, Law No. 8,069/1990, which established the Statute of the Child and Adolescent (ECA), has consolidated itself as one of the main legal frameworks for the protection of the rights of children and adolescents. This statute not only recognizes, but also promotes the notion of absolute priority to ensure the protection and healthy development of young people. According to article 7 of the ECA, the right to life and health must be fully and uninterruptedly safeguarded, imposing on the State, the family, society and private entities the obligation to ensure the necessary conditions for the physical, mental, moral, spiritual and social development of children and adolescents.

The ECA highlights that the right to health must be guaranteed in an "integral" way. Article 11, § 2, is clear in stating that adequate care for children and adolescents with disabilities must be provided without any form of discrimination or interruption. This includes, of course, the right of children and adolescents with Autism Spectrum Disorder

(ASD) to continuous and appropriate treatments, essential for their development. In this sense, the unilateral termination of a health plan contract that interrupts a necessary medical treatment constitutes a violation of the principle of full protection, which is one of the most important pillars of the ECA. The statute ensures that children and adolescents are individuals with their own rights, and as such, they deserve special care and protection.

The Federal Constitution, in its article 227, further strengthens this commitment by determining that it is the duty of the family, society and the State to ensure, with absolute priority, the rights to life, health, food, education, leisure, dignity, respect, freedom and family and community life. The ECA follows this constitutional guideline and highlights, in several of its articles, the need for full protection, which implies that the measures taken in favor of children and adolescents must always seek the best interest of these individuals.

The concept of full protection means that all children and adolescents must be treated as subjects of rights, and these rights must be ensured in a priority and comprehensive manner. For children and adolescents with ASD, this implies treatment that addresses all their specific needs, including ongoing medical care, multidisciplinary therapies, and educational support. Autism is a condition that affects multiple areas of human development, requiring a constant and specialized therapeutic approach. The ECA, by guaranteeing the right to comprehensive health, reflects the urgency of ensuring that treatments are provided permanently, without harmful interruptions.

Article 4 of the ECA reinforces the need for public policies and actions aimed at children and adolescents to be implemented with absolute priority, which means protection from any threat or violation of rights, precedence of care in public services, and privileged allocation of resources. Thus, when a health plan operator unilaterally decides to terminate a contract that covers the treatment of a young person with ASD, it not only violates contractual and consumer rules, but also undermines the absolute priority recommended by the statute.

According to the ECA, it is unacceptable that commercial decisions override the fundamental rights of children and adolescents. The vulnerability of these individuals requires a robust protection network, which ensures them the necessary conditions for their development. It is necessary to consider that autism affects social, cognitive and motor development, requiring continuous care so that these children and adolescents can develop their skills and achieve a better quality of life. The abrupt interruption of therapeutic treatments at a critical moment can cause serious damage to the patient's progress, frustrating the advances already made and compromising the possibility of future gains.

THE UN CONVENTION ON THE RIGHTS OF PERSONS WITH DISABILITIES

The International Convention on the Rights of Persons with Disabilities, adopted by the United Nations (UN), is a treaty of extreme relevance for the protection of the rights of persons with disabilities, incorporated into the Brazilian legal system with the force of a constitutional amendment through Decree No. 6,949/2009. This international framework establishes a series of fundamental principles, among which "non-discrimination" and "full and effective inclusion in society" stand out, essential pillars for guaranteeing rights and equality.

Article 25 of the Convention directly addresses the right to health, determining that signatory States ensure that persons with disabilities, including persons with Autism Spectrum Disorder (ASD), as recognized by the "Berenice Piana Law" (Law No. 12,764/2012), have full access to comprehensive health services. This right includes treatments necessary not only for recovery, but also for the prevention of secondary problems, ensuring appropriate and continuous medical care.

In this context, the practice of unilaterally terminating the health plan contract of a person with autism, under the pretext that the continuity of treatment is not in the interest of the operator because it is prolonged and indefinite, constitutes a flagrant violation of Article 25 of the Convention, which has constitutional status. Such action violates the principle of non-discrimination and prevents autistic individuals from having access to essential health care appropriate to their condition, violating a fundamental right guaranteed by international law.

In addition, this attitude configures a clear form of discrimination, as it removes from this person equal opportunities in access to health services, contradicting the obligation to offer care of the "same quality" that is guaranteed to other citizens, without any form of differentiation. The Convention reinforces that persons with disabilities should be treated with the same respect and dignity as any other person, ensuring that health services are provided without distinction.

Continuity of treatment for autism is crucial precisely because it is a permanent condition. This permanence, instead of justifying the interruption of services, reinforces the need for consistent and uninterrupted care. Continuity is essential not only to avoid setbacks in the development of the person with autism, but also to promote their quality of life and social integration. Therefore, refusal or interruption of treatment under financial or contractual allegations violates both the spirit and the letter of the Convention, which calls for health policies and practices that ensure effective and equal protection and inclusion.

The understanding of the Convention, therefore, is that the permanence of the condition of autism imposes an additional responsibility on States and service providers, so that they adopt measures that ensure the continuity of adequate medical care. The dignity of the human person, a basic principle that underpins the entire treaty, demands that people with ASD be treated with the same seriousness and commitment to the protection of their rights, highlighting the importance of maintaining health treatment without arbitrary interruptions, in order to promote inclusion and equality in all aspects of social and community life.

THE CONSUMER PROTECTION CODE AND THE PRINCIPLE OF CONTRACTUAL GOOD FAITH

The Consumer Protection Code (CDC) is widely recognized as one of the most complete and detailed consumer protection systems in the world. This legal diploma, of a protectionist nature, regulates all stages of consumer relations, ranging from the design of products and services to their delivery and after-sales support, guaranteeing a series of fundamental rights to consumers. Cláudia Lima Marques (2016) highlights that the CDC promotes a new contractual regime, ensuring that relationships are guided by balance and respect for consumer rights, protecting them against abusive and harmful practices.

The Superior Court of Justice (STJ) has long since consolidated the understanding that the CDC is directly applicable to health plan contracts, with the exception of plans operated under the self-management modality, as provided for in Precedent 608. One of the most relevant provisions for the protection of consumers in these contracts is article 51, item IV, of the CDC, which determines the nullity of contractual clauses that put the consumer at an excessive disadvantage. Such clauses are considered abusive, especially because health plan contracts, for the most part, are adhesion contracts, in which the consumer does not have the opportunity to negotiate the terms. According to Rizzatto Nunes (2000), this nullity protects the consumer against situations that place him in a manifestly inferior position, reinforcing the need for fair treatment in consumer relations.

For this reason, a clause that authorizes the operator to unilaterally terminate a health plan contract, whether individual or collective, while the beneficiary is undergoing continuous medical treatment, is abusive. This practice exposes the consumer to a situation of unfair vulnerability and puts their health and physical integrity at risk. The severity of the situation intensifies even more when the treatment involves a disability condition, such as Autism Spectrum Disorder (ASD). For people with autism, continuity of treatment is crucial to develop basic skills that allow them to carry out everyday activities in a more autonomous

and dignified way. Marcelo Sodré (2009) argues that the construction of consumer rights involves a broad understanding of their needs, which includes protection against the interruption of essential services, such as health treatment.

The principle of objective good faith, enshrined in article 422 of the Civil Code, requires that the parties involved in a contract act with honesty, loyalty, and cooperation from the formation until the end of the contractual relationship. In the specific case of health plan contracts, the operator assumes the responsibility of providing essential services to the health and well-being of the consumer. Such a commitment implies an implicit duty of collaboration and respect, so that the contract is executed in a way that protects the life and integrity of the contracting party. Cláudia Lima Marques (2016) reinforces that objective good faith requires not only that the contracting parties act with transparency, but also that they be loyal in the execution of the contract, especially in situations of consumer vulnerability.

Therefore, claiming that the condition of autism is permanent as a justification for the termination of the contract is a clear example of contractual bad faith. By offering its services, the operator creates a legitimate expectation in the consumer, who trusts in the commitment made to have access to continuous and necessary health treatments. This unfair conduct subverts the purpose of the contract and aggravates the vulnerability of the consumer, who needs the service precisely to treat a condition that requires constant monitoring.

The "business risk theory" is an economic and legal principle that establishes that the entrepreneur, when deciding to carry out a certain commercial activity, must assume the risks inherent to that activity. In the context of health plans, the operator, when entering into a contract with a consumer (whether individual or business), also assumes the risks associated with the treatment of the beneficiaries' health conditions, even if these conditions are permanent.

In the case of people with Autism Spectrum Disorder (ASD), the permanent condition cannot be treated as an exception to the business risk. It is common knowledge that, when signing a health plan contract, the operator requests that beneficiaries fill out forms with information about their health status, history of diseases, previous surgeries, and family history, among others. In addition, the operator has the right to require prior examinations before formalizing the contract.

Therefore, it is not acceptable for the operator to later claim ignorance of the contractor's permanent condition, especially if it chose not to require prior examinations that could have revealed this condition at the time of signing the contract. By acting in this way,

the operator ignores that it has assumed the "business risk" and unduly tries to transfer to the consumer a burden that is intrinsic to its business activity.

Furthermore, autism is not an unknown condition in the health sector. Companies operating in the field of supplementary health care must be fully aware of chronic or permanent conditions that require ongoing treatment and, therefore, must be prepared to bear these risks. Any attempt to argue otherwise represents a clear disrespect for the theory of business risk, compromising the integrity and balance of the contractual relationship.

In summary, the CDC, by protecting consumer rights, establishes clear guidelines to prevent abuses by companies, especially in adhesion contracts, where the contractual balance must be strictly observed. The invocation of the principle of objective good faith reinforces the obligation of health plan operators to respect the fundamental needs of consumers, ensuring that the contracted service is provided ethically and responsibly, especially when it involves the health of people with permanent conditions such as autism.

THE SOCIAL FUNCTION OF THE CONTRACT, THE RIGHT TO HEALTH AND THE PROTECTION OF PEOPLE WITH DISABILITIES IN HEALTH PLANS

The social function of the contract is a fundamental principle of contemporary civil law, expressly provided for in article 421 of the Civil Code, which establishes that the freedom to contract must be exercised with respect to its social function. This principle ensures that contracts are not seen only as instruments of commercial exchange, but as mechanisms that directly impact the lives of the parties involved and society in general. In health plan contracts, this social function is even more relevant, as they not only involve economic interests, but also the right to health and, consequently, the right to life, both guaranteed by the Federal Constitution.

By operating in the supplementary health sector, health plan operators assume an expanded duty of care. They cannot consider permanent health conditions, such as Autism Spectrum Disorder (ASD), as a simple economic burden. Continuity of treatment for people with ASD is essential, not only for the maintenance, but for the progress of the cognitive, motor and social development of these people. Thus, the unilateral termination of contracts, alleging the permanence of the beneficiary's condition, disrespects the social function of the contract and compromises the right to dignity and health.

According to Paim (2013), the 1988 Citizen Constitution reinforces the idea that health is a right of all and a duty of the State, articulating the creation of the Unified Health System (SUS) to guarantee universal and equal access. This constitutional view also

implies that the private sector, including health plan operators, has joint responsibility for health promotion, and its actions must be aligned with the principles of protection and equity. Vieira (2016) also points out that, in times of economic crisis, it is even more crucial that health policies are guided by values of social justice and inclusion, which also applies to the practices of health operators.

Health is a fundamental right guaranteed by the Federal Constitution of 1988, as provided for in articles 6 and 196, which impose on the State and the private sector the duty to guarantee universal and equal access to health services. In the case of people with ASD, this right translates into the need for continuous and multidisciplinary care. Alleging that the permanent condition justifies the termination of the contract goes against the fundamental right to health, which requires continuity of treatment as an expression of this essential right. As Melo (2017) states, public-private relations in the Brazilian health system must be guided by principles of equity and respect for the fundamental rights of users, especially the most vulnerable.

Stopping ongoing treatments can have devastating effects for people with ASD, resulting in stagnation or even regression of previously acquired skills. The operators' argument that the permanent condition makes it impossible to continue coverage is untenable. Medicine is constantly evolving, and advancements in the treatment of complex conditions, including the use of new technologies and artificial intelligence, could transform the therapeutic options available in the near future. Thus, nothing justifies the interruption of care that is fundamental today.

The prohibition of social regression is another essential principle in this debate. This principle, developed in constitutional jurisprudence, prevents the State or private entities from reducing social rights already acquired, especially those related to health and human dignity. Brazil has already won important protections for people with disabilities, and any attempt to limit these rights, such as the unilateral termination of health plans, is an unacceptable setback. Sestelo (2017) addresses how financial dominance and mercantilist practices in the supplementary health sector can compromise equitable access and the protection of beneficiaries' fundamental rights.

The Superior Court of Justice, with Topic 1082, established clear guidelines to protect health plan users in continuous treatment, preventing operators from breaking contracts for economic or administrative reasons without considering the vital needs of beneficiaries. The National Supplementary Health Agency (ANS), as a regulatory body, also has a decisive role in regulating and supervising the performance of operators. Normative Resolution No. 465/2021, amended by Resolution 541/2022, obliges operators to cover

multidisciplinary treatments and therapies for people with ASD, highlighting that continuity of treatment is essential for the health and well-being of patients.

Thus, any decision that interrupts health care under the justification that autism is a permanent condition not only violates constitutional and civil principles, but also disrespects the specific regulations of the ANS. Operators must take responsibility for these risks, as required by the social function of the contract, ensuring that the contracted service is provided ethically and in line with fundamental rights.

CASE-LAW PRECEDENTS

The issue of continuity of health treatments, especially in the case of people with Autism Spectrum Disorder (ASD), has been the subject of special attention by the Brazilian Judiciary. The teleological interpretation of Topic 1,082 of the Superior Court of Justice (STJ) reflects a commitment to ensuring the right to health as a fundamental right, in line with the constitutional principles of human dignity and full protection. The STJ, when issuing decisions that prioritize the well-being of health plan beneficiaries, reinforces the need for contracts to be executed in a way that does not endanger the life and development of people with permanent disabilities, such as autism.

Topic 1,082 establishes that, even after the regular exercise of the right to unilateral termination of a collective plan contract, the continuity of treatment must be guaranteed for hospitalized users or those in full medical treatment that guarantees their survival or physical integrity. In the case of people with ASD, the application of this theme is even more pertinent, as continuous treatment is crucial for the development of their skills and for maintaining quality of life.

Before the consolidation of Topic 1,082, the STJ had already expressed itself in the sense of protecting patients with serious health conditions, including autism. A notable example is the judgment of the Internal Appeal in AREsp 1537299 - SP, reported by Justice Maria Isabel Gallotti, published on 12/19/2019. In this case, the STJ decided that, although the unilateral termination of collective contracts is allowed in some situations, this practice cannot be applied when the beneficiary of the health plan is diagnosed with a serious illness or is undergoing essential medical treatment. The court emphasized that stopping the treatment of a child with ASD, who undergoes cognitive and behavioral therapies, would be unacceptable and harmful.

The decision emphasizes that autism, recognized as a disability by Law No. 12,764/2012 (Berenice Piana Law), requires the provision of comprehensive care, including multiprofessional support. Article 3, item III, of the law guarantees access to health services

adapted to the specific needs of people with ASD, a protection reinforced by jurisprudence that prioritizes the continuity of these services.

The Courts of Justice throughout Brazil have followed this protective line, contributing to the formation of a solid jurisprudence in defense of the rights of people with ASD. The Court of Appeals of São Paulo (TJSP), for example, has issued significant decisions, as in the case of AC 1091577-67.2022.8.26.0100, published on 04/28/2023, and in AC 1001020-58.2023.8.26.0404, with publication on 02/19/2024. In these decisions, the TJSP reaffirmed that the unilateral termination of a health plan contract that covers essential treatment for a person with autism is unacceptable, highlighting the right to health and continuity of treatment.

Similarly, the Court of Justice of Maranhão (TJMA) ruled in Interlocutory Appeal 0824482-57.2022.8.10.0000, published on 05/31/2023, in favor of the continuity of medical care for beneficiaries with chronic conditions. These decisions reinforce the understanding that the right to health and life cannot be compromised by contractual issues that aim only at the economic interest of health operators.

Brazilian jurisprudence, in protecting the rights of people with ASD, has been sensitive to the particularities of these conditions. Continuity of treatment is essential, as interruptions can cause significant setbacks in the development of patients, in addition to impairing their social integration and quality of life. This concern is in line with the principle of the dignity of the human person, which is central to the Brazilian legal system.

The social function of the contract, as previously discussed, is also relevant in these cases. When a health operator signs a contract, it assumes responsibilities that go beyond financial profit, especially when it comes to an asset as essential as health. The practice of unilaterally terminating contracts involving essential treatment is seen as a violation of fundamental rights and contractual balance.

In addition, the understanding consolidated by the STJ and other courts strengthens legal certainty, ensuring that the rights of the most vulnerable people are respected. By applying Theme 1,082 and recognizing the importance of continuity of treatment, the Brazilian Judiciary reaffirms its role as a defender of social rights and human dignity.

CONCLUSION

The condition of autism, due to its unique and complex nature, requires differentiated legal protection that ensures a continuous regime of treatment and specialized monitoring, aiming at the full development of the individual's potential. The right to health, in this

context, is intrinsically linked to the continuity of treatment, and any interruption can cause irreversible damage to people with ASD.

Although health plan operators, supported by the principle of contractual freedom, cannot be forced to maintain indefinitely a business relationship that no longer interests them, it is essential that the needs of beneficiaries undergoing treatment are respected. Thus, in situations where termination becomes inevitable, it is essential to offer viable alternatives, such as the provision of a plan with the same coverage and similar financial conditions, without imposing new grace periods, ensuring continuity of care.

The attempt by some operators to exclude people with autism from the protection conferred by Theme 1082 of the STJ must be firmly contested, considering the entire legal and principled framework that supports the rights of these people. Continuity of treatment for individuals with ASD not only guarantees the right to health, but also protects their dignity and promotes their full inclusion in society. To deny them adequate treatment is, in practice, to deny them the opportunity to live to the fullest extent and to develop the potential that their condition allows.

The Brazilian legal system, through instruments such as the Berenice Piana Law, the Statute of the Child and Adolescent (ECA), the Convention on the Rights of Persons with Disabilities, the Consumer Protection Code (CDC) and the regulations of the National Supplementary Health Agency (ANS), establishes a robust basis of protection for people with autism. Thus, it is up to the Judiciary to reinforce and apply these rights in a broad and unrestricted manner, ensuring that all beneficiaries of health plans have continuous and uninterrupted access to treatment, free from any form of discrimination or violation of their fundamental rights.

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VALIDATION OF AN INSTRUMENT TO ASSESS THE KNOWLEDGE, ATTITUDE AND PRACTICE OF PUERPERAL WOMEN ABOUT THE GENERAL DANGER SIGNS OF THE NEWBORN

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ABSTRACT

The validation of an instrument is essential to ensure its reliability and accuracy. This study aimed to validate an instrument to assess the Knowledge, Attitude and Practice of puerperal women in rooming-in about general danger signs that the newborn may present. The study followed 7 stages: 1st conceptual structuring, 2nd definition of the instrument's objectives, 3rd construction of the items and response scales, 4th selection and organization of the items, 5th structuring of the instrument, 6th content validation and 7th pre-test. Then, the psychometric properties of validity and reliability were evaluated. The statistical analysis of the data evaluated the CVI of pertinence, relevance and clarity for each item and all items evaluated in the final survey had CVI greater than or equal to 0.8 in the pertinence and relevance item. The final version of the instrument was validated containing 41 items separated by 3 domains, Knowledge, Attitude and Practices. The internal consistency of the instrument evaluated by Cronbach's Coefficient showed that the instrument has high reliability with alpha equal to 0.88. Validating this instrument was fundamental, as it enabled the application, analysis, and adequate planning of interventions that can improve the care of newborns and reduce avoidable deaths.

Keywords: Knowledge. Attitudes and Practice in Health. Validation study. Newborn.

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INTRODUCTION

The neonatal phase is the one marked by greater vulnerability and all care for the newborn and the risks that surround it is necessary to reduce infant mortality, which is still high in Brazil, however, care alone is not enough, it needs to be accompanied by adequate, complete and highly recognized execution to protect the individual and his health. (BRAZIL, 2015). This infant mortality rate in Brazil has been a concern for the United Nations, which has proposed as one of its "Sustainable Development Goals in Brazil" to reduce the avoidable deaths of newborns and children in the country. (UN, 2015).

The Child Health Handbook is an important tool in the construction of this care, which is distributed throughout Brazil and has become a fundamental document for the baby, as it accompanies the newborn throughout childhood. In addition to recording all the child's information, it also contains the necessary guidelines for caring for the child, such as identifying danger signs, so that the child grows and develops in a healthy way (BRASIL, 2020).

In this context, knowing the danger signs that the newborn may present is essential when it comes to child care, as a simple change in sleep pattern, or even a difficulty in breastfeeding can be a risk to the life of this baby. For this reason, it is a point highlighted in the Child Health Handbook, and in it, in addition to describing the main general signs of danger that the child may give, the ways in which the mother or caregiver should seek help are also guided so that the emergence of diseases and even death can be avoided (BRASIL, 2020).

Thus, the application of the CAP survey is pertinent because knowledge is knowledge, that is, the ability to transmit definitions on a subject based on previously obtained notions. Attitude is the opinion, the feeling, the emotion that one has about a subject. Practice is acting, the impulse to perform an action (MARINHO, 2003). Thus, CAP research investigates a specific population in order to understand its knowledge, beliefs, and behaviors related to a given topic and, thus, perceive existing gaps in knowledge, cultural convictions, or ways of acting that can influence understanding and action in this context. This type of research direction reveals challenges and impasses when seeking solutions to a problem. The data collected serve to guide better application of resources and develop interventions (WHO, 2009).

Along with this, applying validation because, "validity is the aspect of the measure being congruent with the measured property of the objects and not with the accuracy with which the measurement, which describes this property of the object, is made" (PASQUALI, p.158, 2013). This aspect encompasses three categories that are increasingly used in the

validation processes of instruments in nursing, the validity of content, criterion and construct (OLIVEIRA, 2018).

The first stage of the validation of an instrument is the construction of a theoretical basis of the scale, identifying principles and elaborating their respective indicators. The construction of a solid theory is done from the systematization of all the empirical evidence about the instrument. The empirical data about the construct that is intended to be built will guide the construction of its measurement instrument and, based on them, the researcher will be able to formulate his construct theory and this will guide the construction of the measurement instrument. According to the empirical data that will be collected through the instrument thus constructed, they will determine whether their theory is logical or not (LOCH et al, 2021; PASQUALI, 1998).

The next step is to establish the purpose of the instrument and define the population involved. It is understood that the objectives of the research in question will define the concepts to be investigated and will directly link concept to item and target population to sample. There is an equivalence between the concept and the item, the latter being a practical representation and the former an abstract term, as well as the sample is considered the practical part and the target population, the abstract term. When defining the items, based on the concept, this population-target/sample relationship is taken into account, in the same way that when defining the sample, based on the target audience, the concept/item relationship is taken into account (GUNTHER, 2003).

The construction of the items should be based on the conceptual framework, whether through literature search, existing questionnaires, reports from the target population, clinical observation, or expert opinion (COLUCI, ALEXANDRE, MILANI, 2015). In addition, during development, the social environment in which the questionnaire will be applied, the configuration and arrangement of the instrument and its items must be taken into account (GUNTHER, 2003).

It is necessary to adopt some criteria in the construction of the items, such as the behavioral criterion, that is, the item must express a behavior, it must be able to allow the person a clear and precise action, the objectivity or desirability criterion, which must allow different tastes, preferences, feelings and ways of being. The criterion of simplicity and clarity, which value the expression of a single idea and the use of short sentences, with simple and unequivocal expressions, respectively. The criterion of relevance, that is, the item must not convey an attribute different from the one defined and, finally, the criterion of credibility (face validity), which expresses that the item must be formulated in such a way that it does not appear as ridiculous, unreasonable or childish (PASQUALI, 1998).

In addition to building the items, it is also essential to develop and choose a method to obtain the answers. Response scales can take many forms, and method selection should be guided by the nature of the question at hand. Among the techniques used to create response scales, the most common include direct estimation methods, such as the visual analog scale, adjective scales, Likert-type scales, scales with graphic representations, among others. Each type of scale has its own advantages and disadvantages (COLUCI, ALEXANDRE, MILANI, 2015).

The Likert scales were proposed by Rensis Likert in 1932, and constructed in such a way that they expressed, through the answer, their degree of agreement or disagreement to allow a clear view of the position of individuals in relation to the topic in question. This type of scale has a sequence of items that vary in intensity, the classic being the five-point scale, ranging from "strongly disagree" to "strongly agree". Other scales, such as the four-point scale, are also valid, because, in addition to measuring the variety of opinion, they provide a balance between the positive and negative response alternatives (LIKERT, 1932).

The purpose of the domain specification is to ensure that all relevant domains or concepts have been appropriately addressed by the set of items and that all relevant dimensions have been properly incorporated. Experts should examine whether the content is appropriate for potential respondents, verify the accuracy of the domain structure and its content, and assess whether the material included in the domain is representative enough. In this context, judges can offer suggestions for both adding and removing items as needed (COLUCI, ALEXANDRE, MILANI, 2015).

Then, the judges have the responsibility of analyzing each item in isolation. In addition, this analysis should be conducted taking into account several factors, such as the format of the item, its title, the instructions, the domains addressed, the scores associated with the domains (or the instrument as a whole), and the subsequent analysis of the results. This implies evaluating the clarity and relevance of each aspect to be considered during the evaluation (COLUCI, ALEXANDRE, MILANI, 2015).

The questionnaire structuring phase is the one aimed at finalizing the previous stages, focusing on organizing the items in their corresponding domains and defining the general format of the instrument. In this process, it is important to take into account elements such as the title, instructions, response scales, scores and other relevant details (COLUCI, ALEXANDRE, MILANI, 2015). According to the traditional approach of positivist psychometrics, the recommendation is to start with at least three times as many items as desired in the final result, with the aim of ensuring that one-third of them remain after the final selection (PASQUALI, 1998).

Once you have created and organized the instrument, it will likely have more items than the final questionnaire. This is because it is still necessary to confirm that the selected items are really representative and appropriate to address the different aspects of the construct we want to measure. This verification is carried out through a content evaluation, in which we establish connections between the abstract concepts we are studying and the specific indicators that we can observe and measure (COLUCI, ALEXANDRE, MILANI, 2015)

Content or construct analysis seeks to verify the adequacy of the behavioral representation of latent attributes. In it, the expert judges in the area of the construct will evaluate whether the items refer to the characteristic in question or not (PASQUALI, 2013).

Content validity indicates the extent to which the instrument has an appropriate sample of items to measure the specific construct and adequately cover its domain, so that it is necessarily based on a judgment. Although there are no formulas that attest to a fully adequate coverage of the content of the instrument, researchers increasingly use experts to judge the validity of the content of new instruments (POLIT, BECK, 2011).

After review by the judges, it is crucial to conduct an evaluation of the Content Validity Index (CVI). The CVI is a criterion widely used in the field of health, being used to measure the level of agreement among experts in relation to specific aspects of the instrument and its items, expressing this agreement in the form of a percentage or fraction (ALEXANDRE, COLUCI, 2011).

To calculate the CVI, the Likert-type scale of four variables is used, in the evaluation of relevance point 1: not relevant or not representative, 2: item needs a large revision to be representative, 3: item needs a small revision to be representative, or 4: item relevant or representative. In terms of clarity, point 1: not clear, 2: unclear, 3: fairly clear, 4: very clear. Based on the answer obtained, answers 1 and 2 should be revised or eliminated and only the answers "3" and "4" of each judge in each item analyzed of the questionnaire should be considered for sum, divided by the total sum of answers (COLUCI, ALEXANDRE, MILANI, 2015).

Some authors differ as to the agreement between the judges, Polit and Beck (2011) suggest a CVI of 0.90 as a standard to establish the excellence of the content validity of a scale. On the other hand, Pasquali (1998) states that an agreement of at least 80% among the judges can serve as a criterion for deciding on the relevance of the item to the trait to which it theoretically refers and that items that do not reach an agreement in the application of the factors (about 80%) obviously present problems and it would be the case to discard them from the pilot instrument.

The next step is the application of the final instrument with the target audience, known as apparent validation or face validation. This is done to assess how this audience perceives the relevance of the instrument. The last phase is the reliability analysis, which involves the evaluation of internal consistency and temporal stability through repeated application (test-retest) with the target audience of the final version of the instrument (LOCH, 2021).

Based on this, the objective of this study is to validate an instrument, based on risk signals contained in the Children's Handbook and in the Neonatal IMCI, which can analyze the knowledge, attitudes and practices of puerperal women both in the hospital and in the post-hospital period. This approach will allow a clearer and more objective understanding of the main difficulties that these women have in recognizing the general signs of danger. Thus, in addition to strengthening the bond between the mother-baby binomial, the study will help health professionals to carry out a more quality care practice and promoting health education in a more concise way, in rooming-in and outpatient sectors, taking into account the entire social and economic context of these women.

METHODOLOGY

This is a methodological research with a quantitative approach. This study is part of a larger research entitled **"**Evaluation of the Knowledge, Attitude and Practice of Postpartum Women in the Care of Newborns". It is a validation of the knowledge, attitude and practice (CAP) survey, which is a formative assessment that aims to collect data from a portion of the population and favor the development of interventions.

CAP are used to diagnose and evaluate the effectiveness of interventions or programs. They help to understand the knowledge, attitudes and practices of the population in relation to a given topic. In addition, they can be applied to identify problems and design specific interventions. The objectives of the CAPs include assessing knowledge about diseases, understanding people's feelings about them, and identifying risk behaviors. These questions provide information about protection against diseases and perception of danger (OLIVEIRA et al, 2020).

The research was conducted in the Rooming-in Room of CISAM (Centro Universitário Integrado de Saúde Amaury de Medeiros), University of Pernambuco, located in the northern zone of Recife, in the Encruzilhada neighborhood, in the territory of the Health Sanitary District II in Recife, Pernambuco. It is an Education and Health unit, which is part of the Hospital Complex of the University of Pernambuco – UPE. It has 138 beds in the Hospital unit, all linked to the Unified Health System – SUS, being a state reference in high-

risk pregnancy and childbirth, with care for women, adolescents and people with uteruses in situations of sexual and domestic violence and legal abortion – PROMARIAS, performs gynecological surgeries and also has a Human Milk Bank.

The population was composed of nurses and postpartum women from the teaching hospital. The sample was composed of 20 expert judges for the content validation stage, which had as inclusion criterion specialty or experience in the area of child health and as exclusion criterion to have less than 1 (year) of employment with the health unit, and 30 puerperal women from the maternity hospital to perform the pre-test, As an inclusion criterion, a minimum age of 18 years and being with the newborn in rooming-in were defined, mothers who did not present clinical and/or psychological conditions that would allow the understanding of the study objectives were excluded, so that they could not sign the Informed Consent Form.

Based on the literature review, the items of the instrument were developed so that there was a corresponding item for each domain, knowledge, attitude and practice. The answers to the items in the knowledge domain were dichotomous, yes or no, and those in the attitude domain were given based on a Likert scale: "Not important", "Sometimes important", "Moderate", "Important and Very Important". The items in the Practice domain also had responses on a Likert scale: "Never", "Rarely", "Occasionally", "Often", "Very Frequent".

For the expert judges, each item in each domain was judged as to Relevance, whether it belongs or not, to the domain in question, Relevance, whether it is important, and Clarity, whether it is understandable or not, using a Likert-type scale. In terms of pertinence, the scale was composed of: "Very pertinent", "Pertinent", "Not very relevant" and "Not at all relevant", as for relevance the scale was: "Very relevant", "Relevant", "Not at all relevant" and "Not at all relevant". Following the same conformation, clarity was evaluated based on a Likert-type scale: "Very Clear", "Clear", "Not Very Clear", "Not at all Clear", in addition, if the item was not clear, there was room for a suggestion for change.

The stages of the study followed the seven steps of the construction of instruments proposed by Coluci, Alexandre and Milani (2015), 1st conceptual structuring, 2nd defining the objectives of the instrument, 3rd constructing the items and response scales, 4th selecting and organizing the items, 5th structuring the instrument, 6th content validity and 7th pre-test. At the end, the psychometric properties of validity and reliability were evaluated.

The collection was carried out between the months of October 2022 and October 2023. In the validation phase, the invited judges were given the Informed Consent Form, the

judge questionnaire and the sociodemographic questionnaire. In the pre-test, when inviting the puerperal woman to participate in the research, the Free and Informed Consent Form, the final questionnaire, the semantic analysis instrument and the sociodemographic questionnaire were delivered. The semantic analysis instrument was given to analyze the understanding of the items, the words and the completion of the answers.

For data processing, Microsoft Excel software was used. In the content validation stage, the CVI was calculated. The evaluation was made using a Likert scale scored as follows: 1 = Very pertinent/relevant/clear, 2 = pertinent/relevant/clear, 3 = Not very pertinent/relevant/clear and 4= Not at all pertinent/relevant/clear. In the evaluation of Clarity, in addition to the scale, the judges were given a space to suggest changing the item, if they judged it to be "Unclear" or "Not at All Clear". Answers "1" and "2" of each item received a score of 1 and "3" and "4" a score of 0. At the end, the scores were summed by the number of responses (Figure 1).

Figure 1 - Calculation of the Content Validity Index

$$IVC = \frac{\text{Number of Responses "1" or "2"}}{\text{Number of responses}}$$

Source: adapted from Coluci, Alexandre and Milani (2015)

Items that received CVI equal to or greater than 0.8 were maintained, while those that had lower agreement among the judges regarding pertinence and relevance were eliminated from the instrument. In terms of clarity, the CVI was important to make changes in the formatting of the questions to improve understanding. After the updates in the number and structuring of the items, a new instrument was taken to another 10 judges, who evaluated the items in the same way.

In the analysis of the Pre-test data, reliability was evaluated, that is, whether the instrument really measures what it is intended to measure, by means of Cronbach's Alpha Coefficient, widely used to evaluate the internal consistency of the instruments. To this end, values were assigned to the answers that represent the understanding of the women interviewed, transforming them from a nominal to a numerical scale as follows: Yes=1; No=0; I don't know=0; Not important=0; Sometimes it is important=0.25; Moderate=0.5; Important=0.75; Very Important=1; Never=0, Rarely=0.25; Occasionally=0.5; Often=0.75; Very Frequent=1. The answer "I don't know" was considered an omission, so it was replaced by the value zero (MATTHIENSEN, 2011).

The alpha values range from 0 to 1, and are classified as follows (Figure 2):

Figure 2: Cronbach's Coefficient Reliability Classification

Confiabilidade	Muito Baixa	Baixa	Moderada	Alta	Muito Alta
Valor de α	$\alpha \leq 0{,}30$	$0{,}30 < \alpha \leq 0{,}60$	$0{,}60 < \alpha \leq 0{,}75$	$0{,}75 < \alpha \leq 0{,}90$	$\alpha > 0{,}90$

Source: Freitas and Rodrigues (2005)

The main project has already been submitted via Plataforma Brasil and forwarded to the Ethics Committee for Research with Human Beings, in compliance with the guidelines inherent to resolution 466/12 CNS, obtained a favorable opinion from CEP 4.651.198 and CAEE registration: 45334621.9.0000.5191, through the Ethics and Research Committee of the Amaury de Medeiros Integrated University Health Center (CISAM).

RESULTS AND DISCUSSIONS

The sample consisted of 20 judges, all nurses, 15% (n=3) were between 23 and 27 years old, 5% (n=1) were between 28 and 32 years old, 10% (n=2) were between 33 and 37 years old, 15% (n=3) were between 38 and 42 years old, 15% (n=3) were between 43 and 47 years old, 20% (n=4) were between 48 and 52 years old and 20% (n=4) were between 53 and 57 years old.

Regarding gender, 90% (n=18) were female and 10% (n=2) were male, as for color/race, 65% (n=13) were white, 10% (n=2) were black and 25% (n=5) were brown. At the level of education, 15% (n=3) had only completed higher education, 40% (n=8) had specialization, 10% (n=2) had residency, 30% (n=6) had a master's degree and 5% (n=1) had a doctorate.

Regarding the time of experience in children's health, 35% (n=7) had been working in children's health for more than 1 to 4 years, 5% (n=1) were between 5 and 8 years, 20% (n=4) were between 9 and 12 years, 5% (n=1) were between 13 and 16 years, 20% (n=4) were between 17 and 20 years old, and 15% (n=3) had been working in child health for more than 20 years. The profile of the expert judges was mostly over 40 years old, female, white, with a postgraduate degree and more than 9 years of experience in child health.

In the first phase of content validation, 10 judges evaluated the content of each item for pertinence, relevance and clarity, within a 4-point Likert scale. Based on the results, the Content Validity Index of each item was measured. This is because it is necessary that the survey adequately encompasses the scientific knowledge to be transmitted, according to the guidelines and criteria established by the specialist in the area (RIBEIRO, POSSOLLI, RIBEIRO, 2024).

The items in the Knowledge domain had CVI, for the most part, greater than 0.8, but three judges 2, 5 and 9 evaluated item 10 (I10) as "Not Very Relevant" or "Not at All Relevant", resulting in CVI=0.7, so the item was excluded from the instrument. The items in the attitude domain had an adequate CVI, i.e., greater than 0.80, so no item was eliminated. In the evaluation of the Practice, the configuration of the items left doubts as to the relevance of the question, which left the agreement among the judges low. Thus, the CVI of items 8, 10 and 11 was below the desired level, leading to the exclusion of these questions (Table 1).

In the evaluation of the relevance of the Knowledge domain, I10 had a CVI <0.8 and was eliminated. The items in the Attitude domain had CVI>0.8, so they remained in the instrument, however, in the Practice domain, items 8, 10 and 11 had low agreement among the judges and were also eliminated (Table 1).

When judging clarity, the judges who considered the item "Not Very Clear" or "Not at All Clear" were asked to make a suggestion to change the item in question, the judges who answered that a question was "Clear" or "Very Clear", but suggested a change to improve the understanding of the question, a score of 0 of "Not at All Clear" or "Not at all Clear" was considered.

In the Knowledge domain, I8 was less clear for the judges with CVI=0.5, which means that only 50% of the judges judged the item as clear. In the Attitude domain, the item that caused the most misunderstanding among the judges was I9, with CVI=0.6, followed by I8 and I1, with CVI=0.7.

The items of the Practice had, in clarity, the lowest CVI, I9 and I10 with CVI=0.6 and I8 and I13 with CVI=0.7 (Table 1). This is because, initially, the frequency with which the mother perceived a sign of danger was asked, however, the child could never present a sign and she would answer that it would never, with this, it would not be possible to know if the baby never actually presented or if the mother did not know how to identify such a sign. Therefore, the survey was adapted to this variable, as shown in Table 2.

Table 1: Distribution of Content Validity Indices by Item - CAP1 Instrument, Recife – Pernambuco.

	Pertinence														
	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14	I15
IVC - Knowledge	1	1	1	1	0,8	1	1	0,8	0,9	0,7	1	1	1	1	1
IVC – Attitude	1	1	1	1	0,9	1	1	0,9	0,9	0,9	1	1	1	1	1
IVC – Practice	0,9	0,9	0,8	0,8	0,8	0,8	0,8	0,7	0,8	0,7	0,7	0,8	0,8	0,8	0,8

Relevance															
IVC - Knowledge	1	1	1	1	0,9	1	1	0,8	0,9	0,7	1	1	1	1	1
IVC – Atitude	1	1	1	1	0,9	1	1	0,9	0,9	0,9	1	1	1	1	1
IVC – Practice	0,9	0,9	0,8	0,8	0,8	0,8	0,8	0,7	0,8	0,7	0,8	0,8	0,8	0,8	0,8
Clarity															
IVC - Knowledge	1	0,9	0,8	0,7	0,9	0,9	0,8	0,5	0,9	0,9	1	1	1	0,8	0,9
IVC – Atitude	1	1	0,8	0,8	1	0,9	1	0,6	0,6	0,8	1	1	0,7	0,9	1
IVC – Practice	0,9	0,9	0,8	0,8	0,9	0,8	0,9	0,7	0,6	0,6	0,9	0,9	0,7	0,8	0,8

Description: I- Item; IVC- Content Validity Index.
Source: Authors, 2023.

When analyzing the judges' suggestions, the most pertinent to the item was balanced so that it was as clear as possible to the target audience (Table 2).

Table 2: Distribution of suggestions for change by each judge in each item - Instrument CAP 1, Recife - Pernambuco.

ITEM KNOWLEDGE	SUGGESTION FOR CHANGE
1. Do you know how to identify when your baby can't breastfeed or drink milk?	J2: Changes the verb to achieve for difficulty; J9: Change the beginning of the question to "can you tell when";
2. Do you know how to identify when your baby has an abnormal body temperature?	J1: Do you know how to identify when your baby is not at a normal temperature?; J2: Use "your baby is cold or has a fever".; J9: Change it to "can you tell when your baby's body temperature is abnormal"; J10: change abnormal to changed. (continua)
3. Do you know how to identify when your baby is breathing more or less than normal?	J4: Change it to faster or slower; J5: Change it to "is having difficulty breathing (tired)"; J9: Change it to "can you tell when your baby's breathing is faster or slower than normal?".
4. Do you know how to identify the signs of umbilical stump infection?	J1, J7: Change the word umbilical stump to navel; J9: Change it to "you can identify the signs of infection (bad smell, redness and color)".
5. Do you know how to identify the signs of ear infection?	J3: The question is not pertinent because ear infection is more common between 6 months and 2 years, and not in newborns; J6: in your baby.
6. Do you know how to identify when your baby is pooping more or less than normal?	J5: Change it to "it's doing little, normal or a lot of poop"; J9: change it to "do you know how to identify when your baby poops out of the ordinary?"
7. Do you know how to identify when the appearance of your baby's stool is abnormal?	J2: The question should induce the mother to describe the baby's feces: "what should your baby's poop be like?"; J5: change aspect for "color and texture"; J9: change it to "do you know how to identify when the appearance of the stool is out of the ordinary?"; J10: change abnormal to changed.
8. Do you know how to identify the signs that precede the seizure in your baby?	J1: Change it to "do you know how to identify the signs that warn you that your baby will convulse?"; J2: The question should be asked in specific cases; J4: Wouldn't it be more important to act on the seizure?; J5: Replace precede with "before the baby has convulsions"; J8: To change precede by "before"; J9: Change it to "you know

	how to identify the signs that appear before a seizure in your baby".
9. Do you know how to identify if your baby is conscious or not?	J2: The term conscious should be replaced or the question should be reformulated; J3: The mother cannot understand the concept of conscious, better to ask about moving, stretching, making faces, smiling, etc.; J5: As a baby we talk about activity and reactivity, change it to "active/reactive".
10. Do you know how to identify when your baby is about to vomit?	J5: "You know the danger when your baby vomits."
11. Do you know how to identify the signs of dehydration in your baby?	J3: For the use of some technical terms, you need a prior explanation of what it is.
12. Do you know how to recognize pus blisters that can appear on your baby's skin?	J9: Replace it with "do you know how to recognize the pus bubbles that...".
13. Do you know how to identify characteristics of oral moniliasis (mouthpiece/thrush) in your baby?	J9: change it to "do you know how to identify the characteristics of oral moniliasis, also known as mouthpiece or thrush, in your baby's mouth?".
14. Do you know the way (technique) of choking your baby?	J3: "do you know what to do when your baby chokes?"; J4: change it to "how to choke your baby"; J8: change it to "unchoke your baby"; J9: change it to "do you know how to perform the choking maneuver on your baby?"; J10: change it to "do you know the way to choke your baby?".
15. Do you know how to identify when your baby's skin color is abnormal?	J4: change color by color; J9: change it to "do you know how to identify when your baby's skin color is out of the ordinary?"; J10: change abnormal to changed.
ITEM ATTITUDE	SUGGESTION FOR CHANGE
1. Do you think it is important to know how to identify when your baby is unable to breastfeed or drink milk?	J9: change it to "when your baby is unable to breastfeed or drink milk".
2. Do you think it is important to know how to identify when your baby has an abnormal body temperature?	J9: change it to "when is your baby's body temperature out of normal?"; J10: change abnormal to changed.
3. Do you think it is important to know how to identify when your baby is breathing more or less than normal?	J4: change to faster or slower; J5: change it to "you are having difficulty breathing or are tired"; J9: change it to "when is your baby's breathing out of normal?".
4. Do you think it is important to know how to identify the signs of umbilical stump infection in your baby?	J1, J4, J7: change the word umbilical stump to navel.
6. Do you think it is important to know how to identify when your baby is pooping more or less than normal?	J5: change it to "when the stool has a normal color and texture"; J9: change it to "when does your baby poop out of the ordinary?".
7. Do you think it is important to know how to identify when the appearance of your baby's stool is abnormal?	J2: change the word aspect; J9: change it to "when is the appearance of your baby's stool out of the ordinary?"; J10: change abnormal to changed.
8. Do you think it is important to know how to identify the signs that precede the seizure in your baby?	J4: it would be more important to act on the seizure; J5: change it to "know what the signs are like before the seizure; J9: change it to "the signs that occur before a seizure in your baby?"; J10: change it to "what comes before your baby's seizure?".
9. Do you think it is important to know how to identify if your baby is conscious or not?	J3: the mother may not understand the concept of conscious, better ask about moving, stretching, making faces, smiling, etc.; J5: replace it with "is active/reactive".

(continua)

10. Do you think it's important to know how to identify when your baby is about to vomit?	J2: Vomiting and gulfing may be normal in a baby depending on the amount. The question would be more valid if it addressed "Do you know how to identify when your baby's vomiting is a sign of illness? Or even, do you know how to differentiate vomiting from choking?; J5: change it to "what are the dangers when your baby vomits".
11. Do you think it is important to know how to identify the signs of dehydration in your baby?	J3: for the use of some technical terms, you need a prior explanation of what it is.
12. Do you think it's important to know how to recognize pus bubbles that can appear on your baby's skin?	J9: change it to "know how to recognize the pus bubbles that...".
13. Do you think it is important to know how to identify characteristics of oral moniliasis, also called "mouthwash", in your baby?	(continua) J2, J4, J8: include the term "thrush"; J9: change it to "identify the characteristics of oral moniliasis, also called mouthpiece or thrush, in your baby?
14. Do you think it is important to know the way (technique) of choking your baby?	J3: "Do you think it's important to know what to do when your baby chokes?"; J4: change it to "how to choke"; J9: change it to "know how to perform the choking maneuver on your baby?"; J10: change it to "to choke your baby?".
15. Do you think it is important to know how to identify when your baby's skin color is abnormal?	J4: change color for "color"; J9: change it to "when is your baby's skin color out of the ordinary?"; J10: change abnormal to changed.
ITEM PRACTICE	SUGGESTION FOR CHANGE
1. How often do you notice that your baby is unable to breastfeed or drink milk?	J4: The mother will never respond if she never sees these signs, but it does not mean that the practice will be inappropriate; J6: it would not be relevant to know the number of times the mother notices; J10: replace all the statements of the practice with "can you perceive that..."
2. How often do you notice that your baby has an abnormal body temperature?	J10: Swap Abnormal for Changed
3. How often do you notice that your baby is breathing more or less than normal?	J5: Change it to "is normal or tired"; J9: Change it to: "that your baby's breathing is faster or slower?"; J10: Change it to "can you tell if your baby is breathing more or less than normal?"
4. How often do you notice signs of umbilical stump infection in your baby?	J1, J7: change the word umbilical stump to navel
6. How often do you notice that your baby is pooping more or less than usual?	J5: change aspect for "color and texture"; (conclusion)
8. How often do you notice the signs leading up to seizure in your baby?	J5: change precede by "before the baby has seizures"; J8: What would be a frequent seizure? Put the average number of episodes in a given time (month/year).
9. How often do you notice if your baby is conscious or not?	J3: The mother may not understand the concept of conscious, better ask about moving, stretching, grimacing, smiling, etc. J5: change to "active/reactive".
10. How often do you notice that your baby is about to vomit?	J5: change it to "the dangers when your baby vomits".
11. How often do you notice signs of dehydration in your baby?	J3: for the use of some technical terms, you need a prior explanation of what it is.
12. How often do you notice pus blisters on your baby's skin?	J8: she only had 24/48 hours with the NB, the frequency will probably be low.
14. How often do you perform the choking technique on your baby?	J3: "How often do you perform the choking technique on your baby?".
15. How often do you notice that your baby's skin color is abnormal?	J10: change abnormal to changed.

Source: Authors, 2023.

From this evaluation, the Knowledge domain, which initially had 15 items, now has 14 items, by excluding item 10, the Attitude domain had 15 items and remained with the same, while the Practice domains, items 8, 10 and 11 were also eliminated, leaving 12 items in the domain. After the changes in the number of items and in their formulation, the new instrument was submitted to another 10 judges who evaluated the questionnaire in the same way, with the same criteria.

Table 3: Content Validity Index by Item - CAP 2 Instrument, Recife – Pernambuco.

Pertinence															
	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14	I15
IVC - Knowledge	1	1	1	1	1	0,9	0,8	0,9	1	1	1	0,9	0,9	1	ON
IVC – Atitude	1	1	1	1	1	1	0,9	0,9	1	1	1	0,8	1	1	1
IVC – Practice	1	1	1	1	1	0,8	0,9	0,9	1	0,9	0,9	1	ON	ON	ON
Relevance															
IVC - Knowledge	1	1	1	1	0,9	1	0,8	1	1	1	1	0,9	1	1	ON
IVC – Atitude	1	1	1	1	1	0,9	1	1	1	1	1	1	1	1	1
IVC – Practice	1	1	1	1	1	0,8	0,9	0,9	0,9	0,9	0,9	1	ON	ON	ON
Clarity															
IVC - Knowledge	1	0,6	1	0,6	0,7	0,8	0,6	0,7	0,7	0,7	0,9	0,8	0,8	0,7	ON
IVC – Atitude	1	0,9	1	0,8	0,8	1	0,8	0,7	0,9	0,9	0,8	0,8	1	1	1
IVC- Practice	1	0,9	1	0,7	0,8	0,8	0,6	0,5	0,8	1	0,9	1	IN	IN	IN

Description: I- Item; NA- IVC- Content Validity Index does not apply.
Source: Authors, 2023.

Of all the items judged, none had CVI<0.8 in terms of pertinence and relevance (Table 3), so there was no change in the quantity, only small changes in some terms of the questions at the suggestion of the judges (Table 4).

Table 4: Suggestions for change by each judge in each item - Instrument CAP 2 (continued)

ITEM KNOWLEDGE	SUGGESTION FOR CHANGE	AFTER CHANGE
2. Can you notice when your baby's body temperature changes?	J11: replace "altered body temperature" with "different body temperature"; J16: use less technical language; J19: Change for fever; J20: High and low body temperature.	2. Can you tell when your baby has a temperature that is too high or too low?
4. Can you notice the signs of belly button infection in your baby?	J16: Change language with the user, "signs of abnormality", "alteration in the navel", not necessarily infection; J19: "navel smells bad, very dirty, with green discharge".	4. Can you tell if your baby's belly button is red, swollen or pus?
5. Can you notice the signs of ear infection in your baby?	J16: use more informal, clear language, at the level of the user/parent; J19: "dirty ear, some secretion coming out"	5. Can you tell if your baby's ear is red, swollen, or if there is any fluid coming out of it?
6. Can you tell when your baby is pooping an unusual amount?	J16: First to know if the mother understands what is normal, what is normal like?	6. Can you tell when your baby is pooping an unusual amount?
7. Can you tell when the color and texture of your baby's poop is altered?	J19: "poop is different from normal".	7. Can you tell when the color and texture of your baby's poop is altered?

9. Can you notice when your baby has altered movement, activity and/or reactivity?	J16: explain simply, mothers do not always know the meaning of words;	9. Can you notice when your baby has altered movement, activity and/or reactivity?
10. Can you notice the signs of dehydration in your baby?	J19: You have to say what is dehydrated	10. Can you notice the signs of lack of water in your baby's body?
11. Can you notice pus blisters on your baby's skin?	J17: as the public is mostly lay, it would be good to use a more common language: "yellowish bubbles", etc;	11. Can you notice yellowish pus blisters on your baby's skin?
12. Can you notice the characteristics of oral moniliasis, also called mouthpiece or thrush, in your baby's mouth?	J16: "can you identify moniliasis...";	12. You can identify oral moniliasis, also called mouth or thrush, in your baby's mouth?
14. Can you notice when your baby's skin color is altered?	J13: change the language; J19: Insert the colours (purple, grey...)	14. Can you notice when your baby's skin color is altered?
ITEM ATTITUDE	SUGGESTION FOR CHANGE	AFTER CHANGE
2. Do you think it is important to know how to identify when your baby has an altered temperature?	J11: replace "altered body temperature" with "different body temperature"; J19: "fever";	2. Do you think it is important to know how to identify when your baby has a temperature that is too high or too low?
8. Do you think it is important to know how to identify the signs that warn that your baby will convulse?	J16: "how important is it to know how to identify..."	8. Do you think it is important to know how to identify the signs that warn that your baby will convulse?
ITEM PRACTICE	SUGGESTION FOR CHANGE	AFTER CHANGE
4. Has your baby ever shown signs of belly button infection? If so, how often?	J16: "some abnormality or alteration"; J19: "navel smells bad, very dirty, with green discharge".	4. Has your baby ever had a red, swollen or pus-ridden belly button? If so, how often?
5. Has your baby ever shown signs of infection in your baby's ear? If so, how often?	J16: "discharge in the ear"	5. Has your baby ever had a red, swollen ear, or if there is any fluid coming out of it? If so, how often?

Source: Authors, 2023.

In the pre-test, the postpartum women who participated in the study were over 18 years old, 26.7% (n=8) were between 18 and 22 years old, 36.7% (n=11) were between 23 and 27 years old, 20% (n=6) were between 28 and 32 years old, 3.3% (n=1) were between 33 and 37 years old, and 13.3% (n=4) were between 38 and 42 years old. Regarding color/race, 70% (n=21) were brown, 20% (n=6) were white and 10% (n=3) were black, at the level of education, 13.3% (n=4) had up to Incomplete Elementary School, 3.3% (n=1) up to Complete Elementary School, 10% (n=3) up to Incomplete High School, 63.3% (n=19) up to Complete High School, 3.3% (n=1) had incomplete higher education and 6.7% (n=2) had completed higher education.

Regarding the occupation of the puerperal women, 53.3% (n=16) were housewives, 26.7% (n=8) had paid work and 20% (n=6) were unemployed. To analyze the prepartum conditions, we asked about prenatal care, 93.3% (n=28) had consultations, of which 85.7% (n=24) had more than 6 consultations and 14.3% (n=4) had less than 6 consultations, 82.1% (n=23) started consultations in the 1st trimester, 14.3% (n=4) started in the 2nd

trimester and 3.6% (n=1) started in the 3rd trimester, Regarding the location, 96.4% (n=27) performed in public institutions and 3.6% (n=1) performed in public and private institutions.

Regarding participation in educational groups on newborn care, 90% (n=27) of the women answered that they had never participated, this shows a scarcity of essential information, since educational groups during prenatal care are usually planned to provide crucial information on antenatal care, childbirth, postpartum and newborn care. The deprivation of this information can generate negative effects on maternal and child health.

Regarding the understanding of the items and words, none of the items generated disagreement, however, regarding the arrangement of the answers to the questions in the Practice domain, it generated doubts due to the fact that they had more than one answer referring to the same objective, for example, for item 1 of the Practice domain: "Has your baby ever had difficulty breastfeeding or drinking milk? If so, how often? " The following answers "Yes", "No" and "I don't know" were placed, followed by a Likert frequency scale: "Never", "Rarely", "Occasionally", "Often" "Very Frequent", the answer "Yes" would fit into "Rarely", "Occasionally", "Often" or "Very Frequent" and the answer "No" into "Never", so the alternatives "Yes" and "No" were removed.

After validation, the reliability of the instrument was verified by Cronbach's Alpha Coefficient, for which an attribution of values was given to the answers that represents the understanding of the women interviewed, transforming them from a nominal scale to a numerical one. This happened as follows: Yes=1; No=0; I don't know=0; Not important=0; Sometimes it is important=0.25; Moderate=0.5; Important=0.75; Very Important=1; Never=0, Rarely=0.25; Occasionally=0.5; Often=0.75; Very Frequent=1. The answer "I don't know" was considered an omission, so it was replaced by the value zero (Matthiensen, 2011). Based on this, the coefficients per item and the coefficients of the general instrument were calculated (Chart 1).

Chart 1: Distribution of Cronbach's alpha coefficients by item, Recife – Pernambuco.

Domain	Item	Alfa Value	Domain	Item	Alfa Value	Domain	Item	Alfa Value
Knowledge	1	0,8845	Attitude	1	0,8725	Practice	1	0,8855
	2	0,8822		2	0,8742		2	0,8844
	3	0,883		3	0,8739		3	0,8854
	4	0,8835		4	0,8738		4	0,8841
	5	0,8887		5	0,8756		5	0,8841
	6	0,8808		6	0,8742		6	0,8847
	7	0,8837		7	0,874		7	0,8844
	8	0,8793		8	0,8741		8	0,8842
	9	0,8886		9	0,8742		9	0,8841
	10	0,8917		10	0,8734		10	0,8841
	11	0,88		11	0,8737		11	0,8852
	12	0,8832		12	0,8718		12	0,8844
	13	0,8908		13	0,8734			

	14	0,8832		14	0,8725			
				15	0,8758			

Source: Authors, 2023.

Considering the value of the Cronbach's coefficient of 0.8844, it can be stated that the instrument has high reliability.

A validation study brought criticism from the judges regarding the number of items contained in the questionnaire. The judges reported that the volume of items generates fatigue that impairs the accuracy of the answers (MELO et al, 2021). In addition, they believe that this may also affect the acceptance of the survey by the target audience, which brings a risk to the reliability of the answers.

The validation of instruments is essential to have an accurate measure of what is intended to be measured. In it, there are techniques necessary to reach the goal, this involves the validity of content, appearance, criterion and construct. Content validity seeks the representativeness of the items, determined by the judgment of specialists, who in this study brought nurses who are specialists in the area of child health (JÚNIOR, MATSUDA, 2012). Appearance validation, which, although subjective, evaluated the relevance and adequacy of the items to the social and economic context of the target population, which largely has low education and economic power.

Throughout the construction of the items, little scientific support was perceived when it comes to the danger signs of the newborn, so the instrument was formed from two fundamental theoretical bases in the construction of knowledge about this care, especially in primary care (BRASIL, 2020; BRAZIL/PAHO, 2011). In addition, in the theoretical foundation of validation, although very relevant, most studies on instrument validation had been published for more than 10 years.

The study was designed with a sample from a very specific location, the postpartum women who agreed to participate in the study do not fully represent the population of puerperal women in general. However, future studies may be carried out in other locations and with a broader target population, such as in prenatal outpatient clinics, pregnant women, and family members.

The survey has the capacity to evaluate the knowledge, attitude and practice of puerperal women which, when applied, favors the elaboration of specific strategies of the health team that aim to improve the ability to care, avoiding diseases and complications that can lead to the death of newborns, reducing, in small steps, neonatal mortality.

CONCLUSION

The validation of this instrument for assessing the knowledge, attitude, and practice of puerperal women about the general danger signs of the newborn contributed significantly to the promotion of neonatal health, providing valuable insights for the development of targeted and effective educational strategies. The results of this research may inform health education programs aimed at postpartum women, health professionals and public policy managers, with the objective of improving the care provided to newborns and reducing neonatal morbidity and mortality.

It was noticed that the instrument can accurately and consistently measure the dimensions of Knowledge, Attitude and Practice of puerperal women about the general danger signs of the newborn. The results are highly reliable and reflect the instrument's ability to adequately assess these aspects.

With a Cronbach's alpha of 0.88, indicating a high reliability and internal consistency of the instrument, it is suggested that the instrument is suitable to be used in future research and interventions related to this specific theme. This makes it possible to obtain reliable and valid data on the knowledge of puerperal women and caregivers, their attitudes and practices in relation to the recognition of danger signs in the newborn.

These results may also indicate the need for training and educational interventions aimed at postpartum women and caregivers, in order to improve their knowledge about the danger signs of the newborn and promote safe neonatal care practices.

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FLUORIDE'S SOCIOECONOMIC IMPACT ON HEALTH EDUCATION: A GLOBAL PERSPECTIVE

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ABSTRACT

Preventive oral healthcare is a crucial lesson learned with dental health education, significantly impacting both individual well-being and societal economic burden. By empowering individuals with knowledge and skills to maintain optimal oral health, dental education programs can reduce the prevalence of oral diseases, lower treatment costs, and ultimately contribute to a healthier and more economically sustainable future. This article delves into the multifaceted benefits of dental health education, examining its impact on quality of life, healthcare costs, and global economic sustainability. Drawing on recent research, public policies, and community health initiatives from Brazil, Europe, and the United States, we highlight the critical role of dental education in addressing oral health disparities and improving overall population health. As healthcare systems worldwide grapple with rising costs, dental education emerges as a cost-effective strategy. By preventing oral diseases and promoting early intervention, these programs can reduce the need for costly treatments, such as dental extractions and restorations. Moreover, improved oral health can enhance individuals' quality of life, leading to increased productivity and reduced absenteeism. In conclusion, investing in dental health education is not merely a public health imperative but also a sound economic decision. By promoting oral health literacy and empowering individuals to take control of their oral health, we can create a healthier, more prosperous, and sustainable future.

Keywords: Dental health education. Quality of life. Cost reduction. Global economic sustainability.

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INTRODUCTION

Oral health has a major impact to the general health and well-being of populations, directly impacting nutrition, speech, self-esteem, and even the management of chronic diseases such as diabetes and cardiovascular disease. The World Dental Federation (FDI) estimates that global spending on dental care exceeds US$540 billion annually, including treatments, prosthetics, and emergency interventions (FDI World Dental Federation , 2022). Oral health expenditures can represent a significant burden on health systems, especially in countries where the predominant approach is curative rather than preventive (Petersen & Ogawa , 2012). In contrast, countries that prioritize education and prevention, such as several European nations, have achieved remarkable results in terms of cost reduction and improved quality of life for their populations (Schwendicke et al., 2023).

There is a significant difference when comparing oral health expenditures in Brazil, Europe, and the United States. Oral health expenditures vary significantly across different regions of the world, reflecting differences in public health policies, access to preventive care, and investment in educational programs. In Brazil, approximately 8% of total health expenditures in the Unified Health System (SUS) are directed to dental care, ranging from emergency treatments to preventive and restorative procedures (Ministry of Health, 2023). Studies indicate that approximately 60% of dental consultations in the SUS are for treating cavities and performing tooth extractions, procedures that could be largely avoided through preventive interventions (Oliveira et al., 2022).

In Europe, countries such as Germany, Sweden, and Norway have adopted robust oral health prevention policies, including school-based education programs and awareness campaigns. In Germany, annual spending on oral health is approximately 12 billion euros, but the strong emphasis on preventive measures has resulted in a population with lower rates of caries and periodontal disease (Schwendicke et al., 2023). In contrast, Eastern European countries such as Bulgaria and Romania face challenges in implementing comprehensive educational programs, resulting in a higher prevalence of oral diseases and a greater reliance on curative treatments (European Federation of Periodontology , 2022).

In the United States, the oral health scenario is marked by high costs and a significant disparity in access to dental care, influenced by the predominantly private structure of the health system. According to the American Dental Association (ADA), dental care spending in the United States exceeded 155 billion dollars in 2022, of which a considerable portion is allocated to restorative and emergency treatments (American Dental Association , 2023). Local initiatives, such as " Smiles Across America " and school-based oral health programs have been shown to be effective in reducing the prevalence of cavities

and gum disease, especially in underserved communities, resulting in decreased visits to dental emergencies and the costs associated with these services (Jones et al., 2021).

Studies show that lack of access to information and education about dental health contributes to the deterioration of oral health in the population, resulting in a cycle of treatment that could be avoided. In this context, educational initiatives are essential to promote prevention and ensure more efficient and economical care.

LITERATURE REVIEW

The literature on the impact of oral health education on cost reduction and public health improvement has grown significantly in recent years. In a study by Sheiham et al. (2020), the introduction of oral health education programs in schools in developing countries resulted in a reduction of up to 50% in dental caries rates among children aged 6 to 12 years. This study highlights that early education on oral hygiene is a key strategy for reducing health inequalities.

Longitudinal studies conducted in Sweden (Lindberg et al., 2019) followed groups of children for 10 years, demonstrating that those who participated in oral health education programs had a significantly lower need for restorative treatments. Another study conducted in Norway, by Marthaler et al. (2022), reinforces these findings by showing that the inclusion of prevention and nutritional guidance programs in schools can reduce the incidence of cavities by up to 70% over a decade.

In the United States, a study by Milgrom et al. (2021) analyzed the costs of dental treatments in communities with different levels of access to oral health education, concluding that each dollar invested in preventive programs resulted in savings of $2.50 in emergency and restorative treatments. This study highlights the relevance of oral health education as a cost control strategy for predominantly private health systems.

In Brazil, the impact of programs such as "Smiling Brazil" has been widely discussed. According to Soares et al. (2023), the inclusion of educational activities in public schools resulted in a 35% reduction in the rates of cavities and periodontal diseases in children and adolescents. Another study by Santos et al. (2022) shows that oral health education for pregnant women and low-income families can significantly improve children's oral health, reducing cases of cavities in infants and young children.

The long-term economic impact of preventing oral diseases not only reduces direct treatment costs, but also improves economic productivity by reducing absenteeism related to dental problems. According to Sheiham and Watt (2020), every dollar invested in prevention can result in significant savings in future treatments.

There is also the role of digital technologies, which can be powerful tools in promoting oral health. Studies show that health apps and social media campaigns can increase awareness and adherence to oral hygiene practices. For example, a study by Gil-Montoya et al. (2015) highlighted the positive impact of digital technologies on dental health education.

Not forgetting dental health education in rural and indigenous communities. The inclusion of oral health education programs in rural and indigenous communities is essential. Initiatives such as the "Alliance for a Smiling Brazil" have shown success in reducing health inequalities. Lima et al. (2021) emphasize the importance of dental health education in hard-to-reach areas.

And also carrying out professional training with continuing education, investing in the continuing education of health professionals is crucial for quality care. According to Souza and Sousa (2019), continuing education programs for dentists result in better preventive practices and more effective treatments.

METHODOLOGY

To understand the economic impact of oral health education, a systematic review of studies published in the last ten years was conducted using databases such as PubMed , Scopus and Google Scholar. Articles that investigated the correlation between oral health education and cost reduction in different geographic and demographic contexts were analyzed. In addition, reports from international organizations such as the World Health Organization (WHO) and the American Dental Association (ADA) were included, focusing on economic analyses of health systems.

RESULTS

The results of the review indicate that oral health education can generate significant savings. For example, Lee et al. (2022) showed that every dollar invested in oral health education programs in underserved communities in the United States generated savings of up to $6 in emergency treatments. In Europe, countries such as Switzerland, which have robust dental health education policies, report an average savings of 25% in costs associated with corrective dental treatments (FDI World Dental Federation , 2023).

In Brazil, studies such as that by Oliveira et al. (2022) indicate that implementing educational programs in schools could reduce tooth decay rates among children by up to 50%, saving millions of reais in treatments. These savings would allow resources to be

redirected to other areas of health. In a country with large regional disparities, such as Brazil, oral health education has the potential to significantly reduce the burden of oral diseases in vulnerable communities, improving quality of life and reducing school absenteeism and loss of productivity at work.

The importance of dental health education is immense, as it involves raising awareness among the population about the importance of oral hygiene, disease prevention, and access to dental care. Education programs have been shown to be effective in reducing the prevalence of caries and periodontal diseases, especially in low- income communities (Bennett et al., 2016; Bittencourt et al., 2020). When people are informed about oral hygiene practices and the importance of regular dental visits, the demand for complex and costly treatments decreases, resulting in significant savings for the health system.

The economic impact of dental health is very relevant and the relationship between oral health and the economy is evident. Untreated dental conditions can lead to complications that require more expensive interventions, increasing public and private health expenditures. Estimates suggest that for every real invested in prevention, there is a considerable saving in subsequent treatments (Righolt et al., 2018; Lamberts et al., 2016). According to the World Health Organization (WHO), dental caries is one of the most prevalent conditions worldwide, mainly affecting low-income populations (World Health Organization , 2020). Effective prevention could drastically reduce the incidence of caries, resulting in savings of billions of reais annually.

When comparing the Brazilian economy with that of Latin America, the Brazilian economy faces unique challenges, including significant inequalities in access to health services. According to the World Bank in 2021, Brazil invests a lower percentage of its GDP in health compared to countries such as Chile and Argentina, where more robust public health policies have resulted in better oral health indicators (González et al., 2019; Salazar et al., 2020). These differences reflect the urgent need to strengthen dental health education in Brazil, especially in vulnerable communities.

Studies show that Latin American countries that have implemented dental health education programs, such as Chile, have been able to reduce rates of tooth decay and periodontal disease, resulting in lower treatment costs and higher productivity (Peres et al., 2019). The relationship between oral health and economic productivity is clear: healthy workers have fewer absences and contribute more to the economy. According to a WHO study, lost productivity due to dental problems can cost the economy up to 5% of GDP (World Health Organization , 2021).

DISCUSSION

A comparative analysis of different countries reveals that oral health education is an essential strategy for the economic sustainability of health systems. Countries that prioritize prevention, such as Sweden and Germany, have lower rates of oral diseases and, consequently, a reduced demand for expensive curative treatments (Matsumoto et al., 2023). The inclusion of oral health programs in public policies has been effective in reducing regional health disparities, promoting a positive impact on the quality of life of populations.

In the United States, despite the high cost of dental care, there is a growing awareness of the importance of preventive programs. Hansen et al. (2022) argue that expanding oral health education programs to low-income areas could reduce the financial burden on public and private health care systems and improve the quality of life for millions of Americans. These educational interventions not only prevent oral problems but also have positive effects on overall health by reducing systemic inflammation associated with periodontal disease (Huang et al., 2023).

Inequality in access to health care is a challenge in Brazil, especially in the North and Northeast regions. The lack of preventive programs in these areas has resulted in high rates of tooth decay and tooth loss among the most vulnerable populations. Initiatives such as “Brasil Sorridente” have shown that the inclusion of oral health education programs in schools and communities can significantly reduce these rates, while promoting greater awareness of the importance of oral hygiene (Alves et al., 2022). However, continued efforts to expand these programs to rural and indigenous areas, where access to health care is even more limited, are essential.

Popular participation is essential for the effectiveness of health policies. Involving the community in the formulation and implementation of health education programs allows identifying local needs and adapting strategies to the social context (Crisp et al., 2014; Oliveira et al., 2021). Social mobilization in recent decades has allowed the population to influence political decisions, resulting in more inclusive and effective policies.

Comparisons between different countries reveal that oral health education is essential for the economic sustainability of health systems. Countries such as Sweden and Germany have lower rates of oral diseases and, therefore, a lower demand for expensive curative treatments (Matsumoto et al., 2023). In the United States, Hansen et al. (2022) argue that expanding preventive programs could alleviate financial pressure on health systems, especially in low-income areas. In Brazil, despite regional inequalities, initiatives

such as “Smiling Brazil” demonstrate the potential of health education to improve oral health and reduce system costs (Alves et al., 2022).

Furthermore, the literature indicates that integrating oral health education into broader public health policies can result in significant resource savings. According to Wang et al. (2022), in an analysis that used economic modeling to estimate the long-term benefits of oral health education, it was identified that each dollar invested can generate savings of up to $4 in general medical expenses, due to the prevention of complications related to periodontal diseases that affect systemic health, such as cardiovascular disease and diabetes.

There are several successful examples of dental health education programs, such as those implemented in schools and communities, that have shown positive results. One example is the Children's Oral Health Program, implemented in several regions of Brazil, which promotes education and awareness from childhood. These programs not only improve children's dental health and quality of life, but also reduce future costs with dental treatments (Pereira et al., 2019; Azevedo et al., 2018).

Even so, there is much to improve throughout the healthcare chain, in general health as well as in oral health, especially in Brazil, where we have a very large amount of financial resources allocated to public policies that are diverted from their intended purpose, where much better results could be achieved and a much larger number of people could be helped, if it were not for the government's political unpreparedness .

CONCLUSION

Oral health education is a strategic investment that can result in substantial savings for health systems and promote healthier lives for populations. The implementation of educational programs and raising awareness among the population about the importance of oral hygiene have proven effective in reducing oral diseases, providing improvements in quality of life and economic productivity. In a global scenario where oral health care costs are high, investing in oral health education represents a viable and sustainable approach to building a healthier society with a higher quality of life and economically efficient.

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ENTREPRENEURSHIP IN NURSING: AN OPPORTUNITY FOR AUTONOMY AND PROFESSIONAL VISIBILITY

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ABSTRACT

Entrepreneurial nursing is an essential approach to face the challenges of the health sector, promoting innovation in the fields of activity and in health care, consolidating the profession with science, technology and giving personal, professional and financial autonomy. Objective: To discuss entrepreneurship in nursing as an opportunity for autonomy and professional visibility. Methodology: Integrative literature review, which used bibliographic sources in the period from 2019 to 2024. Studies were selected through SciElo, PubMed, Virtual Health Library (VHL), and the Federal Council of Nursing (COFEN). The inclusion criteria adopted were documents available in full, in Portuguese and English, which presented aspects related to the theme in the title or abstract. And exclusion, articles and documents published before the established period, as well as those that did not have relevant content for the topic addressed. Results: From the analysis of the data obtained, ten articles were selected for the elaboration of the research, which allowed the analysis of the existing evidence regarding the types of entrepreneurship, the autonomy of the nurse supported by law and the entrepreneurial entrepreneurship in Nursing. Conclusion: Entrepreneurship in nursing represents a powerful opportunity for professionals in this area to reach new levels of autonomy and recognition.

Keywords: Entrepreneurship. Nursing. Professional autonomy. Nursing consultation.

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INTRODUCTION

The word entrepreneurship originates from the French words *entrepreneur* or *entreprende* (to undertake), and means to organize, manage and take risks in a business or enterprise, it appeared in the mid-fifteenth century. Entrepreneurship is the act of successfully carrying out or coordinating new projects, services, and businesses (Copelli, 2019). At the beginning of the nineteenth century, entrepreneurship in Nursing was already manifested by Florence Nightingale, in assisting soldiers during the Crimean War and with the foundation of the School of Nursing at the Saint Thomas Hospital, together with her Anna Nery provided assistance to the wounded in the Paraguayan War, and Wanda de Aguiar Horta created the first Brazilian theory of the profession (Oliveira, 2022).

The current scenario leads us to understand that entrepreneurship in Nursing is necessary for several crucial aspects, innovating in health care, consolidating the profession with science, technology and innovations in the various panoramas and fields of activity, giving personal, professional and financial autonomy. The entrepreneurial nurse needs to be communicative, understand the needs of his client, be persistent, ethical, know how to win over the public, be innovative and audacious (Jofre, 2020).

The classes of entrepreneurship are the social that represents an innovative approach to solving social problems, improving public health causing a positive social impact. Business entrepreneurship that involves management skills with clinical knowledge providing health services or products, assuming practical business strategies to innovate and improve the form of care provided, giving autonomy to the nurse to have his or her own independent office. In intrapreneurship, on the other hand, it applies to the principles within a health organization such as hospitals, clinics or other institutions acting to create or implement innovative projects and solutions that can improve the quality of care provided within the institutional environment, without the need to open one's own business (Copelli, 2019).

Before COFEN (Federal Nursing Council) through Resolution 568/2018, amended by Resolution No. 606/2019, that if there is a need to include the annexes containing the models of Application for Registration of Nursing Offices and Clinics and models of Registration of Nursing Offices and Clinics, giving the right to Nursing professionals to act autonomously and entrepreneurially in the various branches of health, such as implementing their home care companies, cooperatives, private practices, events, services such as vaccinations, breastfeeding consultancies, sterilization of medical-hospital material, marketing of hospital products, being fully supported (Borges *et al*., 2022).

It is worth mentioning that having a nursing consultation is a nurse's right, guaranteed by Law 7.498/86, art. 11, item I, item "i", by Decree 94.406/87, art. 8, item I, item "i" "e", by the Code of Ethics of Nursing Professionals. On this basis, COFEN Resolution 358/09 (Silva *et al.*, 2020) was standardized.

In view of this scenario, this bibliographic review proposes to discuss, based on the scientific literature, entrepreneurship in nursing as an opportunity for autonomy and professional visibility, promoting greater recognition and appreciation of nurses.

THEORETICAL FRAMEWORK

TYPES OF ENTREPRENEURSHIP

Entrepreneurship is the personal improvement of skills in the administration and use of business opportunities, aiming to optimize and expand processes individually or as a team. The expression "being an entrepreneur" has come to be used frequently to describe a person who starts something innovative, identifies promising opportunities, evaluates the risks involved, and chooses to act assertively (Machado, 2023). In recent decades, entrepreneurship has progressed, driven by economic changes, technological advances, and globalization. With the changes that entrepreneurship causes in labor relations, the professional will need to adjust to the market perspective, and even with several skills, it will be necessary to have the courage to take advantage of opportunities and discover new horizons (Silva, 2020).

Regarding the concept and the different forms of entrepreneurship in Nursing, three main typologies stand out. Social entrepreneurship focuses on progress and change in society, standing out for the promotion of sustainability, autonomy and the provision of services to individuals, groups or communities in conditions of vulnerability. Business entrepreneurship, in turn, refers to the independent work of nurses, either as a self-employed professional or as a business owner. In this scenario, nurses identify opportunities within the health system and offer products and services that are in accordance with their ethical, legal, and technical expertise, promoting significant changes in the sector. On the other hand, intrapreneurship, or corporate entrepreneurship, refers to the creation of entrepreneurial initiatives within public or private organizations in which nursing professionals work (Menegaz, 2021).

Currently, nursing plays an essential role in increasing and consolidating its visibility as a field of science, technology, and innovation, operating in a variety of contexts and areas of activity. In this way, society will be able to better understand the progress of nursing, recognizing its social mission and the benefits it brings to health. Entrepreneurial

nursing opens doors to various fields of activity, allowing professionals to explore new opportunities beyond traditional practices. Some of the main fields include: health consulting, health education, management and administration of health services, home care, creation of health products and equipment, technology and innovation in health, consulting in aesthetic nursing, opening of offices, collective and community health, health auditing, training and qualification companies (Borges, 2022).

AUTONOMY OF THE NURSE SUPPORTED BY LAW

Recently, the possibility for nurses to act autonomously as entrepreneurs was formalized with the approval by COFEN of the regulation for nursing offices and clinics, through Resolution 568/2018, dated February 9, 2018 (Silva, 2020). Although this practice was already registered by previous legislation, Resolution 606/2019 brought updates, including annexes with templates for the Registration and Registration Request for Nursing Offices and Clinics, establishing rules for its operation by the Regional Nursing Councils.

In Brazil, nurses' autonomy is supported by a set of laws and regulations that ensure their ability to work independently in different areas of health care. Law No. 7,498, of June 25, 1986, is the main legislation that regulates the practice of nursing in the country (COFEN). This law is crucial to ensure that nursing practice is conducted by qualified professionals, clearly defining their rights and responsibilities, which contributes to patient safety and the quality of health services in Brazil.

Nursing offices and clinics need to be formally registered as businesses with local professional councils. Although they are exempt from fees and annuities, professionals must keep their financial and registration situation in compliance. This legal support reinforces the role of nurses as entrepreneurs, enabling the expansion of their professional practices and the improvement of access and quality of health care (Silva, 2023).

ENTREPRENEURIAL ENTREPRENEURSHIP IN NURSING

Several factors motivated clinical nurses to enter the business sector. Among the main ones are the identification of opportunities in the health system, the desire to start one's own business, the search for greater professional satisfaction, the perception of a market demand for nursing services, the search for financial independence, the emotional fatigue accumulated after years of work as an employee, and abusive and excessively demanding employment conditions. The entrepreneurial nurse needs to have a holistic view, understanding the whole, regardless of social, political, or economic circumstances (Copelli, 2019).

Entrepreneurship in the health sector enables nurses to achieve professional autonomy in strategies. As in other fields, nurses have the possibility of managing their own enterprise, offering nursing services in the areas of clinical practice, research, management or consulting. By assuming full autonomy and responsibility for their actions, the professional is able to act independently in organizations, whether public or private (Oliveira, 2022).

Entrepreneurship in nursing offers several opportunities for professionals in the area, especially in current times, where it is still necessary to make society aware that nursing is not limited to acts of charity and can be exercised independently, in addition to traditional care. Being an entrepreneurial nurse means acting on their own, undertaking in a way that impacts health, actively participating in the process and with sufficient autonomy to promote changes in the health system. Stimulating independent entrepreneurship among nurses is crucial for the profession, as it creates new opportunities for action, raises the social prestige of nursing and helps in the country's economic growth, since the companies founded by these professionals generate jobs for the population (Copelli, 2019).

METHODOLOGY

According to Borges *et al* (2022), the integrative literature review is a systematic survey of publications on a given subject, making it possible to synthesize and incorporate the results of the studies analyzed.

The search methods used were the virtual databases SciELO (Scientific Electronic Library Online), PubMed (US National Library of Medicine), Virtual Health Library (VHL) and Federal Council of Nursing (COFEN).

A total of 24 articles were found that were relevant to the theme in the abstract and, after reading the full text of the articles, ten of them were excluded, four of which were discarded because they did not contain content compatible with the specific objectives, six were discarded due to the date of publication and 14 were selected as a basis, of which ten were included in the elaboration.

The inclusion criteria adopted were documents available in full, in Portuguese and English, which presented aspects related to the theme in the title or abstract, with a publication period of a maximum of five years counting from the current year (2019 – 2024). Articles and documents published before the established period were excluded, as well as those that did not have relevant content for the topic addressed.

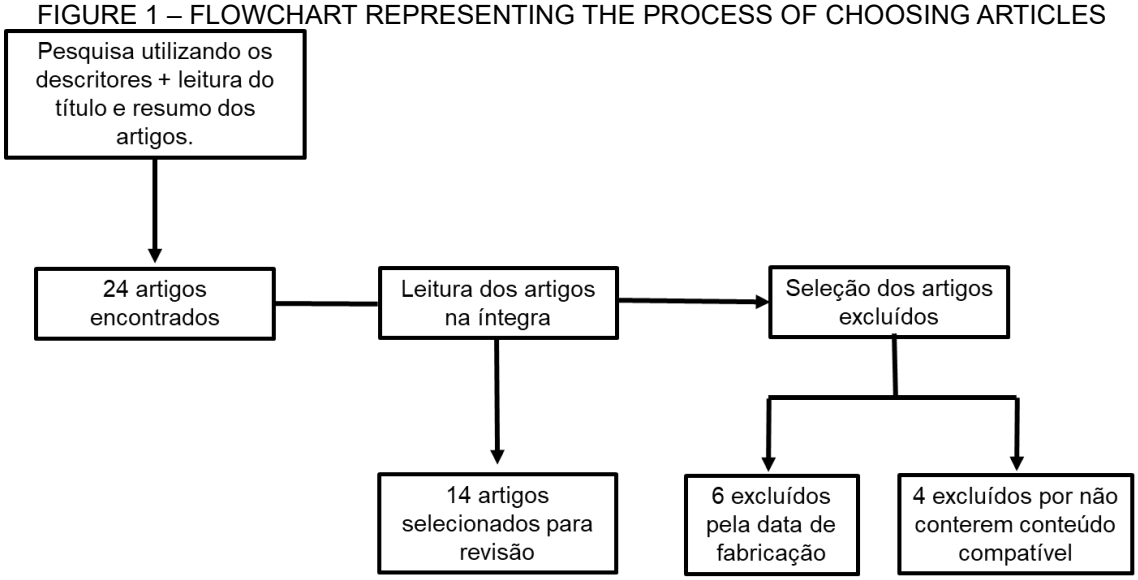
Regarding the descriptors, the following words were used: Entrepreneurship; Nursing; Professional Autonomy; Nursing Consultation.

RESULTS AND DISCUSSIONS

The results and discussions below were organized based on a systematic survey of publications on entrepreneurship in Nursing, making it possible to synthesize and incorporate the results of the analyzed studies.

The final sample of this review consisted of 14 scientific articles, which were used as a basis for a better understanding of the subject, and ten were selected for the elaboration of this research, following the previously established inclusion criteria. The flowchart below demonstrates the process of choosing the articles (Figure 1):

FIGURE 1 – FLOWCHART REPRESENTING THE PROCESS OF CHOOSING ARTICLES



Source: Prepared by the authors, 2024.

After rereading each of the articles, an instrument was filled out with the following information: title, authors, year of publication and results, presented in summary in Chart 1.

TABLE 1 - PRESENTATION OF THE LIST OF ARTICLES ACCORDING TO TITLES, AUTHORS, YEAR OF PUBLICATION AND SYNTHESIS OF RESULTS, MANAUS, 2024.

Title	Author	Year	Summary of results
Nursing performance in entrepreneurship in Brazil.	Borges; File; Milk; Lima Junior.	2022	There are several niches for corporate nursing work, in addition to the motivations surrounding financial stability, growth in the market, leadership, and independence from welfare.
Entrepreneurship in Nursing: an integrative literature review.	Copelli; Erdmann; Santos	2019	Entrepreneurship is related to personal and professional characteristics, such as autonomy, independence, flexibility, innovation, proactivity, self-confidence, and responsibility. The typologies are: social entrepreneurship, business and intrapreneurship.
Entrepreneurial profile among undergraduate nursing students.	Jofre; Giustina; Lane; Luchtemberg; Gobato; Olive tree; Erdmann; Saints.	2020	In the entrepreneurial profile, the results obtained were positive. Entrepreneurship is a skill that can be influenced by psychological characteristics, social context, cultural and educational background.
Nursing Consultation in Primary Health Care: Integrative Review.	File; Spanish; Juliani; Fernandes; Silva; Martin.	2020	Nurses can have an improvement in the Nursing Consultation, in all life cycles, in a scenario of dynamic practices, and in constant transformation as Primary Care.
Entrepreneurial nursing: new fields of action.	Axe; Viana; Olive tree; Saints; Alves; Rock; Silva; Coast; Nery; Shah.	2023	The areas of activity that stood out the most were: scientific research, consulting and advisory, stomatherapy, aesthetic nursing and the production of educational and preparatory content for nursing competitions, with the main challenges reported as the lack of financial resources to invest and the training of clients at the beginning.
Entrepreneurship in nursing: contribution to the goal of sustainable development Health and Well-Being.	Menegaz; Trinity; Saints.	2021	Entrepreneurial action has potential, including in interface with the sustainable development goals. However, once circumscribed in the context of the challenges of the Brazilian health system, it needs promotion and education.
Obstetrics nursing office: the nurse as an entrepreneur.	Neto; Silva; Sanches; Felix.	2022	The entrepreneurial office nurse has become more relevant every day, in addition to becoming more economically stable, resulting in financial independence that consequently improves their quality of life and personal fulfillment.
Entrepreneurship in Nursing: A need for innovation in health care and professional visibility.	Olive tree; Alburquerque; Nunardo.	2022	In the profile of the entrepreneurial nurse, characteristics, attitudes or personal competencies were grouped, as well as the motives and opportunities that drove nurses to become entrepreneurs.
Business entrepreneurship as an	Silva; Xavier; Ferreira; David; Ferreira; Silva;	2023	Nursing has invested less in entrepreneurial entrepreneurship

activity for the professional growth and enhancement of nurses.	Frank; Luna; Moreira; Almeida.		than other professions in the health area. However, this trend has changed, with the emergence of expanding nursing offices and clinics around the world. Nurses' interest in recognition, appreciation, stability, adequate remuneration, and a more important position has driven the development of entrepreneurial actions in the class.
Business entrepreneurship in nursing: challenges, potentialities and perspectives.	Silva; Xavier; Almeida.	2020	Entrepreneurship in nursing is in full growth and encompasses multidisciplinary knowledge. It is an emerging field of research that demands scientific theories directed to nursing practices. The bureaucratic issue was highlighted as a hindering factor for the enterprise of the professional class.

Source: Prepared by the authors, 2024.

Entrepreneurship in Nursing is linked to a sum of skills and competencies specific to the profession. Thus, entrepreneurial nurses are considered professionals who identify opportunities, independence, innovation, and flexibility.

Scientific evidence on entrepreneurship in Nursing has been gradually built over the years, especially in Brazil, although there are also international publications. Entrepreneurship in Nursing is associated with a vision of creating, developing, and taking advantage of opportunities in the areas of care, education, and management related to nursing practice (Copelli, 2019).

Nursing, being a profession with a holistic view of the patient, enjoys creativity and potential to explore new areas, contributing to the economic and social development of the country. For nurses to continue to evolve, it is essential that they develop essential skills for entrepreneurship, such as initiative, autonomy, commitment, motivation, self-confidence, responsibility, logical thinking, versatility, persistence and dedication. Nurses need to value themselves and recognize the relevance of their profession, so that, with seriousness and, above all, self-confidence, they can demonstrate to clients the importance of their business (Borges, 2022).

Currently, nurses are required to adopt a new attitude, but some challenges arise already in the undergraduate course, since entrepreneurship is not included in the curricular disciplines, which causes students to leave without the necessary knowledge to undertake. Other challenges are related to the nurses' concern that starting their own business can be seen as unfair competition with current doctors and employers, or the fear that society will not easily accept the new health services performed by nurses, as the culture that hospitals

and doctors' offices are the only places that offer health services still prevails (Copelli, 2019).

Unfortunately, in Brazil, entrepreneurship in Nursing is perceived more as an opportunity for professional and financial appreciation, which is not achieved in the hospital environment, than as an economic alternative. In addition, many nurses opt for this alternative as a way to escape the exhausting routine they face, aiming to obtain better financial results (Oliveira, 2022).

Considering the importance of entrepreneurship for the visibility and appreciation of nurses, the need for changes in practices, values and management models used in nursing becomes evident. In addition, the profession must establish its presence in the market through the appropriate pricing of its activities, allowing society to recognize and consume nursing services in a concrete, habitual and conscious way. To this end, COFEN published Resolution 673/2021, which guides nurses on charging minimum amounts for their fees. The transformations brought about by entrepreneurship go beyond simple economic growth; entrepreneurship implies initiating and implementing changes in the structure of businesses and in society as a whole (Silva, 2023).

CONCLUSION

The data obtained in this Integrative Literature Review research allowed the identification of entrepreneurship in nursing as an opportunity for autonomy and professional visibility. The results show that nurses have a range of possibilities to practice their activities, combining skills and competencies with entrepreneurship. These skills include a comprehensive view of human needs, adapting to new contexts, and discerning opportunities.

A new view of the nurses' career was also observed, since entrepreneurship has had an impact on freedom and autonomy, evidenced by the change in professional activity and entrepreneurial capacity, leaving a traditional system with remuneration below that desired by the category and which does not provide freedom.

In short, entrepreneurship in nursing represents a powerful opportunity for professionals in this area to reach new levels of autonomy and recognition. By becoming entrepreneurs, nurses not only expand their possibilities of action and achieve their personal goals, but also enhance the practice of the professional nurse in the care of people and communities, offering innovative and high-quality services. Therefore, the need for other studies of the same nature highlighting entrepreneurship as an opportunity to increase the visibility of the profession is pointed out.

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REPETITION AS A POWER OF DIFFERENCE IN CONTEMPORARY ART

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ABSTRACT

The article presents conceptions of the terms Repetition and Difference, based on Gilles Deleuze (2018), addressing a general notion of Repetition, succeeding issues related to Difference; as well as discusses the three temporalities in the act of repeating, producing relationships with the conceptualizations of Contemporary Art by Alain Badiou (2013); thus, weaving links with the poetics that I develop, pointing out how repetition, seen as an artistic process, enhances the difference in Contemporary Art.

Keywords: Difference and Repetition. Gilles Deleuze. Contemporary Art.

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INTRODUCTION

In the face of the constant profusion of images, in which we experience in contemporary times, the repetition of images becomes something common in the virtual environment, where reproducing, sharing and copying something is an easy, fast and possible task for everyone; not being very different from the physical environment and materiality. Bearing in mind that capitalism and its demands or requirements as an economic system require a mass reproduction and accumulation of consumer goods; Such circumstances of functioning move and affect the way of life of the subjects inserted in this contemporary context, where the action of repeating often becomes an unconscious and constant act in the most varied dimensions of life in society.

In this way, repetition is also perceived in contemporary artistic productions, in which the action of repeating is understood by the artist as a power to address and problematize the issues present in our time, typical of Contemporary Art. Thus, Alain Badiou (2013) defines the term "contemporary" as something "of now", belonging to its time; extending to Contemporary Art, the author defines the productions and the current Art System as combatant of the very notion of work, in this way, Contemporary Art would be an art criticism, an artistic criticism of art, addressing, mainly, the concept of finitude of the work.

The author adds that the notion of Contemporary Art is subject to two norms, essential to characterize current artistic productions. The first of them makes an attack against the figure of the artist, who was previously considered a genius, someone spectacular and sacred. This issue is combated through the idea that the artistic gesture can be associated with banal actions and elements of everyday life, at the same time that it can be done anonymously (Badiou, 2013. P. 03).

The second norm is directly related to repetition. Through the conceptions of Alain Badiou (2013) it is possible to consider Contemporary Art as possessing a potentiality that would enable repetition. In this sense, repetition, reproduction and serialization are procedures designed to destroy the idea of a single work within Contemporary Art, as opposed to what was in force in Art History for a long time. This repetition or reproducibility of the work of art, already presupposed by Walter Benjamin (1892–1940), is something linked to the context of capitalism and the market, requiring mass production at the industrial level and also referring to the technological advances in the circulation of information.

In the same way, the artist and, therefore, also the Art System inserted in this context, bring problems of his time in his contemporary productions, questioning in various ways the reproduction of images, and consequently, problematizing the uniqueness,

singularity and aura of the works, within the notion of art and idea, coming from a spiritual realization.

In this perspective of repetition being a possibility within Contemporary Art, Gilles Deleuze (2018) states that the more everyday life becomes standardized, subjected to an accelerated reproduction of consumer objects, explicitly related to capitalism, the more Art must connect to these reproductions of contemporary life and, mainly, the artist must extract from this experience within this context a Difference that, simultaneously, it is present between repetitions and their temporalities. Thus, aesthetically reproducing the problems of contemporaneity, to the point of expressing Difference as a repetitive force of opposition with an effect of freedom.

> Perhaps the highest object of art is to make all these repetitions act simultaneously, with their difference of nature and rhythm, their respective displacement and disguise, their divergence and their decentralization, to fit them into each other and from one to the other, to envelop them in illusions whose 'effect' varies in each case. Art does not imitate, but this happens, first of all, because it repeats, and repeats all repetitions, from an inner power (imitation is a copy, but art is simulacrum, it subverts copies into simulacra). Even the most mechanical, the most everyday, the most habitual, the most stereotyped repetition finds its place in the work of art, and is always out of place in relation to other repetitions on condition that one knows how to extract from it a difference from the other repetitions. This is because there is no other aesthetic problem than that of the insertion of art in everyday life (Deleuze, 2018, p. 385).

Thus, it is interpreted as possible that the most varied forms of repetition (mechanical, virtual, manual, habitual, everyday, among others) are viable to serve as a power for contemporary artistic production, however, a Difference must be extracted from these repetitions, which is of the nature of the action of repeating, in order to produce art from and through Repetition, being both a concept and an aesthetic in artistic making.

In this way, I develop a research in visual poetics, in accordance with Alain Badiou's conceptualizations of Contemporary Art, in which repetition is the central point of study, unfolding in numerous conceptual and aesthetic questions. The problem of the study is the question of how to unfold a base image, not considered original, from the perspective of the production of others, creating a visual unity between the different repeated images. Therefore, how to develop images through repetition, which at first glance are similar and equivalent, but which at their core have differences, arising from varied conceptions; but at the same time that individually they are considered a unit and together they form a unified whole. As well as linking artistic practice to a hybrid process, articulating exclusively manual techniques and digital technologies, typical of my artistic work.

Following what has been exposed, this article presents perceptions about the concept of Repetition pertinent to research in development, having as a basis to discuss the

conceptions of the term, the French philosopher Gilles Deleuze (1925-1995) and his book "Difference and Repetition", originally his PhD thesis in Philosophy, published in 1968 in book format. The general conceptions about the concept of Repetition are highlighted, as well as the three temporalities of the action of repeating, outlining notes pertinent to the research.

Deleuze in "Difference and Repetition", as the name of the book itself elucidates, addresses the two concepts together, in which each of them complements the conceptualization of the other. In this sense, the author states that Repetition is not generality, and that between Repetition and similarity Difference is of nature. Thus, generality is presented in two major orders, the qualitative of similarities and the quantitative of equivalences (Deleuze, 2018. p. 17).

Generality expresses that one term can be exchanged or replaced by another, this exchange of particulars corresponds to the conduct of generality. Contrary to generality, Repetition is only a necessary and well-founded conduct in relation to what cannot be replaced. Repetition refers to a non-interchangeable, irreplaceable singularity. Therefore, the criterion of generality is exchange, while Repetition has theft and gift as criteria (Deleuze, 2018. p. 18).

Thus, to repeat is to behave in relation to something unique or singular, something that has no similar or equivalent. Repetition has as an external conduct an echo of a more secret vibration, of an inner and deeper Repetition in the singular, concretizing itself in a potency. Deleuze (2018) states that in the act of repeating there is a Difference that superimposes itself on the repeated. In this sense, Difference inhabits Repetition, it makes us pass from one order of Repetition to another; the Difference is between two repetitions, just as the Repetition is also between two differences.

Thus, Repetition is possible to something singular and irreplaceable, as well as Art and the uniqueness of each artistic work. The act of repeating takes place between the two generalities, threatening to subvert them, into another power. In this way, Repetition belongs to humor and irony, being by nature transgression, exception, always manifesting a singularity against particulars, being a universal against generalities.

From the initial considerations of the concept of Repetition proposed by Gilles Deleuze, it is possible to have an idea of what are the circumstances of the action of repeating and some of the aspects of Repetition. However, the author goes deeper into the concept, presenting the three temporalities, present, past and future, in the act of repeating, revealing how Repetition behaves in each of them, ensuring itself in syntheses of time.

Despite the uniqueness of Repetition in each time, it will be present simultaneously in the three temporalities genuinely.

Within this perspective, the repetitions that I carry out in the research as an artistic practice, aiming at the construction of the proposals, are simultaneously located in the three temporalities and, consequently, in the syntheses of time belonging to each of them. Thus, the act of repeating as an artistic process relates to the present, the past and the future together, comprising the singular characteristics of each of the temporalities of Repetition, which together form an internal power in the repeating subject and external in the repeated object.

The synthesis belonging to the present is related to habit and is extremely important, as it also constitutes the other temporalities. This synthesis is formed by a contraction, which names it, synthesis of contraction or passive, forming a synthesis of time. In this sense, time is only constituted in the original synthesis that affects the repetition of instants, contracting the instants into each other, these instants being successive and independent. Therefore, constituting the living present, it is in this present that time unfolds. Therefore, the lived present goes from the past to the future that it constitutes in time (Deleuze, 2018. p. 118).

Repetition in the synthesis of the present is represented by habit. Habit extracts from Repetition something new, in this case Difference, initially posited as a generality. Deleuze (2018) states that habit is a contraction, a fusion of Repetition in the spirit that contemplates. It is by contracting that we are habits, but it is by contemplation that we contract. Thus repetition changes nothing in the object that is repeated, but it does change something in the spirit that contemplates this repetition.

In this way, repetition understood as artistic power and process, as in the research I develop, would not change something directly in the object that is in the process of repetition, but would change something in the spirit that contemplates or performs the repetition, in this case, me as an artist. Repetition seen as a habit in the living present, modifies the interior of the artist who submits his artistic practice to the action of repeating, therefore, Repetition itself also changes.

What is transformed is the way I understand the repetition that is in action; With the re-execution of an act countless times, something is modified, gestures are abandoned and others are perfected, aiming at the improvement of repetition according to the objective set on it. I understand subjectively that the act of repeating as a habit changes as I constantly get involved with the action. They are differences that arise from one repetition to another unconsciously while I perform the repetition, they are not rationally realized improvements,

even if they may happen; However, such differences can be perceived later during the re-execution of the repetition, however, new differences will be produced at the same time that the old ones are discovered, a phenomenon related to the past and commented below. Thus, producing a cycle of simultaneous formation and revelation during repetition as a habit.

The first synthesis of time is the original one, however, it is also intratemporal. It constitutes time as a present, but as a present that passes. Time does not begin in the present, but the present is in constant movement in temporality, through leaps that are partially covered. Thus, the present is a paradox, while it constitutes time, it also passes in this constituted time (Deleuze, 2018. p. 117). In this way, another time is needed in which the first synthesis takes place, referring to a second synthesis of time, in this case, the synthesis of the past or memory. But the first synthesis, referring to habit and belonging to the present, is the foundation of time, however, it is not its foundation.

The intention of the present is to pass. However, that which causes the present to pass away and that which appropriates this present and the habit belonging to it is determined as the foundation of time, so the foundation of time is memory. Taking into account that memory is active, it rests on habit; it is at the moment when memory is founded on habit that another passive synthesis originates, in this case, the synthesis of memory or *Mnemosin*, belonging to the past. "Habit is the original synthesis of time that constitutes the life of the present that passes; memory is the fundamental synthesis of time that constitutes the being of the past (what makes the present pass)." (Deleuze, 2018, p. 118).

For Deleuze (2018) the past is closed between two presents, the first of which is the one it was and the other is the one in relation to which it is past. The old and the present are not two successive instants in the timeline, but rather, the present preserves a dimension of the old present. Thus, the synthesis belonging to the past is an active synthesis of memory, being a representation of the old present and a reflection of the present. In this way, the synthesis of habit constituted time as the contracting of instants under a condition of present, however, the synthesis of memory constitutes time as the fitting of the present themselves.

The synthesis of habit and the synthesis of memory differ from each other, thus reflecting on Repetition, and can be material or spiritual repetitions. The two repetitions are quite different from each other, while the material repetition refers to successive independent instants or elements, the spiritual repetition refers to the whole, on different coexisting levels. Such differences between repetitions interfere differently with the very

notion of Difference, derived from the act of repeating. In material repetition, Difference is extracted to the extent that the elements or instants contract in a living present. In spiritual repetition, Difference is included to the extent that the whole comprises the difference between its levels (Deleuze, 2018. p. 121).

According to the above, it is verified that the repetitions performed through habit or memory distinguish between them and influence the differences generated from them. Material repetition is related to the present and formed by instants of independent times that contract, in this sense, making a relationship with the poetics that I develop, the elements repeated materially, physically and virtually, each one has a different temporality at its core, therefore, singular and independent among them, but contracted in a living present or gathered in just one artistic proposal.

Spiritual repetition, on the other hand, formed by memory and belonging to the past, is a fitting of the whole, of all levels of the various presents, which form this temporality. In this sense, the habits belonging to the present and their synthesis are transformed into memory; From the perspective of the research, the repetition in the temporality of the past is seen in the execution of actions that happened previously and that are resumed in the present in the form of a reflection imposed by the past. Consequently, all the difference generated within the subject during the action of repeating in the old present, accumulates in the past and is revisited at all times again in the present present. Thus, the differences will be evident in this internal and spiritual transit between the past (memory) and the present (habit), being perceived in the poetics in the performance of actions for the repetition of the elements.

The third Repetition, belonging to the future, is described by Deleuze (2018) as an eternal return, as repetition is an action before being a concept of reflection. In Repetition we only produce something by constituting the past and metamorphosing the present. What is repeated in this third time is a repetition by excess, the repetition of the future as an eternal return. The eternal return affects the new, which is repeated under the condition of insufficiency and through metamorphosis. In this process, the repeated is autonomous from other times, it is repeated by excess, it is new and alone, constituting the third time, the future (Deleuze, 2018. p. 131).

In the third synthesis, the present becomes only an agent, with the function of disappearing, while the past becomes only a condition operating by insufficiency. In this way, the synthesis of time constitutes a future that affirms the infinity of the product subjected to repetition. The present, the past and the future reveal themselves as repetition through the three syntheses of time, each acting in different ways in the action of repeating.

In this way, "The present is the repeater, the past is the repetition itself, but the future is the repeated" (Deleuze, 2018, p. 132).

According to the above, the third synthesis of time, belonging to the future, is described as an eternal return, so it is verified that the Repetition that happens in the present (habit), submitted to the repetition of the past (memory) is a repetition that will perpetuate itself infinitely, always returning and existing in itself, designating the repetition of the future. Repetition in the eternal return happens as an excess of what is already established, however, aiming at an independence of the other two syntheses, from the point of view of succeeding and constituting new temporalities.

The future is the repeated, it is the final action of Repetition that would not happen without the other temporalities, because the past is the reflection of the act of repeating in the present. The three temporalities, their syntheses, and each of the types of repetition are what constitute Repetition as a whole. Thus, Repetition should not be analyzed only in the face of one of the times, but rather as an action happening simultaneously between temporalities. Repetition is coexistent, in which the present, the past and the future each have their own singularity in the constitution of repetition as a power of freedom towards differences.

Finally, Repetition is not fixed to a term, supposedly original or last. For the repeated object moves between two coexisting time series, between the two present, the present and the ancient, so that neither series can be considered or designated as the original or the derivative. Repetition is not a simple repetition of elements or parts that follow one another, but is the repetition of totalities that coexist at different temporal levels. Therefore, Difference is not extracted from just one repetition, but between the temporalities of a repetition that is totalizing (Deleuze, 2018. p. 378).

In this way, Repetition does not have an original, an element that unfolds the others, it is the repetition of a whole that coexists between temporalities and the differences between the types of repetition. Before an action is designated as a repetition in the present, it is itself a reminiscence of the past, which was a future in other temporal cycles.

In view of this, Repetition as an artistic power in contemporaneity, makes it possible to identify differences between the numerous repeated elements/images, which in a first analysis are similar and equivalent. However, repetition also enables the heterogeneous freedom of Contemporary Art, in which Difference gains strength among repetitions, which, despite being constant, do not have a harmful character, because it is difference that matters in Art, from the point of view of questioning a society submissive to constant transformations, but increasingly automated and standardized.

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THE PREFERENCE OF THE CHARACIFORMES BRYCON ORBIGNYANUS (VALENCIENNES, 1850) FOR THE ENVIRONMENT IN RELATION TO LUMINOSITY

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ABSTRACT

The construction of dams has interfered markedly in the local landscape of some Brazilian states, causing changes in the environment. In this way, the spawning of migratory fish can be harmed. Some species are threatened with extinction, as is the case of *Brycon orbignyanus* , popularly known as piracanjuba. Studies related to the biology and behavior of fish are essential for their preservation. Among the most important factors that affect the feeding strategy of fish, light seems to be a stimulus that makes them more or less active. The objective of this study was to evaluate the preference of the fish *Brycon orbignyanus* for the environment in relation to luminosity. The experiment was carried out with piracanjuba larvae at the Nico Nieser Laboratory of the Ecology and Evolution discipline, in Uberaba, Minas Gerais, Brazil, on January 26 and 27, 2011. For the experiment, a rectangular glass aquarium measuring 30 x 10 x 10 cm was used, which was divided into two environments with each length, one light and the other dark. For five minutes, the movement of each specimen in the aquarium was observed. Due to the possibility of individual identification of the larvae, the method adopted was that of the "focal animal". During the experiment, all the specimens of piracanjuba remained in the bright environment. A significant number of fish species are visually guided and the decrease in light can compromise food selection.

Keywords: Biodiversity. Water resources. Rheophilic species. Bryconidae.

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INTRODUCTION

The exploitation of multiple uses of water significantly influences the availability and quality of water resources[1]. The increase in population and, consequently, industrial growth, has stimulated the development and execution of projects for the construction of hydroelectric dams and irrigation, causing environmental impacts on the ichthyofauna, interrupting the migration routes of spawning fish2.

The construction of dams has markedly interfered with the local landscape of some Brazilian states, causing changes in the economic, social and environmental order in the areas where they are installed. One of the main damages caused to the environment by the construction of dams is the loss of biodiversity3.

This loss is related to the disappearance of terrestrial habitats due to damming, and to the modifications produced in the aquatic habitat, such as changes in depth4.

In this way, migratory fish are affected by the changes imposed by damming. Some species are threatened with extinction, such as *Brycon orbignyanus*, (Valenciennes, 1849) Eigenmann & Norris, 1900, popularly known as piracanjuba. This species has had its population drastically restricted in its natural environment, probably due to environmental degradation5-7.

Fish represent the most numerous and diverse group among vertebrates, with about 25,000 known species, of which approximately 600 occur in the Paraná basin. They are found in different aquatic environments, being adapted to a peculiar habitat, which varies for each species8. In this way, some species inhabit rapids, others in lakes. Many have great commercial value, constituting an expressive source of animal protein for the human population. They exhibit great variation in body size, color, and shape, and some species have elaborate life cycles and reproductive strategies9.

South America has the greatest wealth of freshwater fish on the planet. In Brazil, there are more than three thousand classified species. One of the common difficulties of fish farming stations, with a view to the production of animals, for various purposes, such as the repopulation of watercourses modified by the construction of dams and hydroelectric plants, production of protein for human consumption or fish-pay, is the limitation existing in the initial phases of cultivation of native species. Usually high mortality rates are observed until the fingerling stage. From this stage of development, some authors report an increase in the survival and productivity of fish in culture10.

Environmental factors are decisive for the development of larvae and fish, and greatly influence feeding in the early stages of development11. Although fish have high

reproductive capacity, many species are in the process of extinction. This has been occurring due to the destruction of its habitat, as a result of anthropogenic activities12.

Among the Brazilian fish species, the piracanjuba stands out for its economic value due to its excellent meat. The piracanjuba is a fish that spawns and has good commercial acceptance because it has excellent quality meat, arousing great interest from researchers and producers. Despite this scientific and commercial interest that this species has been receiving, little is known about the preference of this fish for the environment in relation to luminosity13.

Studies related to the biology and behavior of fish are essential for their preservation. Among the most important factors that affect the feeding strategy of fish, light seems to be a stimulus that makes them more or less active. Thus, in order to take measures aimed at preserving the piracanjuba, it is necessary to know the biology and behavior of this species, involving the preference for the environment in relation to luminosity7.

This species is considered large, measuring between 62.5 and 80 cm, weighing up to 8.2 kg. Females reach a total length of 80 cm and body weight of 8.2 kg and males, 68 cm and 3.6 kg6.

This species is ecologically demanding, being one of the first to disappear in response to human-generated changes, especially deforestation, agricultural activities and dams, and can therefore be considered as a biological indicator of the environmental quality of rivers14.

The Brazilian legislation itself defines that the quality of aquatic environments can be evaluated by biological indicators, using aquatic organisms and/or communities for this purpose15.

According to MMA Ordinance No. 445, of December 17, 2014, the piracanjuba is on the National List of Species of Aquatic Invertebrates and Endangered Fish. This species is an endangered species, being fully protected, including, among other measures, the prohibition of capture, transport, storage, guarding, handling, processing and commercialization16.

This species is also included in the list of endangered species of the fauna of Minas Gerais, in the Red Book, since 1998 and is currently critically endangered in this state17.

The species *Brycon orbignyanus* (Valenciennes, 1849) became an endangered species in the Grande, Mogi Guaçu and Pardo rivers. In these rivers, many specimens were captured in the forties. This species became extinct in this region due to deforestation of riparian vegetation, pollution, the construction of dams, and the indiscriminate use of pesticides18.

The objective of this study was to evaluate the preference of the fish *Brycon orbignyanus* (piracanjuba) for the environment in relation to luminosity.

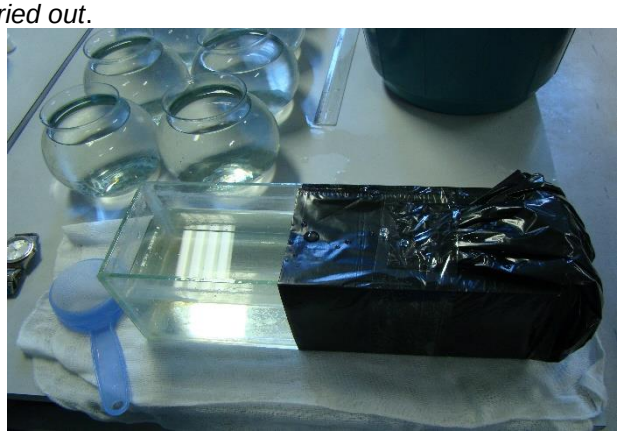
MATERIALS AND METHODS

This work was carried out with the larvae of the fish *Brycon orbignyanus* (piracanjuba). The larvae used were collected at the Companhia Energética de Minas Gerais – CEMIG, at the Volta Grande Environmental Station – EAVG, located in the municipality of Conceição das Alagoas – MG with approximately 04 days of life and undetermined sex, in January 2011.

The experiment was carried out at the Laboratory of Ecology and Evolution, Department of Biological Sciences of the Federal University of Triângulo Mineiro – UFTM, in Uberaba – MG, on January 26 and 27, 2011, from 5:30 p.m. to 7 p.m., with larvae of the fish *Brycon orbignyanus* (piracanjuba). In the laboratory, the larvae were stored in a glass aquarium measuring 95 x 35 x 55 cm, with a capacity of 160 L, with constant aeration at a temperature of 26oC and exposed to the natural light cycle, for two days before the experiment. During the study period, the larvae were fed with natural plankton.

For the experiment, a rectangular glass aquarium measuring 30 x 10 x 10 cm was used, which was divided into two environments with each length, one light and the other dark. For the dark environment, a black plastic bag was used (Figure 1).15 cm

FIGURE 1. Aquarium divided into two environments: light and dark; where the experiment with larvae of *Brycon orbignyanus was carried out*.



The piracanjuba larvae were removed from the larger aquarium, with a one-mm mesh sieve, one by one and transported to the aquarium with two environments.

Due to the possibility of individual identification of the larvae, the method adopted was that of the "focal animal"[19,20], where the fish larvae were placed individually in the bright compartment of the aquarium, and the movement of the specimen was analyzed, with registration every five minutes (Figures 2 and 3).

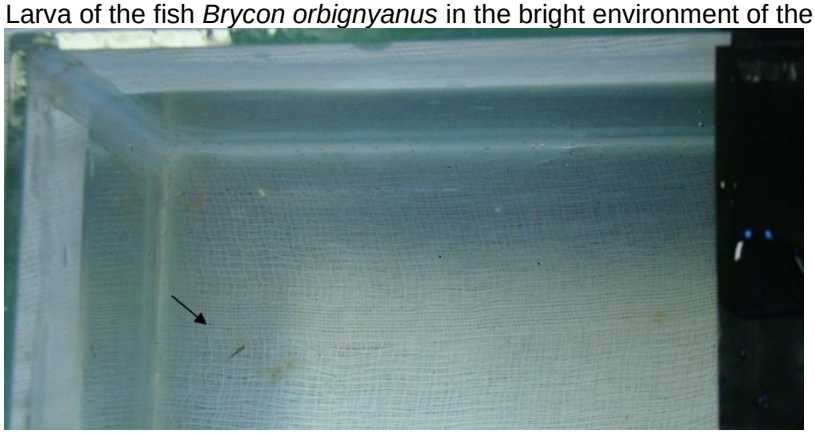
Subsequently, the specimen was removed from the aquarium and placed in another individual aquarium, with a capacity of 600 ml, to repeat the experiment the next day. In total, 08 (eight) observations were made.

All the water used in the aquariums and in the experiments came from Rio Grande, near the Volta Grande Environmental Station.

FIGURE 2. Observation of the specimen of *Brycon orbignyanus*, regarding the possible choice of the environment, in an aquarium divided into two environments.



FIGURE 3. Larva of the fish *Brycon orbignyanus* in the bright environment of the aquarium.



RESULTS AND DISCUSSION

In this work it was verified that the larvae of *Brycon orbignyanus* (piracanjuba) preferred only the bright environment. All four specimens of piracanjuba remained, for five minutes, in the bright environment. This preference did not change on the two days of the experiment (Table 1).

TABLE 1. Number of larvae of the fish *Brycon orbignyanus* (piracanjuba) with a preference for the environment (light and dark) per day.

Days	Bright environment	Dark environment
26/01/2011	04	0
27/01/2011	04	0
Total	08	0

It was observed that the animals moved in the light space in the prone position. At first, the movements of the larvae under study were fast, rectilinear and active. It was only after a few minutes that the movements occasionally reduced in intensity, but always on the light side of the aquarium.

A point to be highlighted in this work is what led the larvae of *Brycon orbignyanus* (piracanjuba) to choose the light environment avoiding the dark one. In this aspect, only a few considerations can be made, but more studies are needed.

It is known that a significant number of fish species are visually guided and the decrease in luminosity, change in light contrast and water turbidity compromise food selection21,22.

Light is one of the most important factors that affect the feeding strategy of fish, being a stimulus to make fish active18. However, the effect of light can also act as a stress-generating agent, causing aggression and an increase in the rate of cannibalism23.

The color of the environment is one of the factors that affects behavior and it is possible that it has implications for the well-being of the fish. However, little is known about the preference of fish in relation to environmental color24-26.

The magnitude of food consumption varies with the light intensity, which influences the possibility of detecting prey, and it is observed that the photoperiod is a factor that implies the growth and survival of the larvae. A characteristic of fish, such as those of the genus *Brycon,* is the well-developed and well-pigmented eyes, which facilitates the visual direction to attack their prey23.

Fish that use vision to capture their food may be affected by environments where the main food is distributed in deep, dimly lit places23.

The study carried out with post-larvae of *Brycon orbignyanus* found that the survival of these fish was directly related to luminosity, the lowest survival was recorded in the treatment without lighting23.

FINAL CONSIDERATIONS

Further studies involving the biology and behavioral aspects of this species are needed to validate this work.

The protection and recovery of habitats should be priority strategies for the conservation of piracanjuba since this fish is considered an indicator of water quality and because its meat is appreciated, in addition to being a source of noble protein. Thus, research on biology, such as surveying the remaining populations and studying the behavior of this species in detail, is necessary.

In regions where this species is threatened with extinction or is already extinct, it can be carried out. However, as this fish is ecologically demanding, it is necessary to define effective actions for the recomposition of the riparian forest, where it does not exist. Another conservation strategy for this species is captive breeding, but this strategy also needs validation.

Allied to the strategies for the conservation of piracanjuba, it is essential to create environmental education programs that highlight the need for the importance of this species as well as the dissemination of information about the damage caused to the environment and, consequently, to man, by the degradation of natural resources.

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DEEPFAKES AND DEEPNUDES AS MODALITIES OF *CYBERBULLYING*, THEIR OCCURRENCE IN THE SCHOOL ENVIRONMENT AND THE VIOLATION OF THE DIGNITY OF THE HUMAN PERSON

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ABSTRACT

This article explains how the so-called *deepfakes*[3] and *deepnudes*[4] are configured as a new possibility of derivation of *cyberbullying*, so that they cause various damages to the dignity of the human person, with regard to image, reputation, intimacy, privacy, the contradictory, the ample defense, the legality and other constitutional principles that violate the victims who have their images illegally used by the aggressors, which ends up affecting the right to education. The text will address concepts, the responsibility of the school, the responsibility of parents, the violation of human rights, the ecology of Edgar Morin's action and the human formation developed by Antônio Joaquim Severino. The verified information pointed to the shared responsibility of parents, the school and society for the protection of children and adolescents, due to this type of digital incident. In conclusion, some paths will be pointed out, such as investments in human education, recognizing the influence of school and family environments and the digital sphere, so that teachers, parents and students contribute to the prevention and resolution of such incidents.

Keywords: *Deepfakes*. *Deepnudes*. *Cyberbullying*. Scholastic. Dignity.

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[3] A computational technique that creates an image, video, or audio that is fake, using advanced computing methods.

[4] A computer technique that creates an image or video that is false, usually to undress the victim or to put him or her in a sexual or embarrassing situation.

INTRODUCTION

This article conceptualizes, analyzes and discusses the so-called *deepfakes* and *deepnudes* - new modalities of *cyberbullying* - associated with the school environment, which aim to seriously attack the dignity of the human person, the reputation, the image and the honor of children and adolescents. From this art, the text will bring the legal and management point of view on the responsibilities of school institutions and family members, with regard to the surveillance, attention and care of those social groups. Finally, the article will present reflections and recommendations for dealing with such incidents.

METHODOLOGY

The method used is the analytical inductive, targeting some constitutional principles, legislation, as well as to support the fight against *cyberbullying* in the modalities of *deepnudes* and *deepfakes,* considering their occurrences in the school environment and how an education based on respect for human rights, in a transversal way, can contribute to the reduction of incidences, working with an education for peace acting in a preventive way. For this, the collation of articles and texts that support this hypothesis was brought.

CYBERBULLYING: CONCEPTS AND PRACTICES

Before talking about *cyberbullying* itself, we will deal with *bullying,* whose identification, description and definition are prior and from which *cyberbullying* derives. Despite the similarities in terms of virulence and aggressiveness, they differ in terms of origin and propagation.

Bullying has its studies and primary work developed in the Nordic countries in the 1970s, and intensified from 1990 onwards, when the causes were also pointed out and prevention strategies indicated (Fante, 2010). Cyberbullying, in turn, comes from the digital technologies developed in the United States of America, for the most part, and from the hyperconnection that has occurred in recent years due to the increase in the use of technological devices, notably after the pandemic moment.

Currently, both phenomena are observed worldwide and can affect different social segments or school levels (elementary, secondary, higher education, public and private schools), being present in both physical and computational locations. Investigations indicate that the occurrences tend to decrease, when families and school institutions become aware of the episodes and seek prevention. In this context, it is worth mentioning the report by the United Nations Educational, Scientific and Cultural Organization - UNESCO (2019, p. 15) which highlights that *bullying*, if

> [...] It characterizes a pattern of behavior rather than isolated incidents, and often worsens if left unchecked. It can be defined as the intentional and aggressive behavior that recurs against a victim, in a situation where there is a real or perceived imbalance of power and the victims feel vulnerable and powerless to defend themselves. Bullying behaviors can be physical (hitting, kicking, and destroying property), verbal (teasing, insulting, and threatening), or relational (defamation and exclusion from a group).
> According to a study based on data provided by three national surveys in the USA, the most common forms of bullying are: insults, name-calling and nicknames; scams, direct assault and robbery; and threats, defamation, social exclusion and isolation.

Cyberbullying is defined by UNICEF as follows[5] (undated, undated):

> Cyberbullying is bullying carried out through digital technologies. It can occur on social media, messaging platforms, gaming platforms, and mobile phones. It is the repeated behavior, with the intention of frightening, infuriating or embarrassing those who are victims.
> [...] In-person and virtual bullying often happen side by side. But cyberbullying leaves a digital footprint — a record that can become useful and provide evidence to help end the abuse.

The evaluations of UNESCO and UNICEF denote parity with the Brazilian occurrences, in which humiliations and exclusions are externalized, which aim to affect the dignity of the offended. The polysemic nomenclature of *bullying* places it in situations of systematic intimidation, given the entanglement of possibilities that this type of aggression encompasses.

It is observed that in school spaces the systematic manifestations, as the term itself indicates, are repeated in the school, exactly as in other environments. Diniz's statement (2016, p. 18-19) corroborates by assuring that the

> Bullying is a set of antisocial, cruel or aggressive (physical or psychic), intentional, insistent and repetitive behaviors, practiced, without evident motivation, by a bully (aggressor-student or teacher), in a school environment, who, by placing himself in a position of superiority, goes against person or people (victims or attacked), exposing them to embarrassing situations, humiliating them, ridiculing or threatening them, who, in the face of an unequal power relationship, are intimidated.

Directing the view to *cyberbullying*, Alves *et al*. (2013, p. 46) highlight the differentials that expand the power of the offender and increase the vulnerability of the victims, namely:

> The new concept (cyberbullying) has different characteristics: it goes beyond the horizon of space and time and is based on sources of power that are based on the handling of new technologies, which extend the personal power of those who bully and the vulnerability of those who are victims. These characteristics are associated with the difficulty of, on the one hand, identifying the aggressor and, on the other hand, defining the time and place of the offense, making it difficult to delimit the field of prevention and intervention in the face of this phenomenon. The direct association

[5] United Nations *International Children's Emergency Fund*.

> of cyberbullying with ICT justifies the enormous ease of its dissemination and its expansion to a much larger universe of people than traditional bullying, and in an indefinite time.

Salles Filho (2019, p. 176), in connection with the school, argues that

> [...] there is a need to consider the manifestations of violence that affect the pedagogical process and coexistence. Social violence takes on its own social contours at school, emerging as forms of indiscipline, aggression, verbal abuse, *bullying*, which almost completely make the pedagogical process in the different school subjects unfeasible. Therefore, we say that the definition of violence in the school environment must consider the reality and context of the school and the students, in addition to the relationship of the teachers, the community constructions and the way that each space relates to so many variables. Considering these issues, we open the reflection to the need to build within schools a pedagogical path of education for peace, obviously considering the notion of complexity.

As seen, Salles, when dealing with the particularities of violence in the school field, takes into account that *bullying* and *cyberbullying* have specific ebbs and flows of relationships in educational institutions and, therefore, have their specificities to be respected and taken into account for possible solutions.

In this way, it is introductory to verify what *cyberbullying is* and previously it is already understood, as will be discussed below, how the use of artificial intelligence involving *deepfakes* or *deepnudes* can generate embarrassing situations, humiliation, ridicule and threats, among others, thus framing in systematic intimidation with high offensive potential the subjectivity of individuals, notably in the school environment.

ARTIFICIAL INTELLIGENCE

The International Machines Corporation - IBM[6] -, an American company focused on information technology, defines artificial intelligence AI, as

> "It is the science and engineering of creating intelligent machines, especially intelligent computing programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to be limited to biological observation methods." (Quotation marks in the original)

This concept is extremely worrying, as its indiscriminate use can be harmful in any area by instrumentalizing the occurrences of *cyberbullying,* as in the case of fake videos and images. This situation has generated debates, particularly in the ethical and individual fields, as people are not prepared for the novelty of overexposure, which is more sensitive considering young people within school environments.

[6] One of the largest companies in the world, in this AI theme.. What is artificial intelligence? Available at: https://www.ibm.com/br-pt/topics/artificial-intelligence. Accessed in: 02/08/24.

The UNESCO General Conference, meeting in Paris from 9 to 24 November (2021), in its 41st session in 2021, considering the current challenges of AI, including in the area of education, created a booklet[7] of recommendations to participating countries. In the aforementioned booklet there is an eminently ethical concern, in various contexts, in particular, that which relates to education and human rights. Nothing referred, however, to *cyberbullying*, but suggested, indirectly, mental health, violence and other related themes.

Below we will see how harmful AI can be when used in the tampering of images and videos and how this links to systematic intimidation.

DEEPFAKES, DEEPNUDES, AND OTHER PRACTICES

One of the derivations of *fake news* is the case of *deepfakes.* According to Cabral (2018, n.p.):

> Deepfake is a technology that uses artificial intelligence (AI) to create fake but realistic videos of people doing things they have never done in real life. The technique that allows video montages has already generated everything from pornographic content with celebrities to fictional speeches by influential politicians. Debates are now circulating about the ethics and consequences of technology, for better or for worse.

As verified, public figures have already been victims of this type of manipulation, in audios and videos, almost always restricted to those interested in technology. The popularization of programs and applications has made access more possible, including for children and adolescents, who can use them as a practice of *cyberbullying*. To make it even more explicit, an example of a situation of *deepfakes* that occur with some frequency in the school niche are the insertions with people's faces in joking videos or with scenes of explicit abuse (Demartini, 2022).

With young people increasingly immersed in technological content, it is important to know their responsibilities as an individual/society/species (Morin, 2017), and therefore it is necessary to have an unwavering digital education, so that there is a preparation for the identification of fake news. An indispensable support is the Delors Report (2010), which focuses on digital literacy and resorts to learning to know, learning to do, learning to live together and learning to be, with regard to, in this case, social networks.

It is also worth noting that *deepfakes*, *fake news* and *cyberbullying* affect the senders, as they induce inappropriate and unreasonable conduct, and almost always result from psychological issues; and the receivers, who potentially present egoic weaknesses,

[7] UNESCO. School violence and bullying: report on the situation of the world. Brasília: 2019. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000381137_por. Accessed on: 25 mar. 2023.

resent these practices and, for this reason, are targets of those who consider themselves superior or powerful. It is understood, therefore, that there is a need for constant clarification and learning, for the prevention of hate speech and the violation of human rights.

Deepnudes are achievements that have been occurring for years, and make it possible to alter images, leaving victims in embarrassing situations, above all, by using nudity and/or sexual exposures. It is noted that what was restricted to media targets has impacted ordinary people, as they arrive in all fields of coexistence. In this sense, Arbix (2020, n.p.) states that AI improves life in many aspects, but it also has an aptitude for evil, as it often aims to harass women and LGBTQIAP+ communities.

There are apps that use a pre-existing image of another person and fit the victim's face, in order to put it in that unreal situation. And others who take a real photo of the victim, leaving him naked, with a database of similar people and make this illusory creation. Both situations raised in lies are still a form of *fake news* and *cyberbullying*, most of the time. And it is worth asking, who is able to distinguish such a digital creation? Even if the falsehood is later proven, the damage has already been consummated.

As reported by Ferreira (2023, n.p.), on the Olhar Digital portal, there are cases in the United States of America and Brazil, but he mentions *deepfake* which is a more generic modality than *deepnude*, as already explained: "A group of students from Westfield High School, in New Jersey (USA), used an artificial intelligence (AI) application to assemble photos of school girls in pornographic images. Called *deepfake*, the practice was discovered and alerted by some of the victims, who learned of the photos after one of the boys decided to tell the reason for the 'buzz' at school.

Continuing the details of the American case, according to Ferreira (2023, n.p.), students confessed to the creation of the false images and the sharing, the school reported it to the parents but with confidentiality, while the parents of the victims complained for action, given the emotional and psychological pain generated. It is easy to imagine how a situation like this affects the entire school environment.

In the Brazilian case, Ferreira (2023, n.p.) reports a much-commented case that occurred in November 2023:

> Not surprisingly, this week a school in Brazil, in Rio de Janeiro, also faced the same situation. According to CNN, parents of students at Colégio Santo Agostinho received a circular from the school board warning about the use of AI tools in the creation of photo montages of students.
> More than 20 victims of harassment have already been identified. The school made itself available to the families of the students and stated that it will take appropriate disciplinary measures at the school level. The institution also warned that parents pay more attention to their children's virtual lives.

On the use of AI in *deepnudes* and its consequences in the school field, presenting an article especially on what happened at Colégio Santo Agostinho, located in Barra da Tijuca, Rio de Janeiro, Souza (2023, n.p.) clarifies the need to understand the consequences:

> Principals and teachers, parents and guardians, as well as – and especially – minors themselves, need to be prepared to understand the consequences of using AI to manipulate reality. Although the naked bodies exposed in the message groups are not the real bodies of the students, the boundary between the real and the artificial here matters little. The intimidation is real. Once again, it is necessary to remember: what happens on the internet does not stay on the internet. The damage goes beyond the network and generates consequences on the other side of the screen.

Because of all this, it seeks to increase the responsibility of platforms and prohibit the sale and use of applications for such illegal purposes, according to ongoing bills. There is a very serious problem now: how to discern the real from fiction with such a realistic degree that fake images and videos have been gaining with such technological attributes of manipulation? Muanis (2023, p. 55) brings interesting considerations about it:

> One last warning from Hans Belting is also in order. For the author, one cannot confuse virtual images with images of a virtual world. According to him, virtual images, made synthetically in digital, continue to be images of our world that, taking shape in computers, gain a series of complexities. The big question is how much, increasingly, we constitute in images a virtual world, which only exists in the imagination or in an imagetic reality complementary to ours, another space of mimesis, and what effects this can have on the way man sees himself and the very society in which he lives, directing his political and citizenship decisions.

From the above, it is denoted that, for those who do not have a satisfactory digital literacy, they will face several behavioral dilemmas, including to distinguish or at least consider that such a situation of exposure of the nudity of others may be false, such as when they are in doubt between the synthetic and the real about certain content passed on, because the distinction is something that generally requires knowledge by experts, But due to the mode of exposure, all caution is necessary, including for the viewers of these incidences, which is a concern in the school niche. This will overlap with issues related to *cyberbullying* many times, according to the examples brought below, in which there will be aggressor(s) and victim(s).

OCCURRENCES IN THE SCHOOL ENVIRONMENT AND THE ROLE OF SCHOOLS

In Brazil, Law 13.185[8], of 11/06/15, came into force in 2016, which institutes the Program to Combat Systematic Intimidation (*Bullying*). In paragraph 1 of article 1 of the

[8] This and the other laws mentioned will be detailed in the references.

aforementioned law, it defines as follows: "systematic intimidation (*bullying) is considered to* be any act of physical or psychological violence, intentional and repetitive that occurs without evident motivation, practiced by an individual or group, against one or more people, with the aim of intimidating or assaulting them, causing pain and anguish to the victim, in a relationship of power imbalance between the parties involved."

And in the sole paragraph of article 2 (Law 13.185/2015), it explains the modality of *cyberbullying*: "There is systematic intimidation on the world wide web (cyberbullying), when the instruments that are proper to it are used to depreciate, incite violence, tamper with photos and personal data in order to create means of psychosocial embarrassment."

In its article 4 [9] (Law 13.185/2015) the law is very clear in defining the responsibilities of educational institutions, as seen in a footnote. It is observed that there are many verbs that indicate actions, that is, measures for the institution to take and that must be proven to have been complied with in an eventual occurrence. For example, some verbs and complements mentioned in the aforementioned article: prevent and combat, train teachers, implement and disseminate campaigns, institute practices of conduct and guidance for parents, provide psychological assistance, integrate the mass media with schools and society, promote citizenship, avoid punishment of aggressors and promote awareness measures. Have all schools done this? In any judicial or administrative investigation, the burden of proof will be on the school institution.

Now, article 5 (Law 13.185/2015) of the aforementioned legal diploma is expressed when dealing with the duty of educational establishments, with regard to this issue, as noted: "Art. 5 It is the duty of the educational establishment, clubs and recreational associations to ensure measures of awareness, prevention, diagnosis and combat of violence and systematic intimidation (bullying)."

[9] Art. 4 The objectives of the Program referred to in the caput of Art. 1 are:
I - to prevent and combat the practice of systematic intimidation (bullying) throughout society;
II - to train teachers and pedagogical teams for the implementation of actions for discussion, prevention, guidance and solution of the problem;
III - To implement and disseminate education, awareness and information campaigns;
IV - to institute practices of conduct and guidance of parents, family members and guardians in the face of the identification of victims and aggressors;
V - to provide psychological, social and legal assistance to victims and aggressors;
VI – to integrate the mass media with schools and society, as a way of identifying and raising awareness of the problem and a way of preventing and combating it;
VII – to promote citizenship, empathetic capacity and respect for others, within the framework of a culture of peace and mutual tolerance;
VIII – to avoid, as far as possible, the punishment of aggressors, favoring alternative mechanisms and instruments that promote effective accountability and the change of hostile behavior;
IX - To promote measures to raise awareness, prevent and combat all types of violence, with emphasis on the recurrent practices of systematic intimidation (bullying), or physical and psychological embarrassment, committed by students, teachers and other professionals who are members of the school and school community.

Even with the occasional criticism that fell on the law, as there is always something missing in legislation or that must be elaborated with improvements in the dynamics of reality, she standardized the theme by specialty. Thus, it remains for private or public educational institutions to take the necessary measures, both observing the didactic/pedagogical aspects of the subject, as well as evaluating the legal risks that any failures in the conduct of such situations may generate in terms of consequences for students. As the saying goes, prevention is better than cure. Regarding the accountability of educational institutions, Santos and Mesquita (2023, n.p.) point out:

> There are two main legal grounds that support the school's civil liability in cases of bullying:
> Strict Liability: The Bullying Law 13.185 establishes the strict liability of the school. This means that it is not necessary to prove the fault or negligence of the institution for it to be held responsible for the damage caused. It is enough to demonstrate that the act of bullying occurred in the school environment and that the school did not take adequate measures to prevent or stop the situation. In this case, the school is considered liable regardless of its conduct, as the damage is presumed due to the omission or lack of care in its obligation to protect students.
> Risk Theory: The school, as an entity that carries out educational activities, can also be held liable based on the risk theory. According to this theory, the school, by admitting students into its environment, assumes the risk of bullying situations eventually occurring. Thus, it is the school's duty to adopt appropriate measures to prevent and combat bullying, that is, the risk inherent to its educational activity is transferred to the institution, which must act diligently to minimize it.

Articles 932 of the Civil Code apply in terms of civil liability to educational institutions[10], including such institutions being held responsible for the commissive or omissive acts of their employees, as noted. The objective liability of educational institutions also applies here, as well established by article 14 of the Consumer Protection Code[11], in which if there is a defect in the provision of the service, it must repair regardless of fault.

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[10] Article 932. The following are also responsible for civil reparation:
[...] III - the employer or principal, by its employees, servants and agents, in the exercise of the work that is incumbent upon them, or by reason of it;
IV – the owners of hotels, inns, houses or establishments where they are housed for money, even for educational purposes, by their guests, residents and students; [...]
BRAZIL. LAW 10.406, of January 10, 2002. **Civil code.** Official Gazette of the Federative Republic of Brazil, Brasília, DF, 11 jan. 2002. Available at: http://www.planalto.gov.br/ccivil_03/leis/2002/L10406.htm. Accessed on: 14 nov. 2016.

[11] Article 14. The service provider is liable, regardless of the existence of fault, for the repair of damages caused to consumers by defects related to the provision of services, as well as by insufficient or inadequate information about their enjoyment and risks.
§ 1 - The service is defective when it does not provide the security that the consumer can expect from it, taking into account the relevant circumstances, including:
I - the manner of its supply;
II - the result and the risks that are reasonably expected from it;
III - the time when it was supplied.
Paragraph 2 - The service is not considered defective due to the adoption of new techniques.
Paragraph 3 - The service provider shall not be held liable only when it proves:
I - that, having provided the service, the defect does not exist;
II - the exclusive fault of the consumer or of a third party.
Paragraph 4 - The personal liability of liberal professionals shall be ascertained by verifying guilt.

In this sense, expressly dealing with the responsibility of schools, they must combat *bullying* and *cyberbullying* within their walls and depending on the situation in the digital environments linked to the institution, that is, acting physically or digitally, promoting courses, campaigns and training for their employees, students and parents. Being part of the institution's Corporate Governance should be a fixed topic that must be careful and always updated.

It can even be said that educational institutions must act preventively and be in *Compliance* in Digital Education, with regard to any situation involving *bullying* or *cyberbullying*, under penalty of being civilly or criminally liable for illegalities found, notably when they are omitted in the preventive aspects. Especially because civil legislation interprets the situation as framed in strict liability, that is, regardless of the demonstration of guilt.

It should be noted that, whenever the situation reaches the Judiciary, the fair measure used to condemn, whoever it is, will be the verification of the undermining of the principle of human dignity[12], ascertaining whether there was disrespect for the fundamental rights of the victim, enshrined in our Federal Constitution, whether by framing the occurrence of *bullying*, *cyberbullying* or other type of illegality, This is clearly observed in the occurrences of *deepfake* and *deepnudes*.

PARENTAL RESPONSIBILITY AND DIGITAL ABANDONMENT

The responsibility of parents or guardians for what their children do in the physical world seems clear, which extends to the digital world, especially with regard to repairing the damage caused by children and adolescents. It is worth repeating what article 932 of the Civil Code says: "Art. 932. The following are also responsible for civil reparation: I - the parents, for the minor children who are under their authority and in their company; [...]"

However, this can occur due to the negligence of parents or guardians in not monitoring, guiding and protecting their children on digital platforms, applications, games, communicators, etc., which can constitute digital abandonment. The law already considers other types of abandonment such as affective/emotional, financial/material, but digital abandonment is treated as a new modality. According to Ruiz (2022, n.p.), digital abandonment is conceptualized as follows:

> Digital abandonment is parental negligence characterized by the omission of the duty of care, protection and safety of children in the virtual environment. The

[12] FIDALGO, Adriano Augusto. *Cyberbullying and the dignity of the human person.* IT Specialists. Available at: http://www.tiespecialistas.com.br/2015/08/o-cyberbullying-e-dignidade-da-pessoa-humana/. Accessed on: 14 nov. 2016.

> indiscriminate and excessive access of children and adolescents to the content available on the web and the absence of parental supervision in this "digital world" can generate harmful effects on children due to the many situations of vulnerability and risk to which they are exposed.

Parents have in relation to their children the duty of custody, of protection, of the so-called parental power that unfolds in full protection and integral formation, including that of providing digital education, with the duty of vigilance, which encompasses care and security, about what children and adolescents do in all the places they go, including digital ones. In this sense, Klunck and Azambuja (2019, p. 128) also comment:

> Thus, in view of the principle of full protection, the legislation imposed on parents a set of powers-duties arising from family power. It should be noted that the exercise of family power implies an obligation, more than a right. In this way, it is up to the family to ensure the realization of fundamental rights, as well as to assist, raise, educate, protect, supervise, in addition to having affective, moral and psychological obligations. When parents do not comply with these duties that are inherent to them, in order to protect and prevent possible risk situations, negligence is denoted. As seen throughout the article, digital abandonment, characterized by the omission of parents regarding the safety of their children in the virtual environment, placing them in a situation of vulnerability, can be characterized as a hypothesis of negligence.

In this way, if any cyberbullying situation involving *deepnudes* or *deepfakes occurs*, in addition to the responsibility of the role that parents or guardians hold in relation to their children by the Civil Code in terms of compensation to be paid, the argument of digital abandonment will be applied. And it is understood that, soon, the parents of recidivist children who were also omissions, eventually, depending on the seriousness of the situation, may also lose the right/duty over the parental power to which their children are subjected in situations of great gravity and custody in those of medium severity. In short, parents will lose such rights/duties that will be transferred to another responsible person. Which is very serious, because in simpler terms, it would be as if the father and mother lost this connection with their children due to incompetence in the duty of custody of children and adolescents.

THE VIOLATION OF HUMAN RIGHTS

It is necessary to conceptualize human rights initially, in the words of Ramos (2014, p. 24):

> Human rights consist of a set of rights considered indispensable for a human life based on freedom, equality and dignity. Human rights are the essential and indispensable rights for a dignified life. There is no predetermined list of this minimum set of rights essential to a dignified life. Human needs vary and, according to the historical context of a time, new social demands are legally translated and inserted in the list of human rights.

It should be noted that the UN 2030 Agenda, among the 17 Sustainable Development Goals, include those selected and interconnected with the eventual fight against *cyberbullying*: health and well-being, quality education, gender equality, decent work and economic growth, reduction of inequalities, responsible consumption and production, peace, justice and effective institutions and partnerships and means of implementation. In other words, all issues are closely linked to human rights, education and sustainability of people, companies and the planetary ecosystem.

The protection of human rights is fundamental to ensure a fair and inclusive society, so this includes protection against violence and abuse, such as *cyberbullying*. That is why it is important that effective policies and strategies are implemented to prevent and combat this type of violation of subjectivities and to ensure the protection of human rights in the digital age.

In the case of human rights violations in the event of *cyberbullying* involving *deepnudes* or *deepfakes* , they are the ones that attack human dignity itself, such as honor, reputation, image rights, intimacy and privacy, as well as due process, adversarial and full defense, as well as the right to education itself, as already mentioned, because with the disclosure of false photos or videos of the victim, in addition to all the constraints, she will be judged and suffer perennial reputational damage, as not even compensation will be able to correct such unjust aggression.

In such a way, in order to protect such human rights, the fundamental rights that are the internal legislation of each country, in the case of Brazil, applying the norms within our legal system, such as the Federal Constitution, the Civil Code, the Civil Rights Framework for the Internet, the Law to Combat *Bullying*, among others, as defense mechanisms for the protection of victims, as well as the norms that orbit in the educational sphere.

THE ECOLOGY OF ACTION BY EDGAR MORIN

The following considerations highlight the issue of the ecology of action, which is detailed here with the intention of making correlations between it and the occurrence of *cyberbullying* (Morin, 2000, p. 86-87):

> Here the notion of ecology of action intervenes. As soon as an individual undertakes an action, whatever it may be, it begins to escape his intentions. This action enters a universe of interactions and it is finally the environment that takes possession of it, in a sense that can contradict the initial intention. Often the action boomerang over our heads. This forces us to follow the action, to try to correct it — if there is still time — and sometimes to torpedo it, as NASA officials do, when they explode a rocket that deviates from its trajectory.
> The ecology of action is, in short, to take into account the complexity that it supposes, that is, the random, chance, initiative, decision, unexpected, unforeseen, awareness of drifts and transformations.

Now, the ecology of action is also shown to be essential for confronting situations of *cyberbullying*, especially involving *deepnudes* or *deepfakes*. It is linked to the systemic situation, to human complexity, to the triad of individual, society and species, other points developed by Morin. With all these factors and others combined, there will be a method to seek to understand and seek to remedy situations of systematic intimidation, because as Morin (2000) says, one learns on the street, at school, with the family, in the movies. Thus, in the school environment, managers will also be able to collect useful information to remedy the situations assigned to them, knowing the profile of the members of the school community and knowing their individualities and how that environment influences them, colleagues, customs, local practices, to act in a preventive or repressive way, when necessary. On the understanding of human complexity (Morin, 2000, p. 101):

> Understanding the other requires awareness of human complexity. Thus, we can seek in novelistic literature and cinema the awareness that one should not reduce being to the smallest part of oneself, or even to the worst fragment of one's past. While, in ordinary life, we hasten to enclose in the notion of criminal the one who has committed a crime, reducing the other aspects of his life and his person to this single trait, we discover in their multiple aspects the *gangster kings* of Shakespeare and the *real gangsters* of the crime films. We can see how a criminal can transform and redeem himself like Jean Valjean and Raskolnikov. We can finally learn from them the greatest lessons of life, compassion for the suffering of the humiliated, and true understanding.

With regard to *cyberbullying, it* seems to be unequivocally clear that it is not possible to pay attention only to it as a phenomenon – a knowable object – without going into depth into the issue of the subjects (knowers) – responsible for mediation, teacher, coordinator, principal and student – because they generate the causes, the effects and feed each other, communicate, retaliate and form a peculiar system. In the case of *deepnudes* or *deepfakes*, in the school environment, all these factors must be considered to understand why that attack occurred, who are the viewers, aggressors and victims, to seek extrajudicial and judicial solutions, depending on the severity of the event, to remedy the occurrence, as punishing is not always the best way.

HUMAN FORMATION BY ANTÔNIO JOAQUIM SEVERINO

In this item of the research, it will be sought to articulate the elementary need for individuals to have a human formation[13], which is in line with what is refuted in

[13] Severino's concept of education (2017, pp. 134-135) is adopted here, in which he highlights the importance of the teacher, in these words: "My idea of education is therefore that of the achievement of a way of being, through a becoming, a way of being that would be characterized by an existential quality marked by a maximum possible of emancipation, by the condition of autonomous subject. A situation of full humanity. Education is not only an institutional or instructional process, its visible side, but fundamentally a formative investment of the human, whether in the particularity of the personal pedagogical relationship, or in the scope of the collective

cyberbullying, such as the harmful effects harming a complete human formation, given the sequelae that usually affect the victims, as highlighted throughout this article. In better detail, the absence of human formation leads to systematic intimidation and after the occurrence of *cyberbullying*, the sequelae of the fact often interrupt or harm the victim or other participants so that they achieve a better human formation, due to the occurrences of school dropout, traumas and others.

What does this human formation mean, why does it matter anyway? This is an inexcusable mission of the teacher, as highlighted by Severino (2006, p. 621):

> In Western culture, education has always been seen as a process of human formation. This formation means the very humanization of man, who has always been conceived as an entity that is not born ready, that needs to take care of himself as if seeking a stage of greater humanity, a condition of greater perfection in his way of being human. Therefore, formation is a process of human becoming as a humanizing becoming, through which the natural individual becomes a cultural being, a person – it is good to remember that the meaning of this category involves a complex set of dimensions that the verb to form tries to express: to constitute, compose, order, found, create, instruct, place itself alongside

The interface between human formation and education as a cultural product is notably perceived. In this sense, education plays a fundamental role in the debarbarization, emancipation and autonomy of the individual, as Severino (2006, p. 632) pointed out:

> The commitment of education is to debarbarization, it is to transform itself into an emancipatory process, in which there is a systematic struggle for autonomy, for emancipation. And its only tool is enlightenment, which is a passage from the unconscious to the conscious, from the non-aware to the aware, from the pseudo-aware to the aware. Enlightenment illuminates and eliminates. From the perspective of Critical Theory, the role of education is to ensure the survival of cultural formation in a society that has deprived it of its foundations. Cultural industrialization compromised this formation. It is up to educational processes to invest in the transformation of instrumental reason into emancipatory reason. On the other hand, education can be made viable, guaranteeing its formative fruitfulness, if it is constituted as an exercise of critical self-reflection. For education, it is a matter of producing a true consciousness.

Thus, it is necessary to think in an interconnected way, to verify the variables, both with regard to the teacher, the students and the entire school environment, how the State treats it, its insertion in the school environment, the qualification of the teachers, the methodologies used, the family monitoring and the family structure of the young people, that is, all the elements that end up making up the success or failure of each individual. In short, which will trigger a pursued – albeit utopian – human formation of excellence.

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social relationship. Teacher interaction is a universal and irreplaceable mediation of this education, in view of the condition of man's educability."

Thus, to speak of subjectivity is also to speak of the dignity of the human person, since it recognizes all human extension and complexity. Dealing with school failure, due to the reductionism of research in which subjectivity is taken into account, Dias (2009, p. 14) pointed out as follows:

> Experiences of exclusion and deep disaffection lead to incapacity, mark non-belonging and can condemn failure. It is in this sense that the reductionism of investigations on school failure is insisted on, given the small number of studies that include subjectivity as part of the context implied in the theme. The projection of frustration imprints lasting marks that, recursively, promote prophecies that are fulfilled and rejected.

In partial conclusion, it can be said that both the State, the Educational Institutions, and the teachers, must be aware of all these factors, and it is imperative that the best practices are guaranteed so that human education is reached in its highest power, fully, always seeking integral education for the individual good and for the common good. behold, in the social contract (individual/society/species; according to Morin), only with personal success - understood as the formation of autonomous and prepared individuals, with a sense of humanity flourished - will collective success be achieved and vice versa, as Morin says: "The *whole is* greater than the sum of the *parts*". And, in this way, *cyberbullying* cannot be an indigestible stone.

FINAL CONSIDERATIONS

This article brings considerations about the concepts of *bullying* and *cyberbullying*, to focus on the second, in order to highlight how it is a global problem that is difficult to combat and prevent, rooted in all societies and that has been enhanced with technology, so that its effects spread to an incalculable range of people and with enormous speed.

I brought the article concepts of artificial intelligence, *deepfakes* and *deepnudes*, highlighting how these occurrences operate, with the mention of some real cases that occurred in Brazil and abroad, with the manipulation of images creating unreal situations or undressing people and how this impacts the lives of individuals, especially children and adolescents in the school environment.

Thus, an explanation of the responsibility of schools on the subject from a legal and management point of view is developed in the text. From another perspective, the legal responsibility of parents or guardians and the possible digital abandonment stand out, given the duty of custody and monitoring of legal guardians over infants. In fact, the partnership between school and parents is fundamental for the prevention of occurrences and, when it is not possible, it must be inferred how to deal with it together, reducing the damage and

enabling a healthy coexistence, because with education it is understood that the occurrences can be reduced.

Next, it was addressed how the violation of human rights occurs in the hypothesis of *cyberbullying* involving *deepfakes* and *deepnudes*, observing its severity for the reputation and subjectivity of the victim(s). Bringing right after the ecology of Edgar Morin's action to understand how the place and coexistence influence the entire process of systematic digital intimidation. Afterwards, the indispensable human training defended by Severino was addressed, a protective shield that can prevent incidents from occurring, with knowledge about technology (digital education) and knowledge about our (human) rights.

It is understood that investing in human education is elementary, to have a digital ethic, with respect for other people, which involves knowing the human rights involved in the guests, as well as knowing about digital education, about what should or should not be used or manifested in digital environments, making young people aware that the critical use of technology is important, because what is done in online environments has consequences in the face-to-face environment, with possible responsibilities in the coexistence between colleagues, in the family, at school and in cases of greater gravity before the Guardianship Council, the Police and the Justice.

Using the image of people – children and adolescents especially, because in addition to the aforementioned norms we have the Statute of the Child and Adolescent and the principle of full protection[14] – to manipulate information or to create artificial situations of false nudity, hurts morals and ethics within the school, is illegal, and the consequences are serious, which is presumed to be the nature of damage that can cause to adults and even more so to young people.

From the school's point of view, it is recommended, as these situations are inevitable, to invest in teacher training on these incidents in educational institutions, on the ethical use of technology, on education based on human rights, so that these contents are provided to students in class, in lectures for parents, as well as so that schools develop protocols to know how to deal with these occurrences, with the most appropriate measures for the management of situations with this severity.

[14] Federal Constitution: "Art. 227. It is the duty of the family, society and the State to ensure the child, adolescent and young person, with absolute priority, the right to life, health, food, education, leisure, professionalization, culture, dignity, respect, freedom and family and community life, in addition to safeguarding them from all forms of negligence. discrimination, exploitation, violence, cruelty and oppression."

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THE ADJUVANT USE OF CONSCIOUS SEDATION WITH NITROUS OXIDE IN ODONTOPHOBIC PATIENTS AT THE UNIVERSITY DENTAL CLINIC OF THE INTA-UNINTA UNIVERSITY CENTER

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ABSTRACT

Anxiety and odontophobia represent significant barriers in the daily life of dental surgeons, directly impacting the quality and success of care. These conditions manifest at different levels and require varied management strategies, such as behavioral techniques, pharmacological sedation, and other complementary approaches. Overcoming such challenges is essential not only for the benefit of the patient, but also for the improvement of the professional's clinical practice. The present study aimed to evaluate the efficacy of conscious sedation with nitrous oxide (N_2O) in reducing anxiety and odontophobia in patients undergoing dental procedures. Five consultations were performed with conscious sedation in patients previously diagnosed with odontophobia. For the analysis, two evaluative instruments were applied: the Corah Dental Anxiety Test, used to measure anxiety levels before and after care, and the Trieger Test, used to assess changes in motor coordination resulting from sedation. In addition, vital signs, symptoms, and complications during the procedures were recorded and systematized for analysis. The results indicated that there were no significant changes in the Trieger Test scores before and after the

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consultations, suggesting that conscious sedation with nitrous oxide did not compromise the motor coordination of the patients. Stabilization or reduction of blood pressure was observed during the procedures, in addition to a noticeable reduction in anxiety levels, according to the data from the Corah Test. However, the intensity of odontophobia was shown to be associated with the complexity of the procedures performed. We conclude that the use of conscious sedation with nitrous oxide was effective in reducing anxiety in dental procedures, reinforcing its role as an adjuvant tool in the management of odontophobic patients. However, the results did not allow us to establish significant correlations between anxiety, age, or gender of the patients.

Keywords: Nitrous Oxide. Odontophobia. Conscious Sedation. Dentistry. Anxiety.

INTRODUCTION

Odontophobia represents a significant challenge in dentistry, negatively impacting the success of treatments. Patients with this condition often seek care only in emergency situations or in the face of a severely compromised oral health condition. The first contact between professional and patient is essential to reduce fear and anxiety; however, for cases of more severe trauma related to dental treatment, isolated behavioral approaches may be insufficient. In this context, conscious sedation with nitrous oxide stands out as a valuable tool, enhancing behavioral control, minimizing fear and anxiety, and favoring the conduct of care for both the dentist and the patient (PICCIANI, 2014).

Conscious sedation is an effective alternative in dentistry, especially indicated for patients whose level of phobia or anxiety prevents treatment Dental practice, often associated by patients with uncomfortable, painful and unpleasant experiences, can trigger different degrees of fear, anxiety or apprehension, varying in intensity according to the individual (PEDEN; COOK, 2014; MOURA, 2005).

In addition, according to Malamed (2012), pharmacological techniques play a fundamental role in dentistry, allowing the prescription and administration of drugs aimed at modulating the patient's state of consciousness. Currently, the dentist has a wide range of pharmacological resources, including agents with analgesic and sedative properties, which promote the effective control of fear, anxiety, pain and patient behavior. These agents make it possible to maintain a state of conscious sedation, in which the patient remains responsive to verbal commands, cooperative and fit for the dental procedure (APPUKUTTAN, 2016).

Nitrous oxide (N_2O), commonly termed laughing gas, laughing gas, or nitrous oxide, is a widely used inhalation agent due to its analgesic and anesthetic properties. It can be administered pure or in combination with oxygen (O_2), in concentrations usually ranging between 40% and 70%. In addition, it can be associated with other anesthetic agents, both inhalation and intravenously (Air Liquide Healthcare, 2022). N_2O has been widely used in dentistry, especially in the practice of conscious sedation, standing out for its efficacy in the management of anxiety and phobias related to dental procedures. This application has been consolidating and gaining increasing relevance, as its use demonstrates significant benefits in promoting comfort and patient adherence to treatment (SOARES, 2013; MACHADO et al., 2022).

This scenario reinforces the importance of nitrous oxide in dental practice, especially in the face of the challenges represented by dental anxiety and odontophobia. While dental anxiety is defined as a negative emotional state that can occur independently of previous

unpleasant experiences, such as severe pain or inadequate management by the dentist (SILVA et al., 2023; DADALTI et al., 2021; OLIVEIRA, 2019),

Odontophobia, in turn, is characterized as an irrational fear related to dental treatment, often accompanied by physiological and psychological manifestations, such as a feeling of terror, elevated blood pressure, tremors, and general malaise. In this context, the use of nitrous oxide stands out as a safe and effective strategy to minimize these adverse responses, promoting greater comfort and collaboration of patients during procedures. (MURAD et al., 2020). Odontophobia is recognized by the WHO (World Health Organization) as a real disease, and is divided into three levels: mild, moderate and severe odontophobia (DE STEFANO, 2019).

In these cases, it is extremely important that the control of pain and anxiety, which can manifest during dental treatment and in the presence of DC, has the use of nitrous oxide and oxygen associated or not, as it is effective and favors both the patient and the professional during dental care (MOURA, 2005). Understanding and reducing the patient's fear is of interest to the DC, when considering that it reduces stress in the work environment and reduces patient evasion, considering that there will be better reception in view of their condition (MURAD et al., 2020).

In order to study the current need to alleviate the expectation of pain and to evaluate the degree of anxiety/odontophobia of patients before, during and after the use of nitrous oxide in dental care, the objective of the present study is to verify the use of conscious sedation with nitrous oxide/oxygen, emphasizing its indications, contraindications, advantages and disadvantages, as well as the equipment used and its proper technique.

OBJECTIVES

GENERAL OBJECTIVE

To evaluate the decrease in the degree of anxiety of odontophobic patients with the use of nitrous oxide during dental care.

SPECIFIC OBJECTIVES

a) Identify the reasons for the patient's anxiety in the DC's office;
b) Observe the efficiency of the technique by this method;
c) Assess the threshold for changes and perception of pain, well-being and control of the patient's behavior;

THEORETICAL FRAMEWORK

NITROUS OXIDE

Nitrous oxide is a colorless gas with a sweet taste, it is an analgesic agent with an anxiolytic effect and can cause depression and euphoria in the central nervous system (CNS) (FIORILLO, 2019).

Conscious sedation allows the patient to remain awake and responsive while preserving all senses, protective reflexes, spontaneous breathing, and the ability to react to physical stimuli and verbal commands. This technique, which uses the combination of oxygen and nitrous oxide (O_2/N_2O), is widely used in dentistry, especially for its relaxing effect, which contributes to the control of anxiety, and not for its anesthetic properties (SOARES, 2013, RODRIGUES et., 2024).

This conscious sedation causes a minimum degree of depression of consciousness in the patient, maintaining his autonomy during spontaneous and continuous breathing. During its use, no intervention is necessary to maintain the appropriate air passage because it presents adequate spontaneous ventilation. Cardiovascular function is maintained at normal safety levels (FANGANIELLO, 2004).

The combination of nitrous oxide (N_2O) with oxygen (O_2) is widely used and well accepted in pediatric patients due to its rapid clinical action, which manifests itself within a few minutes. In addition, this technique allows the administration of doses gradually, both in increase and reduction, reinforcing the safety and efficacy of conscious sedation as a therapeutic method (RODRIGUES CHALA, 2016).

One of the determining factors for the choice of nitrous oxide (N_2O) in conscious sedation is its characteristic of not undergoing significant metabolization in the body. This property minimizes the occurrence of relevant side effects, since the gas is quickly eliminated through expiration, with minimal impact on vital signs. Approximately 99% of the administered N_2O is excreted by the lungs, without undergoing biotransformation in any organ, while a residual fraction is eliminated by secondary routes, such as skin, urine, and intestinal gases (FANGANIELLO, 2004).

In Brazil, there is an increase in the number of dentists who incorporate the use of nitrous oxide in their clinical practice, aiming to provide greater comfort, safety and tranquility to patients during care. This approach was endorsed by the Brazilian College of Dentistry (CCB) in 2004. However, it is important to highlight that many professionals have limited training and little practical experience in outpatient sedation, since this competence is not yet widely integrated into the curricula of undergraduate dental courses in the country (COSTA, 2004).

Indications

As with any sedation technique, the administration of nitrous oxide (N_2O) must be carefully indicated by the dentist, taking into account the specific characteristics and needs of each patient. The dosage of N_2O can vary according to the individual response, and it is essential that the professional adjust the concentration of the gas according to the patient's particularities (DE MOARES, 2019). In this process, the risks and benefits must be weighed, as well as the patient's clinical history, including pre-existing medical conditions and adverse reactions to sedatives (RODRIGUES CHALA, 2016).

The main indication for the use of nitrous oxide occurs in patients in whom conventional behavioral control techniques have not been shown to be effective. In this context, sedation with N_2O has been shown to be particularly useful to reduce fear and anxiety, making it possible to perform dental procedures in a calm and controlled manner (BRUNICK, 2008). The main indications include patients with intense fear, anxiety, hyperactivity, physical and/or mental disorders, as well as those who have allergies to other agents used in conscious sedation (SOARES, 2013).

In general, nitrous oxide sedation is recommended for patients classified as ASA I and ASA II in elective procedures, and for ASA III patients in emergency room visits. It is also indicated for non-cooperative pediatric patients, especially those who have a gag reflex, recurrent fainting episodes, difficulties in enduring prolonged procedures, or a history of odontophobia (SILVA, 2015). In addition, patients with clinical conditions such as anxiety, hypertension, diabetes, and controlled heart disease can also benefit from the technique, as long as the evaluation of the feasibility of the treatment is carried out together with the physician in charge (PEDRON; FALQUEIRO, 2013).

Contraindications

According to Knuf (2022), the adverse effects associated with nitrous oxide (N_2O) are mostly the result of interactions with other drugs or preexisting clinical conditions. One of the main adverse effects is respiratory depression, which can occur when N_2O is administered in conjunction with other sedatives, potentiating the depressant effect. In addition, diffusion hypoxia can be observed after N_2O interruption, since the concentration gradient of gases in the lung rapidly inverts, diluting the oxygen in the alveoli and leading to a reduction in circulating oxygen. To mitigate this risk, administration of 100% oxygen is recommended immediately after cessation of N_2O use.

Another relevant adverse effect is the increased risk of postoperative nausea and vomiting (PONV), especially in procedures lasting more than two hours. To prevent this

problem, antiemetic prophylaxis is indicated in order to reduce the incidence of PONV (MILLER, 2022).

Contraindications to the use of N_2O are relatively specific and may vary according to the individual characteristics of the patient. N_2O can inactivate methionine synthase through the oxidation of the vitamin B12 cobalt, which can result in megaloblastic anemia. Although in healthy patients the effects are subclinical, in individuals with a deficiency of this enzyme, the damage can be neurological and hematological. Patients with severe heart disease, in the first trimester of pregnancy, or in critical condition are among the groups contraindicated for the use of N_2O (KNUF, 2022).

In addition, the use of N_2O is contraindicated in patients with pneumothorax, small bowel obstruction, middle ear surgery, and ophthalmic procedures involving the retinas, due to the increased volume and pressure in enclosed spaces. This is due to the solubility of oxygen and the possibility of gas bubbles forming in places such as the eye or closed cavities (BUHRE, 2019).

According to Schulte (1982), sedation with N_2O should also be avoided in patients with pulmonary hypertension, due to the risk of increased pressure in the pulmonary artery, resulting from sympathetic stimulation. In patients with severe psychiatric disorders, the use of N_2O is also contraindicated, as the gas may induce vivid dreams and hallucinations.

Sedation with nitrous oxide should be avoided in procedures that involve cauterization in the head and neck region, since, although N_2O is not flammable, it can contribute to combustion. Patients with claustrophobia should also not be subjected to this technique, given the discomfort generated by the sensation of suffocation caused by the perceived tightness during the administration of gas.

Regarding breastfeeding, it is recommended that the mother breastfeed only after complete recovery from the effect of N_2O, since the half-life of the gas is short and there is no evidence of absorption by the baby (SOARES, 2013).

Other temporary contraindications include airway obstructions, allergic rhinitis, sinusitis, flu, and colds, since sedation with N_2O depends on the inhalation of the gas and requires an unobstructed airway. Finally, it is important to highlight that the use of N_2O is not associated with an increase in mortality, cardiovascular complications, or wound infections (KNUF, 2022).

Advantages

There are several advantages in using the combination of nitrous oxide and oxygen by inhalation. For example, a faster onset of action, change in the depth of sedation by the

inhalation route at any time due to the possibility of dosing the gases administered allowing the dose to be balanced according to the clinical condition obtained, equipment that provides significant safety in the use of nitrous oxide, flexibility of action and maintenance of the peak of clinical effect, in addition to the fast recovery time, due to the pharmacological characteristics of nitrous oxide and few side effects associated with the use of this sedation method (SOARES et al., 2013).

Disadvantages

The disadvantages of this technique are: the high cost of the equipment and the need to purchase gases, the fact that nitrous oxide is not a potent agent and may not achieve the desired clinical effects in a group of patients who are more tolerant, the minimum degree of patient cooperation, because if the patient becomes agitated before the use of sedation, its efficacy may be interfered with (SOARES, 2013).

Also as a disadvantage we have the need for an office with space compatible with the equipment, and the perception of the possibility of varying the dosage from patient to patient, and the need for specific training to manage the equipment in a theoretical and practical way (BARBOSA et al, 2014).

Rodrigues Chala (2016), in his study, also points out the possibility of the patient not accepting to wear the nasal mask.

THE GOSPEL OF THE GOSPEL

Dadalti et al (2021) defined dental anxiety as an excessive and irrational negative emotional state suffered by patients undergoing dental treatment. It may correlate with previous traumatic experiences such as severe pain or discomfort during and/or after a dental procedure and negative experiences with the dental surgeon's management.

Meanwhile, Murad et al (2020), defines the term odontophobia as irrational fear of dental treatment, which occurs simultaneously with signs of terror, hypertension, tremor, and malaise, as specified in the Diagnostic and Statistical Manual of Mental Disorders (DSM). Dental anxiety and odontophobia are quite similar, formed by similar elements that work in a similar way. Anxiety emotions are diffuse and non-specific, they are associated with fear and observed in various situations, and can be felt even when the feared stimulus is absent.

De Stefano in 2019, stated that odontophobia has been recognized by the World Health Organization (WHO) as a real disease. According to WHO estimates, it is believed to affect about 15 to 20% of the population.

THE USE OF NITROUS OXIDE IN DENTISTRY

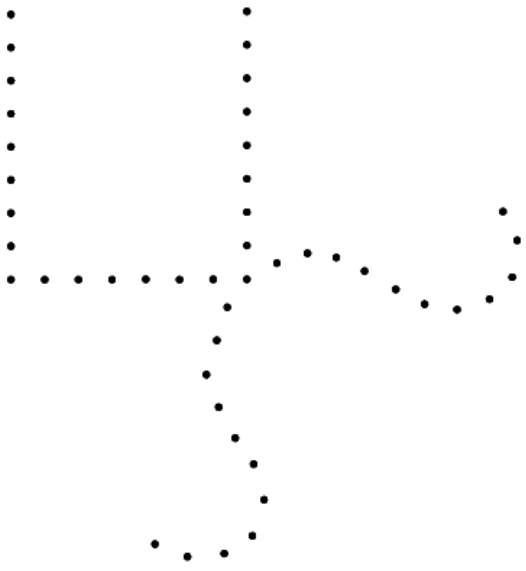
Anxiety and fear have been related to Dentistry since its origin, which generate great discomfort in patients with dental procedures. Especially with regard to the application of local anesthetics and rotating instruments, which are the main causes of transoperative anxiety (SOARES, 2013).

Understanding the relevance of patient fear during dental visits and the occurrence of dental anxiety has direct implications in dental practice. Identifying the exploratory factors will allow the dentist to properly plan their treatment plan to reduce dental phobia and anxiety, which consequently reduces stress in the workplace. (MURAD, 2020).

In addition to administering a personalized dose to each patient, this titration technique greatly reduces or almost avoids side effects (GILLMAN, 2019).

At the beginning of the inhalation sedation technique, it should be preceded by the Trieger Test (Figure 4), which consists of joining the points of a pre-established figure and should be applied in two moments at the beginning of the service and also at the end of the procedure. In short, in a simple, fast and effective way, the dentist will compare the results (based on the number of stitches lost and the time spent to complete the stitches) and verify the total removal of the effect of the gas on the patient (MALAMED, 2003).

Figure 4 - Trieger Test



Fonts: Ladewig, 2016

METHODOLOGY

STUDY DESIGN

This is an observational, cross-sectional study, with a quantitative and qualitative descriptive approach, aimed at assessing the degree of anxiety/odontophobia of patients, through a statistically valid representative sample (MANZATO; SANTOS, 2012).

LOCATION AND PERIOD

Held at the dental clinic of the INTA-UNINTA University Center, in Sobral-CE, between May and June 2023.

SAMPLING

The sampling consisted of convenience, selecting odontophobic patients seen at the clinic during the study period, provided that they met the inclusion and acceptance criteria of the Informed Consent Form (ICF).

INCLUSION AND EXCLUSION CRITERIA

Inclusion:

- Patients over 18 years of age undergoing dental treatment at INTA-UNINTA.
- Report or diagnosis of odontophobia with indication of conscious sedation.
- Patients with controlled systemic diseases (diabetes, hypertension, heart disease).

Exclusion:

- Patients who have dropped out of treatment.
- Subjects with upper airway obstruction or severe behavioral problems.
- Pregnant, claustrophobic, mouth breathers or with severe psychiatric conditions.

DATA COLLECTION

Data were collected using the Corah Scale for dental anxiety, applied before and after nitrous oxide treatment. In addition, the Trieger test was used to evaluate the recovery of sedation in the pre- and postoperative periods. After consent via informed consent, participants answered the questionnaire in subsequent consultations.

RISKS AND BENEFITS

Minimal risks include invasion of privacy and emotional discomfort when answering questions. On the other hand, the study promoted advances in knowledge about

odontophobia and contributed to the early identification of associated conditions, enabling an appropriate referral.

ETHICAL ASPECTS

This was followed by Resolution 466/12, with approval by the Ethics Committee (opinion No. 6.098.803 and CAAE 68169223.9.0000.8133). Participation was voluntary, upon signature of the ICF, ensuring confidentiality and respect for the rights of the participants.

MATERIALS AND METHODS

A meeting was held with clinical professors at the beginning of the 2023.1 academic semester to identify patients with odontophobia indicated for conscious sedation. The Corah questionnaire, validated to assess dental anxiety, was applied before and after the consultation, together with the Trieger test to monitor the effects of sedation.

STATISTICAL ANALYSIS

The data were organized and analyzed in Microsoft® Excel and Word. The analysis included simple frequency and tests of association between dependent and independent variables.

RESULTS

During the semester of 2023.1, the research was carried out with the approach of 09 patients, and after individual evaluation of each of the patients, observing the inclusion and exclusion criteria, we reached a number n=05 (five) of the total number of patients in the sample (Table 01). Each patient was numbered from 01 to 05, according to the chronological order of the consultations, as follows: Patient 01, Patient 02, Patient 03, Patient 04 and Patient 05. The patients in numbers 02 and 05 are female, and the other patients 01, 03 and 04, respectively, are male, table (01), obtaining in this study 60% of the male gender and 40% of the female gender. Another data obtained was related to the age of the patients interviewed, obtaining the mean age among the participants of 35 years.

Table 1. Gender of the patients participating in the Research

PATIENTS	01	02	03	04	05
Gender M (Male) F (Female)	M	F	M	M	F
Age of Patients	32	40	20	54	29

Source: Survey data, 2023

On the day of the dental procedure, before the beginning of the care and sedation with nitrous oxide, the CORAH Anxiety Scale (1969) was used, because it has good applicability, internal consistency and test-retest reliability, and is a reliable instrument to assess the characteristics of anxious patients.

This scale consists of the application of a questionnaire with four questions, each with five answer alternatives, which seeks to assess the feelings, signs and reactions of patients, related to dental treatment, which served to assess the degree of anxiety of odontophobic patients before the dental procedure, to assess their anguish, anxiety, signs and reactions of patients, related to dental treatment. Each answer alternative received a certain score (from 1 to 5), and at the end, the patients were classified according to their degree of anxiety based on the sum of these points, shown in Table 02).

In the Corah test, the following score was assigned: very little anxious (0-5 points), slightly anxious (6 to 10 points), moderately anxious (11 to 15 points) and extremely anxious (16 to 20 points).

Table 25. Response of the CORAH Rate of the Participating Patients

PATIENTS	01	02	03	04	05
Quantities	13	13	13	20	18

Source: Survey data, 2023

In the dental consultation, the collections and measurements were made at 03 different moments: before starting the service and with the patient at rest (05 minutes before), during the dental care and at the end of the dental care (05 minutes after). The following parameters were performed and evaluated: Heart Rate (HR), Blood Pressure (BP), and Oxygen Saturation (SO). Such measurements were performed using the VITA i80 – ALFAMED monitor, which served as a baseline data verifier of the physical parameters used to assess preoperative anxiety, as shown in table (03).

Table 3. Responses related to Heart Rate (HR), Blood Pressure (BP), and Oxygen Saturation (SO) at the moments before, during and after sedation.

PATIENTS Before sedation	01	02	03	04	05
FC	70	65	79	75	104
PA	12/8	14/8	12/7	15/9	12/8
SO	99%	99%	99%	98%	98%

Source: Survey data, 2023

PATIENTS During sedation	01	02	03	04	05
FC	54	59	66	65	110
PA	10/6	12/8	11/7	16/10	12/8
SO	100%	99%	100%	100%	99%

Source: Survey data, 2023

PATIENTS After sedation	01	02	03	04	05
FC	63	63	71	58	88
PA	10/7	13/8	11/7	17/9	11/8
SO	98%	99%	98%	98%	97%

Source: Survey data, 2023

The other data computed in the research is related to the reasons/triggers of anxiety/fear that required sedation to better perform the procedure is shown below in table (04).

Table 4. Reasons/triggers of anxiety/fear.

PATIENTS	01	02	03	04	05
reasons/triggers of the Anxiety/Fear	High and low rotation sound	Anesthesia and sound of high and low rotation	Anesthesia and sound of high and low rotation	Health professionals (doctors, dentists and nurses)	Dental procedures in general

Source: Survey data, 2023

Each subject in the sample was submitted to a type of procedure, whose nomenclatures were determined below in table (05), showing the breakdown of the procedures and classification according to the type of procedure and its sensations during the use of conscious sedation, table (06).

Table 5. Procedure performed during sedation with Nitrous Oxide.

PATIENTS	01	02	03	04	05
Procedure Made	RAR supra Gum	AC Clinical crown augmentation	AM Molar access	EXO Exodontia 3º molar	T ENDO Endodontic treatment

Source: Survey data, 2023

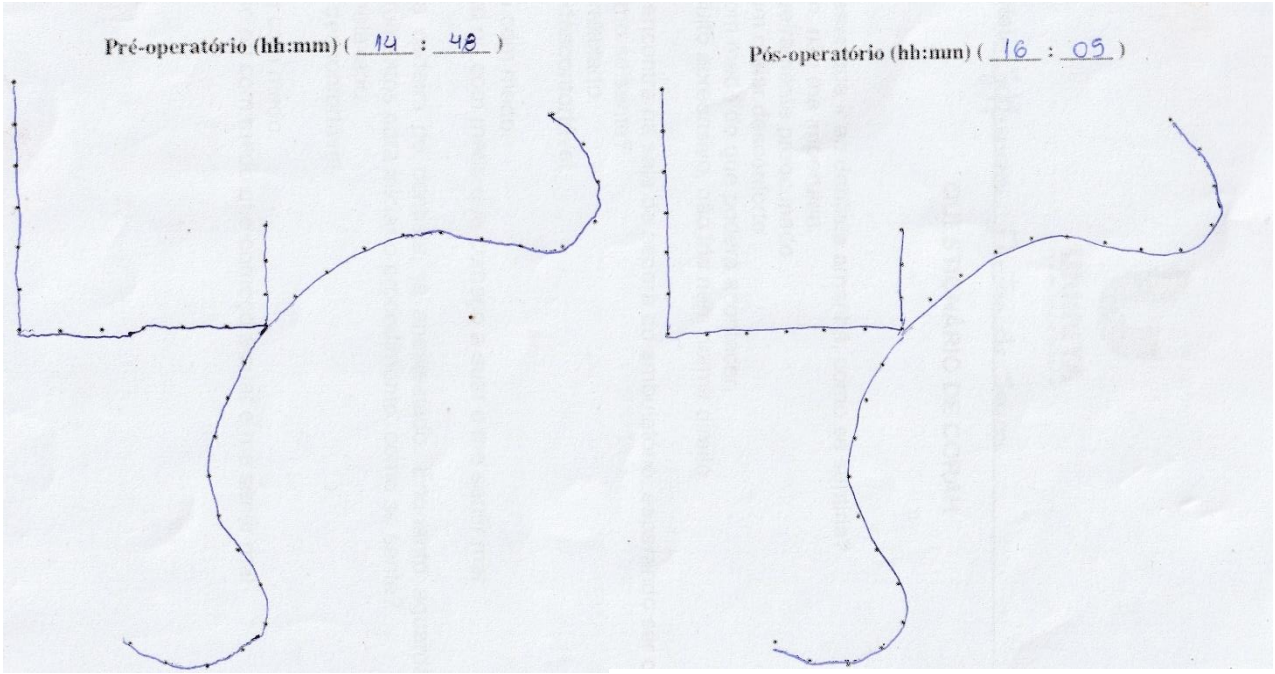
Table 6. Sensations reported during sedation with Nitrous Oxide.

PATIENTS	01	02	03	04	05
Sensations during Sedation	Anesthetized lips, heavy eyes, and decreased hearing	Anesthetized lips, heavy eyes and a feeling of floating	Numbness in the lips	He did not report sensations and changes	Anesthetized lips, heavy eyes, feeling like you're in a dream, and decreased hearing

Source: Survey data, 2023

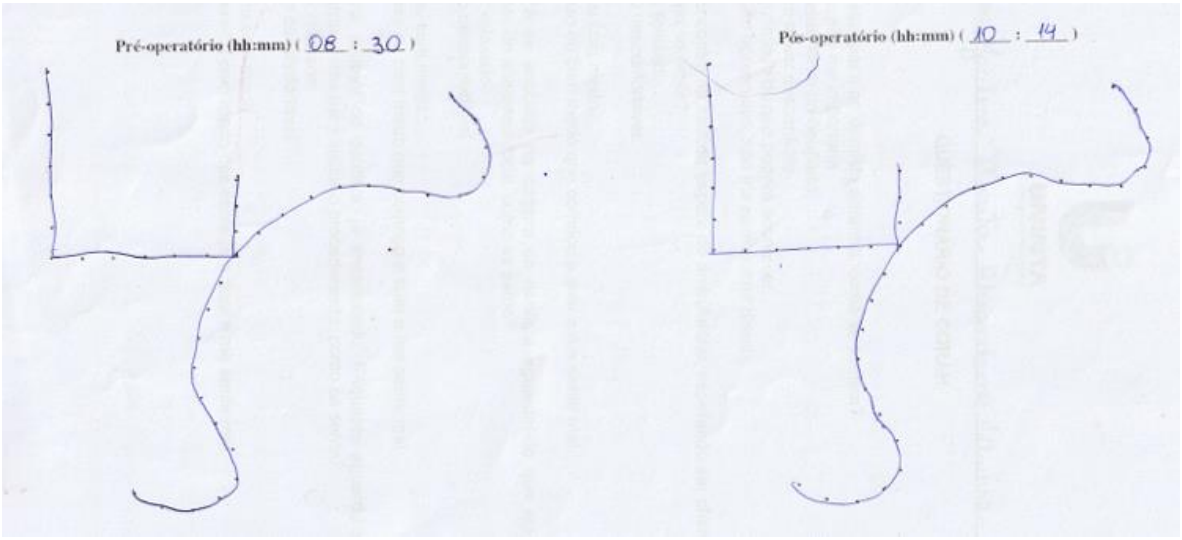
Finally, we have the Trieger test, which was applied before the use of sedation in the patient with N2O gas and after immediate care.

Figures 1: Patients' Trieger Test - Patient 1



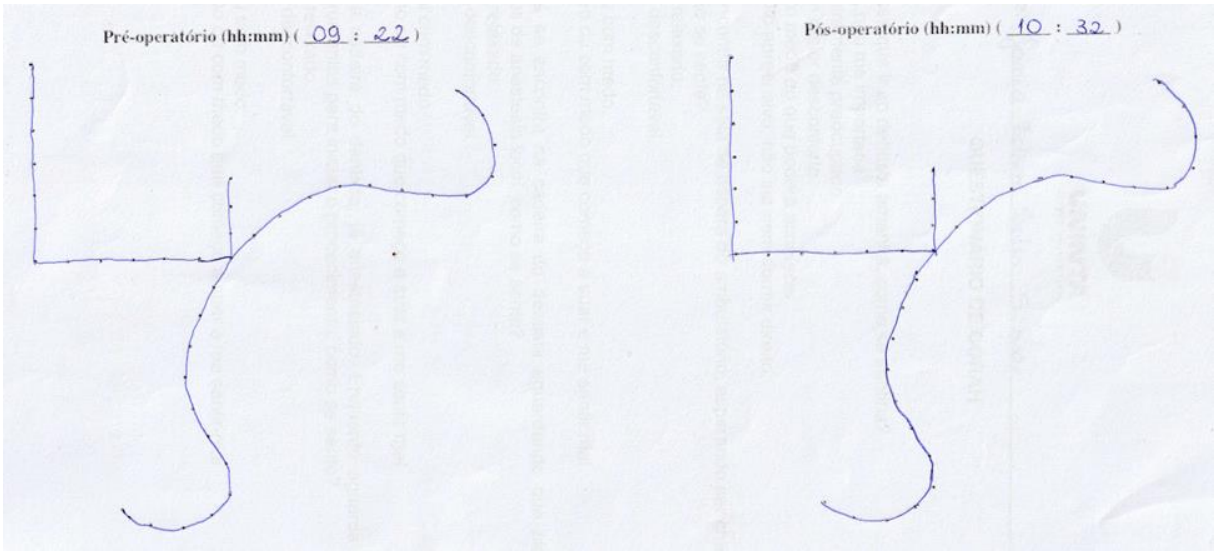
Source: Survey data, 2023

Patient 2



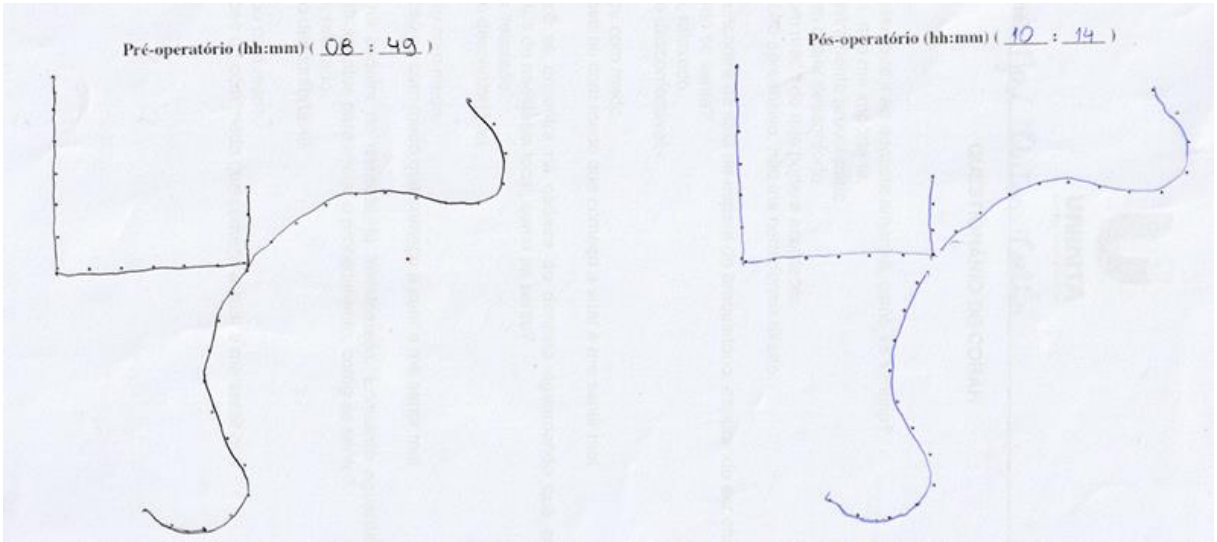
Source: Survey data, 2023

Patient 3



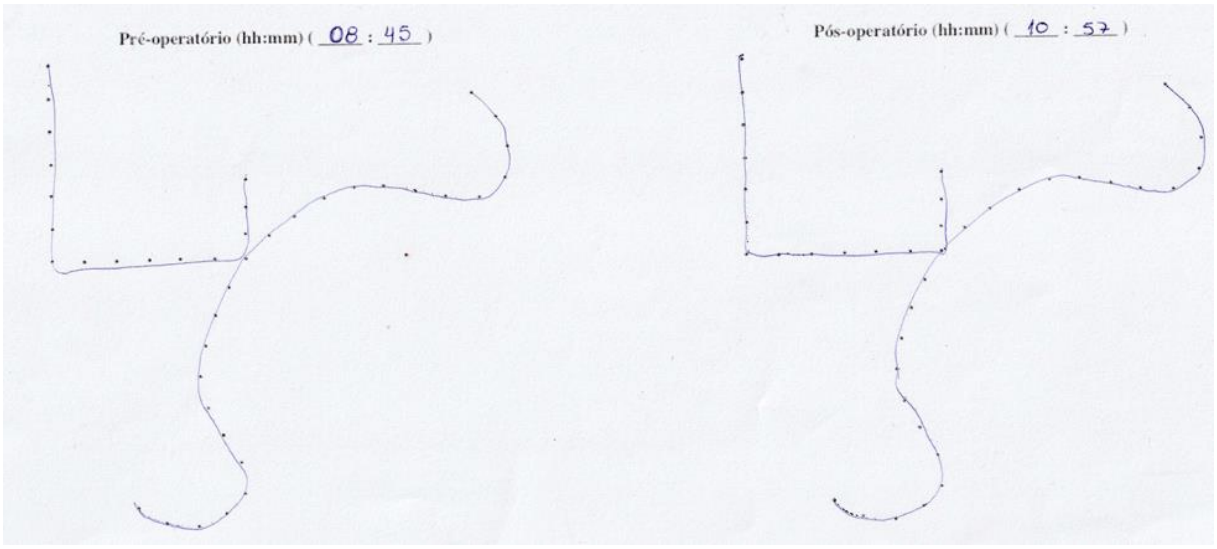
Source: Survey data, 2023

Patient 4



Source: Survey data, 2023

Patient 5



Source: Survey data, 2023

DISCUSSION

Anxiety in its general aspects can hardly be quantified, leaving as an alternative to measure it through visual, behavioral, and verbal scales, thus evaluating the physiological parameters of patients such as their change in heart rate, blood pressure, saturation, cortisol level, and salivary alpha-amylase levels (BASSANI et al., 2023; ROCHA, 2018). In addition, questionnaires should be administered immediately before starting dental care because, at that time, patients were experiencing all sensations, including any emotional responses, triggered by the impending care. Dental anxiety questionnaires have limitations because they are subjective and their results are influenced by patients' responses (DADALTI, 2021).

In this study, these changes were evident as mentioned above, and data were collected at 03 moments to be able to observe all these effects. After measuring vital signs, the patient was invited to take the Trieger test. This test aims to identify the patient's degree of psychomotor recovery, through comparative observation between the initial test, done before the sedation procedure, and the final one, applied right after the end of sedation. We used as analysis the accuracy of its completion by associating the number of wrong points and the time spent filling in the stippling of the initial test were compared to that of the final test. If the time and accuracy were approximately equal between the initial and final tests, it means that the volunteer presents psychomotor recovery, which is compatible with his prompt release (CALDAS, 2008). In the present study, no significant differences were observed in its clinical or statistical aspect when filling out the Trieger test.

The results obtained through the analysis of the genders in this study, considering the procedures performed, were not sufficient to determine which gender would be the most

anxious, due to the size of the sample, another fact that was observed and relevant is that, in the more complex procedures, they presented a higher degree of anxiety. Studies by SIVIERO et al., (2008); GUENTSCH et al., (2017); YAKAR et al., (2019); CALTABIANO, et al., (2018); CARVALHO (2012) and KHEIR et al. (2019), state that women have a higher degree of anxiety when compared to men, regarding dental treatments. Other studies have not found or cited differences in the degree of anxiety between genders (KLAGES, 2006; KANAFFA-KILIJANSKA, 2014; KANEGANE et al., 2009; and DOU, 2018) and for authors such as ARMFIELD, (2022); JEDDY, (2018) and FUENTES, (2009) state that the male gender has a higher degree of anxiety. The author MALVANIA (2011) emphasizes that the occurrence of the female sex being more prone to anxiety is related to a combination of emotional and social factors. There is a general readiness in the case of women to vent and recognize their feelings without further prejudice and judgment when in relation to men, for this reason the results would be more inclined to the female sex. These differences in the literature can be associated with personal and socioeconomic differences, as well as differences in the methodology applied, the type of study design, the method of analysis, the type of dental anxiety measure, and the sample size.

Works such as KANEGANE et al., (2009); ASTROM, (2011) and VAN WIJK (2012), demonstrated in their studies that dental procedures reported in the literature as stressful and causing anxiety and/or fear are minor oral surgeries, such as tooth extraction, and in periodontics periodontal scaling also appears as an anxiety-generating procedure. In our study, there was no significant difference between the patients submitted between the different dental treatments in relation to anxiety, which demonstrated that the reported oral surgery, regardless of the tissues and sites involved, generates similar levels of anxiety in odontophobic patients.

Regarding age and anxiety at work, it was observed that anxiety did not differ according to the patient's age. Comparing with the results in the literature, there are several divergences. Some studies associate greater anxiety in young and adult patients, when compared to elderly patients (MAGGIRIAS, 2002; GORDON et al, 2013; VIINIKANGAS et al., 2007 and CALTABIANO, et al., 2018), and other authors such as Liddel; Locker (1997) stated that anxiety tends to decrease over the years, while other studies show that the opposite occurs, that over the years, there is greater anxiety in elderly patients compared to younger ones, which is explained by traumatic situations and experiences already experienced previously in their lives, when they were young.

In the present study, this variable between the age of the volunteers and the exacerbation of anxiety was not concretely established, presenting results similar to those

of other authors who concluded that sociodemographic factors, such as age, do not have a correlation with anxiety levels (SIVIERO, 2008; SINHG, 2000; KANEGANE, 2009; KANAFFA-KILIJANSKA, 2014 and NASCIMENTO, 2011).

The blood pressure analysis showed that diastolic and systolic blood pressure was altered (increased) in the patient who underwent minor oral surgery, and this patient who in the Corah test had the highest degree of anxiety. In the other dental procedures on blood pressure, there was a decrease or maintenance of the same blood pressure measurement. Fiorillo (2022), states in his study that nitrous oxide causes a small depression in the heart flow while peripheral resistance increases slightly, and, due to this, blood pressure remains unchanged, but during the research it was observed that the BP of 04 patients decreased as the concentration of N2O in the body increased, not agreeing with data in the literature.

When it comes to heart rate, a decrease in this data was observed, and we can argue that in addition to the effect of gas for this decrease, many studies show that there is also an influence of several other factors, such as: gender, physical fitness, body position and age, the latter being one of the most important determinants of heart rate variation (DAVINI et al, 2004; ZHANG, 2007).

The saturation of patients who underwent nitrous oxide, practically all managed to reach 100%, it is known that the oxygen received from the device is greater than we have free in the atmosphere, which represents about 21% of the available volume, according to Sousa (2021). Another important factor to take into account is that, with aging, there is also a decrease in the maximum volume of oxygen, essentially due to the reduction in the patient's maximum heart rate (CHEITLIN, 2003).

Another relevant fact was explained by De Moares (2019), who concludes that due to its mechanism of action, the patient has decreased senses such as touch, hearing, vision, and pain. This statement was observed in the reduction of hearing in patients 01 and 03.

It is noteworthy that anesthesia was the moment that produced the greatest anxiety and variations in the patients' data, in relation to the other clinical time during the consultation, corroborating several studies that, in the literature, demonstrate that the stressful procedures that cause anxiety and/or fear are anesthetic injections and minor oral surgeries (BOTTAN, 2008; JEDDY, 2019), such as the extraction done by the patient in the research.

In JEDDY (2019), we see that the sensations of extreme relaxation, distant hearing and the sensation of floating are the most common during N2O care, still from this point of view for LADEWIG (2016), when the patient reaches the ideal analgesia stage, usually

associated with a low percentage of N2O, some characteristic signs and symptoms can be observed, such as: Feeling of numbness in the feet and hands (walking to the legs and arms); tingling sensation in the lips, tongue, palate, cheek, etc., eyelid spasms, nasal and cadenced voice, feeling of relaxation, reduction of anxiety or fear expansion of hearing where noises and conversations can bother.

Many of these characteristics were observed by the patients, except for patient (04), the most odontophobic and with a more complex procedure, in which case his anxiety may be "masking" the signs and symptoms of sedation, as patients are often not sensitive to these signs due to excessive nervousness, high tolerance to gas or inefficient inhalation, However, at the end of the service, he reported that he found the service better with sedation.

Continuous and direct observation of the patient is of utmost importance to verify that the patient does not show signs of over-sedation. These signs range from increased blood pressure, nausea and discomfort to vomiting and loss of consciousness, situations like this did not occur during this research (LADEWIG, 2016).

Thus, it is observed that phobia, anxiety and pain do not occur only as a result of invasive procedures, although it is most often associated with these procedures, but as previously mentioned, anesthesia itself seems to be among the most painful procedures and causes the greatest moment of tension in dentistry (KAUFMAN, et al., 2005).

FINAL CONCLUSIONS

We can conclude that in the present study, there was a positive difference in the reduction of the level of anxiety in the proposed dental procedures with the adjuvant use of nitrous oxide, but we cannot correlate these data with the relationship between anxiety and age or gender of the patients, due to the size of our sample, suggesting more studies with a larger number to determine these relationships.

A point of relevance was the relationship with the increase in heart rate and blood pressure during dental anesthesia at the time of greatest anxiety in the patients.

The use of this method with nitrous oxide is extremely important for patients with anxiety/odontophobia because positive effects during dental treatment have been observed in clinical practice and in the literature, further fostering the need for this practice of conscious sedation to be disseminated to everyone, professionals and patients.

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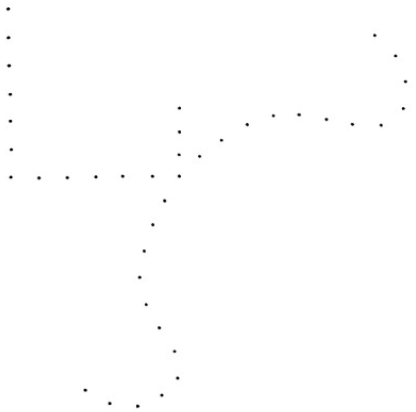
ANNEX A - TRIEGER TEST

Sedação – Teste de Trieger

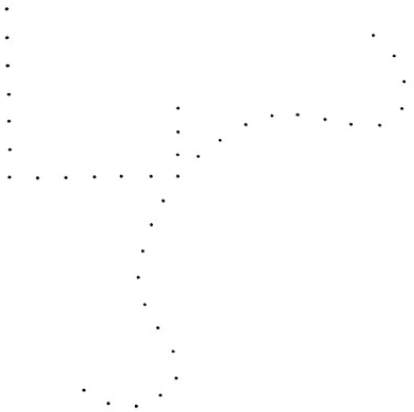
Paciente _____ Consulta _____

Acompanhante _____ Parentesco _____

Pré-operatório (hh:mm) (_____ : _____)



Pós-operatório (hh:mm) (_____ : _____)



ANNEX B – CORAH QUESTIONNAIRE

Patient: _____

CORAH'S QUIZ

If you had to go to the dentist tomorrow, how would you feel?

1. Alright, I wouldn't mind.
2. I would be slightly worried.
3. You would feel greater discomfort
4. I would be afraid of what might happen.
5. I would be very apprehensive, I wouldn't even sleep properly.

When you find yourself in the waiting room of the outpatient clinic, waiting to be called by the dentist, how do you feel?

1. Quiet, relaxed.
2. A little uncomfortable.
3. Tense.
4. Anxious or afraid.
5. So anxious or scared that I start sweating and feeling bad.

When you find yourself in the dentist's chair waiting for him to start local anesthesia procedures, how do you feel?

1. Quiet, relaxed.
2. A little uncomfortable.
3. Tense.
4. Anxious or afraid.
5. So anxious or scared that I start sweating and feeling bad

You're in the dentist's chair, already anesthetized. While waiting for the dentist to pick

up the instruments to start the procedure, how do you feel?

1. Quiet, relaxed.
2. A little uncomfortable.
3. Tense.
4. Anxious or afraid.
5. So anxious or scared that I start sweating and feeling bad

ANNEX C – APPROVAL OF THE ETHICS COMMITTEE

CENTRO UNIVERSITÁRIO INTA - UNINTA

Plataforma Brasil

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: O USO ADJUVANTE DA SEDAÇÃO CONSCIENTE COM ÓXIDO NITROSO EM PACIENTES ODONTOFÓBICOS NA CLÍNICA UNIVERSITÁRIA ODONTOLÓGICA DO CENTRO UNIVERSITÁRIO INTA-UNINTA

Pesquisador: LUÍS HENRIQUE DOS SANTOS NOGUEIRA

Área Temática:

Versão: 2

CAAE: 68169223.9.0000.8133

Instituição Proponente: INSTITUTO SUPERIOR DE TEOLOGIA APLICADA - INTA

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 6.098.803

Apresentação do Projeto:

Trata-se de um estudo observacional, do tipo transversal, com abordagem quantitativa e qualitativa de natureza descritivo presencial construído especificamente para avaliar o grau de ansiedade/odontofobia dos pacientes. O presente estudo ocorrerá no município de Sobral – Ceará (CE) na clínica odontológica da universidade UNINTA. Terá como amostragem pacientes odontofóbicos que forem realizar tratamento odontológico. Esta amostra será escolhida por um processo que dará a todos os indivíduos as mesmas chances de serem selecionados e representará o número de pacientes odontofóbicos atendidos na clínica escola durante a pesquisa.

Objetivo da Pesquisa:

OBJETIVO GERAL

Avaliar o grau de ansiedade/odontofobia dos pacientes com o uso do óxido nitroso no atendimento

Endereço: Rua Coronel Antônio Rodrigues Magalhães, 700 - segundo andar - prédio sede 1
Bairro: Dom Expedito **CEP:** 62.011-230
UF: CE **Município:** SOBRAL
Telefone: (88)3112-3500 **E-mail:** cep@uninta.edu.br

odontológico, verificando as suas indicações e contraindicações e esclarecer as normas e procedimentos de segurança para a sedação com óxido nitroso.

OBJETIVO ESPECÍFICOS

a) Identificar quais os motivos de ansiedade do paciente no consultório do CD;

b) Observar a eficiência da técnica por esse método;

c) Avaliar o limiar as alterações e percepção de dor, bem-estar e controle do comportamento do paciente.

Avaliação dos Riscos e Benefícios:

De acordo com o pesquisador, os riscos são mínimos, invasão de privacidade, responder a questões sensíveis, tais como seus níveis de estresse, ansiedade, divulgação de dados confidenciais. Caso algum constrangimento seja relatado por parte do voluntário a participação deste pode ser paralisada. É muito importante que o acadêmico atue identificando e registrando no questionário todos esses requisitos.

Como benefício essa pesquisa irá contribuir para o avanço dos estudos sobre esse tema e relatar e identificar precocemente se estão relatando algum sinal ou sintoma de doença associada ao seu estado de saúde ou condição geral da sua saúde e com isso procurar acompanhamento de uma equipe multidisciplinar e ter um completo e total bem-estar.

Comentários e Considerações sobre a Pesquisa:

Pesquisa relevante para o paciente presente e futuros e o método de obtenção do consentimento foi corrigido.

Considerações sobre os Termos de apresentação obrigatória:

Este protocolo apresentou os seguintes termos: projeto na íntegra, folha de rosto carimbada e assinada, carta de anuência, TCLE, cronograma e orçamento.

Recomendações:

Este protocolo não apresenta pendências

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Telefone: (88)3112-3500 **E-mail:** cep@uninta.edu.br

Conclusões ou Pendências e Lista de Inadequações:

Não apresenta óbices éticos, estando aprovado

Considerações Finais a critério do CEP:

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_2083062.pdf	01/06/2023 11:23:40		Aceito
Projeto Detalhado / Brochura Investigador	TCCMichelly.docx	01/06/2023 11:23:14	LUÍS HENRIQUE DOS SANTOS NOGUEIRA	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE.docx	29/05/2023 14:52:17	LUÍS HENRIQUE DOS SANTOS NOGUEIRA	Aceito
Cronograma	cronograma.docx	29/05/2023 14:52:07	LUÍS HENRIQUE DOS SANTOS	Aceito
Declaração de Instituição e Infraestrutura	CartadeAnuencia.pdf	22/03/2023 15:04:32	LUÍS HENRIQUE DOS SANTOS NOGUEIRA	Aceito
Folha de Rosto	folhaderosto.pdf	22/03/2023 15:03:14	LUÍS HENRIQUE DOS SANTOS	Aceito

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

SOBRAL, 02 de Junho de 2023

Assinado por:
ANTONIO EDIE BRITO MOURAO
(Coordenador(a))

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THE CULTURAL INDUSTRY AND THE ALIENATION OF THE MASSES: A COMPARATIVE ANALYSIS BETWEEN THE BOOM OF THE 20S AND THE CONTEMPORARY DIGITAL AGE

https://doi.org/10.56238/sevened2024.037-056

Aloísio Cassio dos Santos[1], Eduardo de Oliveira Aducci[2], Juliano Jose da Silva Tolentino[3], Marcio Gabriel Schinor Mazega[4] and Pedro Vinicius Rampim[5]

ABSTRACT

The present study investigates the cultural legacies of the 1920s boom and its influence on the current cultural industry. The objective is to understand how the mechanisms of cultural production and consumption of that time shaped contemporary practices, perpetuating the alienation of the masses. Using a comparative approach, the study is based on a literature review and content analysis of primary and secondary sources, including works by Adorno and Horkheimer, as well as historical and contemporary data on cultural production. The methodology involves the detailed analysis of texts, films, music and other forms of media from the 20s, comparing them with the cultural productions of the digital age, such as social networks, streaming and other digital platforms. The results indicate that the cultural massification that began in the 1920s, driven by technological advances and the market economy, established the foundations for the modern cultural industry, characterized by globalization and digitalization. It is concluded that, despite technological changes, the principles of alienation and mass consumption remain central, evidencing the continuity and adaptation of cultural control strategies over time. This study contributes to a deeper understanding of the cultural and social dynamics that shape the perception and behavior of the masses in contemporary times, highlighting the historical relevance and persistence of cultural patterns established a century ago. In addition, the research underscores the importance of critically recognizing and analyzing these cultural heritages to better understand the challenges and opportunities present in the digital age.

Keywords: Cultural Industry. Mass Manipulation. Boom of the 20s. Cultural massification. It was digital.

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INTRODUCTION

At the end of World War I, with the recent defeat of Germany and its allies, the United States assisted the affected countries of Europe in their reconstruction, due to the damage caused by World War I. Consequently, this brought to the United States a period of high economic growth, which became known as the "Boom of the 20s" or "The Roaring 20s", due to the high economic development and breaking of several taboos. In this way, this period is marked not only by economic ascension, but also by developing and creating various cultural aspects that shaped and influenced the world, such as the creation of Jazz, the development of the Hollywood industry, the first break in the female paradigm and the creation of the *American Way of Life* .

Added to this, the United States spread its lifestyle through the media of the time, proclaiming itself the ideal country to live in, which constituted the American lifestyle and in a way, carried the example of the sovereignty of capitalism and democracy. However, the *American Way of Life* brought one of the first ideas of mass alienation, because at the time it was disseminated through advertisements in the media, such as Hollywood movies, in order to show everyone that the country was going through the best phase of its history and that in a way it was superior to other countries, which created and shaped the premise of the perfect country, where there would be no poverty and not even difficulties, ideals that still persist and have gradually strengthened themselves to the present day, which is currently displayed on social networks, such as Instagram and Facebook.

In this way, the painting of the perfect country and the perfect American life, or at least superior to most countries, still persists, through advertisements and digital influencers. Consequently, nowadays, these aspects shape some social behaviors of citizens of other countries, such as Brazil, where most of the population idealizes the United States as a perfect country to live in and, in addition, an inferiority complex has developed in the country when compared to other nations.

Figure 1:Photo of the famous American balls of the early 20s.



Authorship: ROBERTO, Luis. Roaring Twenties – The "Roaring 20s". Prof. Luis Roberto, 2020. Available at: <https://professorluizroberto.com/roaring-twenties-os-loucos-anos-20/https://professorluizroberto.com/roaring-twenties-os-loucos-anos-20/>. Accessed on: 20 May 2024.

OBJECTIVES

GENERAL OBJECTIVE

To understand the events of the Boom of the 20's, with emphasis on the propaganda of the American lifestyle, consequences experienced in contemporary times by the Brazilian population and in the world, corroborating the clarification of how the mechanisms of cultural production and consumption of that time shaped contemporary practices, perpetuating the alienation of the masses.

SPECIFIC OBJECTIVES

To analyze how the events of the Boom of the 20's influenced Brazil, with emphasis on American propaganda (cultural heritage), understanding the rooting of the Cultural Industry in Brazil;

In addition, analyze the first signs of the emergence of mass alienation, its first intentions and dissemination through the media of the time, and the emergence of the Cultural Industry, reaching the development of mass alienation and the Cultural Industry in the world, in 1920, and how this affects other countries;

In this way, it also demonstrates how mass alienation has grown and been perpetuated in contemporary times, as one of the greatest ways to influence the population to consumption or in political issues, and its consequences, specifying its development and strengthening.

METHODS

To carry out this work, which was developed in the discipline of History, taught by Professor and Advisor Cássio, by students of the 3rd year of High School with Formative Itinerary in Exact Sciences and Engineering of the Technical School Etec Professor Massuyuki Kawano. In the first instance, a qualitative research (bibliographic survey) was carried out in order to understand the aspects that guided the consequences of the Post-World War I and the Cultural Industry, in order to expose the events of the 20s, experienced by the United States and other countries. In addition, the classes and support materials made available by the teacher were used, as well as research materials from the internet. In the second instance, a collection of responses was carried out, through a digital form, with a sample of the population, on a national scale, in order to relate the practical aspects with the theoretical ones and demonstrate the characteristics of mass alienation in contemporary times and in Brazil, this was made available to public servants and people who had passed public examinations. Finally, it was related to the theoretical ideas developed with the results obtained in practice, in order to develop the concluding theses for the relevant work.

RESULTS AND DISCUSSION

In 1920, after World War I, the United States experienced great economic growth, which would later result in the Crisis of 1929, known as one of the greatest crises in the capitalist environment. During the years 1920 to 1929, the USA developed its culture and consolidated itself as a world power, which enabled the formation and dissemination of the idea of the *American Way of Life*, or "American Lifestyle", which preached American supremacy and the ideal of the perfect life, possible only for Americans and residents of the USA. In addition, this lifestyle began, at the time, to be propagated by Hollywood, through films and advertisements that showed the good moment experienced by the American population, in addition to developing the first expressions of female freedom and breaking antiquated feminine standards, as well as the strong development of American culture, such as the creation of Jazz.

Consequently, the American way of life did not take long to spread around the world. However, a devastated world living in a disastrous and nebulous post-war period began to be frequently bombarded by American propaganda, such as newspapers, films and other media of the time. In these aspects, the advertisements showed a reality very different from that experienced in the rest of the world, influencing several people to believe in the idea of the American lifestyle and in the sovereignty of capitalism and consumerism. Thus, a good

part of the world's population was influenced to believe that the United States was the perfect country, which, at the time, further spread the ideals of capitalism and democracy.

In this way, the *American Way of Life* began to consolidate itself around the world and become an apparatus of strong influence. Consequently, it influenced the world in several ways, but with a focus on the need for well-being expressed in the consumerism of material goods, which became a hallmark of American society and led to the Crisis of 1929, due to the Fordist model (Taylorism). During the 1920s, films such as "The Jazz Singer" (1927) exemplified the new freedoms and cultural expressions, while reinforcing the ideals of consumerism and the *American Way of Life*. The advertising of the time, present in newspapers and magazines, incessantly promoted products that symbolized this new lifestyle, such as Ford automobiles and innovative appliances.

In this way, according to Instrumental Reason, a term introduced by the founders of the Frankfurt School Adorno and Horkheimer, which refers to the use of reason as a tool to achieve practical and utilitarian ends, often at the expense of ethics and human values, the *American Way of Life* was used as a way to maximize the profits of the industries of the time, carrying few traces of true American culture and carrying traces of the need for consumerism to achieve happiness.

However, it is crucial to understand that the Cultural Industry does not come from capitalism, but from the industrial environment. In this way, the *American Way of Life* was not necessarily influenced by government doctrines, but by the industries of the time, which aimed to sell the large inventories generated by Fordism, which marked a consumer society. Thus, the idea is maintained that mass manipulation was not necessarily born from the social or political environment, but from the industrial environment and was, at the time, driven by the beneficial scenario, that is, the strong development of Hollywood industry and the weakening of European industries. Consequently, the American lifestyle has become fixed on the world stage with the idea of well-being in the consumerism of material goods, socially shaping diverse populations in a consumerist scenario. In this way, the American lifestyle was not only a way of manipulating people, but the first facet of the Cultural Industry and mass manipulation worldwide.

In Brazil, it did not take long for the consequences to be evidenced, with one of the most striking scenarios being the 1950s and its consolidation in São Paulo. With the growing spread of the Cultural Industry, it did not take long for the concept to arrive in Brazil, especially after industrialization during the Vargas government, marking a more refined lifestyle for some São Paulo residents, but also establishing a consumer society, as added by Marcia Barros Valdivia.

> In the face of the American "way of life", very well expressed in the media, the need for well-being was presented to Brazilian society, expressed in the consumerism of material goods, since industries were producing novelties such as household appliances, automobiles, furniture, clothing and accessories, which marked the era and outlined styles. People were seduced into having material goods, so that they could accept the invitation to enter the consumer society, as long as they had the main passport, "capital". (VALDIVIA, 2015, p. 187).

Consequently, the facet of the Cultural Industry influenced the people of São Paulo at the time to believe in a society more based on consumerism. However, this fostered some social problems in Brazil, as the *American Way of Life* could indeed be very beneficial and tempting to the people of São Paulo, as it was a fabulous escape from the problems and exhausting days of work, but with the recent urbanization of São Paulo and Rio de Janeiro, the ideals of the American lifestyle showed, also, that they could not solve the individual social problems of São Paulo society, the famous urban problems, which were invisible, because man should be a worker, guided and standardized on the basis of a capitalist industrial society. Exacerbated consumerism, propagated both in the 1920s and in the current digital age, has brought significant social and economic impacts. In the 1920s, the incentive to unbridled consumption resulted in the Crisis of 1929, highlighting the risks of a market excessively dependent on consumption. Currently, consumerism is perpetuated by algorithms that personalize ads and promote incessant consumption. This phenomenon contributes to growing social inequality and environmental problems, as the mass production and disposal of consumer goods increases the ecological footprint.

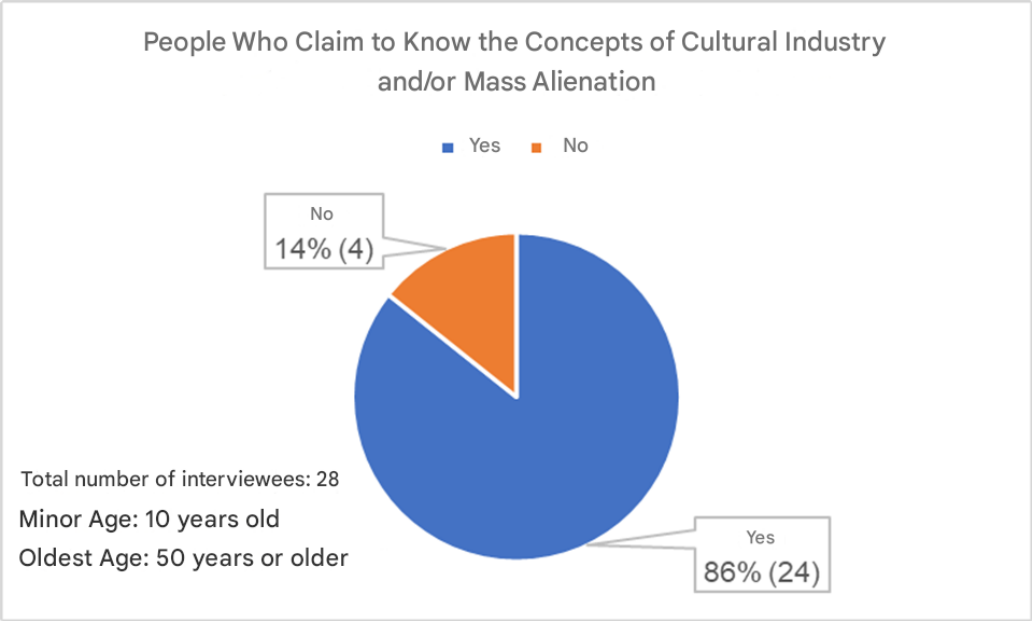
As a result, the Cultural Industry did not emerge today, but gradually established itself on the world stage, having its roots in the Boom of the 20s and, mainly, in the *American Way of Life*. In this regard, with the recent globalization and the speed of connections, the Cultural Industry has gained a much larger stage of action than in the 1920s. Consequently, films, music, books, and other cultural products are produced with the aim of maximizing profit, rather than promoting critical thinking or social transformation, perpetuating consumer ideals. In this way, the Cultural Industry has never had an end since its conception, as it has been used in different ways until it reached the present day. For example, the Cultural Industry has already served to disseminate capitalism around the world and, at the same time, to disseminate authoritarian doctrines, such as Nazism and fascism. In this way, the Cultural Industry remains relevant in the contemporary digital age, as it has been modified to adapt to digital media, which could serve to combat the dissemination of scientific knowledge and ways to develop critical thinking.

In addition, in the contemporary digital age, the Cultural Industry also exerts a significant influence on the population in political affairs, using advanced technologies to

manipulate perceptions and behaviors. In this way, social networks and digital media platforms are designed to maximize engagement through algorithms that reinforce biases and create information bubbles, limiting exposure to divergent perspectives. This facilitates the spread of dominant narratives and disinformation, shaping public opinions in ways that favor specific interests. The manipulation of the masses by the digital cultural industry results not only in media alienation, but also in political alienation, transforming individuals into passive consumers of polarizing and often misleading content. This algorithmic segmentation not only perpetuates consumerism but also facilitates the spread of misinformation, further polarizing society and hindering critical public debate.

As a result, the Cultural Industry proved to be an abrasive concept in Brazil, having its appearance in the 1950s. In this context, as much as in the 1920s it was used to transmit the ideal of exacerbated consumerism and American sovereignty to the people of São Paulo, evidencing problems even in this lifestyle, the Cultural Industry currently exercises a great social paradigm, as it served as a way to accentuate different social problems in the urban environment, especially in large cities. According to Adorno and Horkheimer, the Cultural Industry influences the great mass to passivity, condoning a society inert to advertisements. Consequently, Brazilians have been molded to patterns that accentuate social alleys and predominate social inequalities. In this scenario, urban advertising has increasingly become a game of influences, where each advertisement aims to engage the population, through their perceptions, segmenting Brazilian society between those who influence and those who are influenced. In this perspective, cities considered urban serve as a way of visualizing the effects of the Cultural Industry. In addition, it favors the famous "cancel culture" on social networks, as it instigates social division and the clash of ideas, by preaching the supremacy of an ideology, instigating in the digital environment the cancellation of the opinion of third parties, which generally do not reach or agree with the ideals of the Cultural Industry or the ideology that many already share, such as the case of actress Thaila Ayala, who launched a clothing brand called Vir.us.2020 in the midst of the pandemic and was canceled for the suggestive name.

Figure 2: Graph that measures the knowledge of the interviewees about the concepts analyzed.



Authorship: Graph of the research carried out, Tupã (SP); Marcio Gabriel Schinor Mazega, 3rd grade of the Formative Itinerary in Exact Sciences and Engineering. Accessed on: September 16, 2024.

Based on the data obtained and what was mentioned earlier, it is notable that the majority of the population claims to know the terms worked. However, even with this knowledge, the population is still strongly influenced by the Cultural Industry and its mechanisms, being stuck in conformity. Thus, despite recognizing these concepts, many individuals are already born in an environment impregnated by these ideals, such as the idealization of a foreign lifestyle, which leads many Brazilians to consider other cultures superior. This phenomenon is the result of exposure to commercials and disclosures that promote the supremacy of a culture, country or ideology, as shown by the *American Way of Life*, fixing a reality imposed for years.

Although they identify that the concepts mentioned exist, the population is inserted in this environment in such a way that they do not see how it directly affects their behaviors. As a result, mass culture is perpetuated, aggravating its social consequences and making the population amorphous, in addition to weakening Brazilian democracy. According to Jean Baudrillard, the world lives in a reality of simulacra, where images and representations replace reality, creating a 'hyper-reality'. The Cultural Industry, according to him, creates a great scenario of perceptions and achievements through images that reach society directly. In this way, the imposed manipulation generates a hyper-reality, causing the propagated images to replace people's reality, shaping their perceptions and actions, homogenizing society.

Consequently, in contemporary times, the Cultural Industry is not only based on its old mechanisms, but also on conformity. For many societies, the Cultural Industry is

considered something normal or cultural, transmitted over the years as a form of culture and its constant influence, promoting false realities and feelings of acquisition. Thus, the Cultural Industry perpetuates itself, masked in a conformism, as shown in the American society of the 1920s and consolidated in contemporary American society as a lifestyle, where only through consumption is it possible to achieve social well-being.

Therefore, most people cannot escape this imposed reality, passing on an imposed ideal and homogenizing. Society has lost the ability to criticize what is imposed, fixating on a social illusion of consumption and inferiority, affecting the social development of several countries, especially Brazil. In Brazil, the Cultural Industry, in addition to promoting consumption for social welfare, has also consolidated ideals of inferiority among the Brazilian population, which feels inferior when compared to foreigners. This feeling is generated by the perception of living in an inferior nation. These ideals were presented to Brazilian society during years of living with the American lifestyle and its ideals of supremacy and consumerism.

In addition, the Cultural Industry has appropriated digital media to expand its radius of influence and social manipulation. In this way, the Cultural Industry also gains prominence in the digital age, through social algorithms that create cultural bubbles and facilitate dissemination, the so-called echo cameras. In these environments, people enter cycles of posting and viewing the same content, dividing society into cultural bubbles and expanding the manipulation of the masses. In addition, this scenario favors the influence of people, who are grouped by common ideals. From this point of view, according to Jürgen Habermas, the Cultural Industry transforms communication into a commodity, maximizing dominant ideologies and reducing criticism, promoting a superficial and homogenized view of reality. Consequently, the mechanisms of social networks, such as echo cameras, increase the control capacity of the great masses, maximizing the reach of the Cultural Industry. This reduces cultural differences between social groups, reducing the socialization of different groups in the digital environment, opening space for the circulation of fake news and slowing down critical and social development.

CONCLUSIONS

Therefore, the mechanisms of the culture industry, shaped in the 1920s, continue to influence the masses in the digital age. The *American Way of Life*, propagated through the media of the time, sedimented an ideal of consumption and success that transcended borders and persists to the present day. Thus, alienation is not a new phenomenon, but a constant that adapts to new technologies and forms of communication, with this, the data

collected reveal that the Brazilian population, despite knowing what these terms are, as in other parts of the world, is still strongly influenced by stereotypes and consumption patterns disseminated by the cultural industry.

Consequently, the idealization of an American lifestyle, the search for material goods and the adherence to trends dictated by social networks are concrete examples of this alienation. In this way, the contemporary cultural industry, with its tools of personalization and segmentation, has made the manipulation of the masses even more effective. Social media algorithms, for example, create information bubbles that reinforce biases and make it difficult to access different perspectives, which fragments society and facilitates the spread of fake news and political polarization, reducing the critical capacity of individuals and weakening democracy.

Therefore, it is essential that society develops tools to resist the manipulation of the cultural industry, critical education, encouraging critical thinking and access to reliable information are essential for individuals to become more conscious consumers and more engaged citizens. In addition, there needs to be stricter regulation of digital platforms in order to ensure transparency and accountability in the production and dissemination of content. In short, the cultural industry has shaped and continues to shape society, influencing values, behaviors and decisions, but it has changed from what was shaped in the 20s. Understanding the mechanisms that sustain it is the first step to building a fairer and more democratic future, in which individual autonomy and diversity of thought are valued

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THE PSYCHOSOCIAL AND STRUCTURAL IMPACTS OF NEOCOLONIAL PRACTICES ON CONTEMPORARY EASTERN CONFLICTS IN THE GAZA STRIP AND SUDAN

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ABSTRACT

The conflicts in the Gaza Strip and Sudan have profound psychosocial and structural impacts on local populations. In Gaza, years of violence, blockades and military operations result in collective trauma, anxiety and social disintegration, especially among children and young people, who grow up in an environment of insecurity and deprivation. In Sudan, conflicts, such as those in Darfur and South Sudan, have roots in ethnic, political, and economic divisions, aggravated by neocolonial practices, which lead to forced displacement, hunger, destruction of infrastructure, and marginalization, perpetuating cycles of poverty and violence. In both regions, structural violence and neocolonialism hinder human development and stability. The analysis of the documentary Gaza (2019) reveals the psychological and social impacts of war, highlighting the resilience and survival strategies of the inhabitants, while the book I am Malala (2013) offers reflections on resistance against oppression, the right to education, and empowerment in conflict contexts. These elements show how neocolonial practices perpetuate inequalities, collective traumas, and sociopolitical instability. The analysis uses both quantitative and qualitative approaches to understand the complexity of the data, showing that conflicts not only disrupt societies but also demonstrate human resilience and the need for global action to promote peace and justice. Thus, the narrative exposes the importance of addressing the roots of inequalities to mitigate the impacts of these conflicts.

Keywords: Impacts. Psychosocial. Structural. Conflicts.

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INTRODUCTION

Contemporary conflicts in the Gaza Strip and Sudan are complex and deeply rooted in a history of neocolonial practices that perpetuate social, economic, and political tensions. In this context, we will address the psychosocial and structural impacts resulting from these practices, including the physical and psychological shocks faced by affected populations. Neocolonial practices, which manifest themselves through economic exploitation, political intervention, and military control, still shape the dynamics of power in various regions of the world, where instead of liberating these nations, they subject them to new forms of oppression, destabilizing social, political, economic, and local ideals.

In the Gaza Strip, the continued occupation and blockade imposed by Israel, coupled with an international position that often marginalizes Palestinians, result in a series of psychosocial shocks. The local population faces a daily life of extreme violence, resulting in psychological traumas such as depression, anxiety and post-traumatic stress disorders. In addition, the physical destruction of infrastructure, hospitals, schools or even homes, contributes to an ongoing humanitarian crisis with structural effects that deepen social vulnerability. Sudan has been marked by internal conflicts, such as the wars in Darfur and South Sudan's struggle for independence, exacerbated by a history of British and Egyptian colonialism, followed by neocolonial practices that have shaped the country's political and economic structure. Ethnic division and the exploitation of natural resources, such as oil and minerals, were fundamental to the perpetuation of the conflict. In the context of neocolonialism, many analysts argue that Western and regional powers, by seeking to maintain control over Sudan's resources, especially oil, have sharpened internal conflicts. Thus, this work aims to analyze how these neocolonial dynamics intensify the vulnerability and traumas of affected communities in the Middle East, permeating social instability and continuous marginalization.

Image 1: Conflicts in Darfur



Source: Sudan and conflicts in Darfur. Zen Class, 2028. Available in: Sudan and the Conflict in Darfur - Zen Class. Accessed in: 09/30/2024

Image 2: Conflicts in the Gaxa Strip



Source: Gaza Strip. Vatican News, 2024. Available at: https://www.vaticannews.va/pt/mundo/news/2024-03/medicos-sem-fronteiras-faixa-de-gaza-situacao-geral-catastrofica.html. Accessed in: 09/30/2024

OBJECTIVES

GENERAL OBJECTIVE

To investigate the structural consequences of neocolonial practices on the political and economic systems of the Middle East, seeking to understand how neocolonial practices, such as economic control, political influences, and military interventions, have shaped the formation of governments, the distribution of wealth, access to resources, and power relations in the countries of the region.

SPECIFIC OBJECTIVES:

- Identify the changes in the economic and social structures of the Gaza Strip resulting from neocolonial practices and explore how external influences, particularly from Western and regional powers, have impacted the local economy of Gaza, with an emphasis on trade, infrastructure and employment, also analyzing the reaction of Palestinian society, especially in terms of social cohesion, population displacement and political organization, as a response to these factors.

- Examine the impact of Western military and diplomatic interventions on Sudan's power dynamics, seeking to assess how military and diplomatic interventions, especially from Western countries, have influenced changes in political leadership and control of Sudan's resources.

- Explore the impact of neocolonial practices on education and youth in the Gaza Strip and Sudan, investigating how neocolonial influences affect access to education and the future prospects of young people in the Gaza Strip and Sudan, encompassing educational financing, the formation of curricula aligned with external interests, and how this impacts skills development, in addition to analyzing the role of youth in resisting or adapting to current political structures.

METHODS

The present work was developed outside the classroom by students of the 3rd grade of High School in the Biological Itinerary of ETEC PROFESSOR MASSUYUKI KAWANO, located in the municipality of Tupã - SP, supervised by Professor Aloísio Cássio dos Santo. The training action presents a qualitative strategy through bibliographic data, capable of corroborating the complexity of the details of the information obtained, in order to present thematic questions on the psychosocial and structural impacts consequent to neocolonial practices in contemporary eastern conflicts in the Gaza Strip and Sudan, based on the knowledge acquired in class and research carried out in an extracurricular environment. Thus, the work was divided into four stages: initially the group was formed in the extra-class environment, from a thorough research the theme of great relevance today was selected, then the research topics were divided among the members of the group and later there was a meeting to organize and relate the idea of this article, and finally, the construction of the banner for the presentation that aims to bring relevant information regarding the psychosocial impacts of today's conflicts.

RESULTS AND DISCUSSION

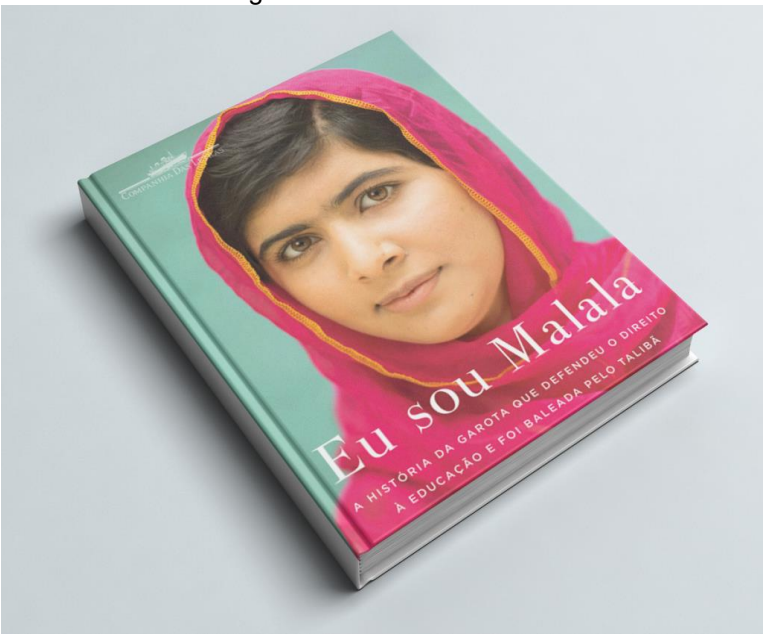
The book I Am Malala (2013) narrates the life of Malala Yousafzai, a young Pakistani woman who defends the right to education, even in the face of a reality of Taliban violence and oppression. By drawing a parallel between the psychosocial and structural impacts of the conflicts in the Gaza Strip and Sudan with the experiences portrayed in the book, it is possible to identify similarities in terms of oppression, collective traumas, and the dynamics of resistance in the face of violence. In the Gaza Strip, the constant blockades, bombardments, and military operations generate an environment of deep trauma, where the population, especially children and young people, develop anxiety disorders, depression, and a continuous sense of insecurity. These conditions resemble what Malala describes in her experience in Pakistan, where Taliban violence creates an environment of fear and repression, affecting people's mental health and well-being, especially children living without guarantees of safety. Similarly, in Sudan, internal conflicts perpetuated by ethnic and political divisions, such as in the Darfur and South Sudan regions, result in lasting trauma, highlighting how widespread fear and control over education and individual freedom profoundly affect the minds of young people, who are often deprived of opportunities for personal development and are forced to live in environments of repression and silence. Malala, in her book, highlights how the destruction of schools by the Taliban in Pakistan was a strategy to weaken communities, since without education, the ability to resist oppression and improve social conditions becomes almost impossible.

Similarly, conflicts in Sudan, exacerbated by ethnic and political divisions, lead to the destruction of social infrastructure, such as schools, health centres and transport networks. The war in Darfur, for example, dismantles entire communities, impedes access to education and essential services, and plunges the region into a cycle of poverty and violence. Malala, in her narrative, reflects on the importance of a solid infrastructure to ensure the future of a society, especially with regard to education as a means of empowerment and liberation.

Added to this, the documentary Gaza (2019) makes it clear that the situation in Gaza is largely the result of neocolonial practices and external interference, which perpetuate the blockade and prevent any real possibility of development. The film depicts how international power dynamics, combined with occupation and economic siege, create a situation of dependency and marginalization that makes reconstruction difficult. Despite the devastating impacts of the war, the documentary Gaza also portrays the extraordinary resilience of the population. In the midst of the destruction, the residents continue their lives, demonstrating an impressive ability to resist and find small forms of hope and normality. Resilience can

also be seen in Sudan. In war-torn regions such as Darfur, displaced communities often try to rebuild their lives, even with limited resources and under the constant threat of violence. In Sudan, as in Gaza, people struggle to maintain a sense of normalcy, investing in education, cultivating small businesses, or simply creating safe spaces for their families, despite the chaotic conditions.

Image 1: Artwork "I am Malala



Source: I am Malala. Medium, 2020. Available at: https://www.midialouca.com.br/biografias-e-memorias/47657-eu-sou-malala-malala-yousafzai-9788535923438.html. Accessed in: 09/30/2024

Image 2: Religious consoling young people



Source: "Right now, we only have God," says a religious woman asking for peace. Canção Nova, 2023. Available at: https://noticias.cancaonova.com/mundo/guerra-israel-hamas/neste-momento-so-temos-deus-desabafa-religiosa-pedindo-paz/ . Accessed in: 09/30/2024

Image 3: Gaza Documentary (2019)



Source: Gaza Documentary. The Glass House, 2024. Available at: https://acasadevidro.com/cinedebate-gaza2019/. Accessed in: 09/30/2024

CONCLUSION

It can be inferred, therefore, that the analysis of contemporary conflicts in the Gaza Strip and Sudan reveals the persistence of neocolonial practices that perpetuate social inequalities, collective traumas and political instability. The populations of Gaza and Sudan face not only the immediate impacts of violence, but also the collapse of their social and economic structures, which increases their vulnerability and hinders human development. The narratives in works such as "I am Malala" and the documentary "GAZA" highlight the resilience of communities in the face of adversity, highlighting the struggle for empowerment and education and the desire to be able to obtain their rights. The conflicts in the Gaza Strip and Sudan result in profound psychosocial and structural impacts for local populations, such as anxiety, depression and disintegration of the social fabric, especially affecting children and young people, who grow up in an environment of constant insecurity and deprivation. By emphasizing human resilience in the midst of chaos, this study underlines the need for collective action that ensures dignity and stability in the affected regions.

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ALTERITY IN THE PHILOSOPHY OF EMMANUEL LEVINAS: THE THESIS OF NON-INTENTIONAL CONSCIOUSNESS

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ABSTRACT

This research aims to analyze alterity, based on the thesis of non-intentional consciousness of E. Levinas. The French philosopher is an important representative of discussions about alterity throughout the twentieth century, in addition to being a critic of the ontological framework that objectifies the human being. Many scholars recognize the author's political discourse, due to his experiences in the concentration camps, parallel to his reflections on otherness. However, few pay attention to the phenomenological bases of passive subjectivity in his philosophy. This work seeks to highlight the moment in which Levinas recognizes in the unintentional consciousness the possibility of deposing the sovereignty of the self. Now, the moment the ego is surprised by the Other, which is external to it, it owes it an answer.

Keywords: Me. Other. Philosophy.

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INTRODUCTION

E. Levinas' initial reflections on otherness are influenced by the philosophy of E. Husserl. The reflexive paths traced by the philosopher from Kauna, which lead to his radical conception of alterity, start from the radical way in which Husserl structures phenomenology. Certainly, the Levinasian theses also do not abdicate the fundamental contribution of Martin Heidegger, especially his work Being and Time. It is from fundamental topics of Husserl's phenomenology, however, that the questions about the articulation with the French philosopher's thought are configured, with the notion of intentionality in vogue. Since the proposed discussion aims to analyze the Levinasian thesis of non-intentional consciousness, which is an impactful change for the Self, it also analyzes the role of the Other for the radical perception of subjectivity. There is no doubt that the aforementioned masters of Levinas are fundamental for the understanding of his philosophy, but the way in which he approaches the problems surrounding alterity makes his thought peculiar to the ethical discussion in philosophy. Levinas insisted on "speaking phenomenologically, beyond phenomenology itself", and this greatly explains how Husserl's philosophy does not fully substantiate his way of thinking.

This article is justified by highlighting the bases for the theme of alterity in Levinas' thought, indicating the moment in which the French philosopher recognizes Husserlian's limits. Levinas detects the limits of phenomenology because he understands that it still remains in the ontological realm. Its ethical formulation comprises the relationship of the "I" with the other, which rejects the predominance of the anonymity of existence (inherent to the I-it relationship), in the total denial of the objectification of the other. It is in the counterpoint of "good conscience", marked by intentionality, with "bad conscience", marked by passivity without intentionality, that Levinas situates the moment in which the Self is returned to its point of origin beyond ontology. Subjectivity, in this way, is awakened by the obligation to respond to someone.

It seeks to discuss the radical perception of alterity in Levinas' philosophy by analyzing the influences of E. Husserl, as well as his overcoming, in the analysis of intentional consciousness and in the horizons of meaning that act under the background of totalizing reason, in order to understand how the birth of the Self beyond itself occurs. In Levinas, the radical construction of subjectivity gives meaning to the other notion of alterity.

PHENOMENOLOGY IN LEVINAS' THOUGHT: INFLUENCES OF E. HUSSERL

In his article "non-intentional consciousness", written in 1951, Levinas recognizes important concepts of E. Husserl's phenomenology and shows how they served as the

basis for the formulation of his discussion of otherness. The notion of horizons of meaning (related to the thought that is absorbed in thought), which suggests being in the present tense of the indicative, as well as the concept of intentionality (adjacent to horizons of meaning), are structuring elements of the thesis of "non-intentional consciousness" developed by Levinas. Intentional consciousness is a significant contribution of E. Husserl's philosophy, and the understanding of this encircles the horizons of meaning when inclined to thought, since it is through reflection that such horizons revive in the being of being. The thought, in turn, gains meaning as a concept, and this same makes an appeal to the thought that thinks it, determining, according to Levinas, the subjective articulation of its opinion. It is in the logic of this scheme that the notion of timelessness is linked to the discussion about being, in the present tense, which is the determinant of its phenomena. In the relationship between intentional consciousness and the object, Husserl is concerned with concreteness as the basis of thought. (HUSSERL, 2006) If Husserl's effort is commendable, as he seeks to develop concepts without taking away more from them than they could give, there still resides in the German philosopher's thought fully theoretical bases that echo the positivism of the nineteenth century.

Husserl follows the Western philosophical tradition in establishing the privilege of the theoretical, of knowledge, and of the ontological sense of being. Despite starting from phenomenological bases, Levinas directly indicates the moment in which he follows a different course from the ultimate positions of Husserl's transcendental philosophy. In the relationship between idealism and realism, the latter assumes a meaning that does not indicate an a priori world, and therefore remains within the scope of idealism. Professor Timm de Souza, commenting on Levinas, mentions that idealism calls into question the need for confrontation between idealist and realist positions, as it is the logical sense that starts to assume the determining space (SOUZA, 2010). The philosopher from Kaunas insists on the idea that there are concrete facts that go beyond the totalizations of knowledge or thought concreteness. That is, no matter how solid a thought concreteness or a perfected theory may be, they are incapable of understanding the events that place the Other in the condition of subordinate. Levinas says:

> The being that appears to the self of knowledge not only instructs it, but, ipso facto, gives itself to it. Perception, on the other hand, captures; and the Begriff retains this meaning of domination. The "giving of oneself" - whatever the efforts that the distance "from the minutes to the lips" requires - is at the level of thinking thought, promises it, through its "transcendence", possession, enjoyment, satisfaction. As if thought thought to its measure by the fact that it can – incarnated thought – achieve what it thinks. Thought and psyche of immanence: of sufficiency to oneself. And this is precisely the phenomenon of the world: the fact that an agreement is secured in the grasp between the thinkable and the thinker, the fact that its appearing and also

> a giving of itself, that its knowledge is a satisfaction, as if it came to satisfy a need. (LEVINAS, 2010, p. 168)

The agreement between the thinkable and the thinker is an important tonic of intentionality and reveals much about "self-sufficiency." The self of knowledge is instructed by the being that appears to it, which is also a giving, implying the configuration of the concept that suggests the idea of domination. This means that the self of knowledge conceptualizes the being that presents itself to it in order to achieve what it thinks. This possibility generates satisfaction, since conceptualizing is a pleasurability with oneself. Fabri is correct when he states that consciousness belongs to the being, because to whom it shows itself contracts a dependence in relation to the being (FABRI, 1997). Levinas tends to be more categorical in relation to Husserl's phenomenology, noting how in the subject, once it is a central reference in front of every concrete thought, the objective experience becomes an orientation towards the object, whose content does not suffer interference from the subject. Paradoxically, although the subject is the reference to conceptualize the object that is given, the subject remains behind the experience.

THE INTENTIONALITY OF CONSCIOUSNESS IN THE RETURN OF THE SAME TO ITSELF

At the core of intentional consciousness there is the return of the Same to oneself, for in the understanding of something, there is the return to its generative energy, where knowledge and everything else is decided. This model, which overcomes the opposition between realism and idealism, is based on a form of realistic idealism whose philosophical system coincides with the unity of itself with itself. In other words, "the psyche of theoretical knowledge forms a thought that thinks according to its measure". That is why it is not difficult to imagine an immense world full of mirrors that reflect nothing but the image itself. Now, the way of thinking to one's own measure, in one's own adequacy to the thinkable, is self-consciousness. In the meantime, the same is found in the other. However, the effort made to guarantee reason its lucidity ends up privileging the positivity of the being that exhibits itself as a being. And in this attempt to lucidize, the "I think" predominates.

In this return to itself, through intentionality, the Same always seeks to situate itself with autonomy and firmness, to the point of suppressing otherness. The relationship between thought and the thinkable, along the lines of intentionality, makes it possible to verify that "what thought knows or what in its 'experience' it apprehends is, at the same time, the other and thought itself" (LEVINAS, 2002). That is why, when referring to being, thought is directed to something external, although, paradoxically, it remains in itself.

Levinas leads his reasoning to the evident sovereignty of the self, in which the self thinks is the ultimate form of the spirit as knowledge. In this way, all things are brought back to the I think, configuring a system, which, because it is intelligible, leads to self-consciousness. The "being-in-act", Levinas will tell us, is interpreted as coinciding with what it itself constitutes. By virtue of this intertwining of the subject with the thought object, we can question whether it can be possible for the I think to no longer put itself in front of the thinkable, or to erase itself in front of the thinkable. In this respect, the notion of interiorization comes to the fore as a possible escape valve for the marks of the thinking self in the face of the thought.

Conscience, however, glimpses such a possibility in different ways. An alternative would be through "words", these, in turn, are signs that consciousness itself gives to itself. Another possibility would be to try to look for a meaning beyond what is immediately presented to consciousness. However, through the inner discourse of questioning and searching for answers, there is a reflection on oneself that still proceeds from the I think. Even in these exercises around interiorization, in the attempt to deviate from intentionality, this continues as the keynote of the return to oneself. It must be considered, in any case, that in the apparent permanence in itself, the element of language becomes a relevant point of discussion in Levinas' philosophy, since it circulates as part of the multiplicity of minds. It is true that knowledge would still control it, because "it consists, for each of the interlocutors, in entering into the other's thinking" (LEVINAS, 2002).

Now, in entering into the thought of the other, reason prevails and becomes the background for the "inner speech". And in this supposed "dialogue" between subjects who seek to encompass each other, the exchange of ideas is truly effected in a single consciousness. Such coincidence, originating in reason, also rests on the attempt to establish peace among people by unanimity. This feat, however, only becomes achievable under the power of domination that apprehends the other, or the knowledge of the latter as a thing, without distinction in the face of all that is. The role of language in the process of building peace, according to Levinas, is in its lead to reason. And despite the meeting of "I's" supported by reason, the dialogue does not fail to indicate the possibility of rupture in the game of assimilations waged between the subjects. That is why Levinas' questioning makes sense when analyzing whether truth, related to the search for peace among people, could not find another way, such as in the dialogue of the self and the other (even without the destitution of the sovereignty of the self under the tonic of common truth). However, how to bring to dialogue opposite beings willing to do violence?

It seems, however, that without a dialogue that precedes totalizing reason, in its activity that completes knowledge and emphasizes the "I-It" to the detriment of the "I-Thou", the Self itself finds it difficult to be reborn. This is because intersubjectivity, so to speak, still according to Husserl's perception, shows itself as a formulation that subordinates language to knowledge. From then on, communication would be born from the "signs of language", which, from the intentional consciousnesses of beings (in which the consciousness that each consciousness has about something is known), the "expressive manifestations of the signifying bodies in the presentation" are formed (LEVINAS, 2002). In other words, language would be born from the presentation that is at the same time the experience of the thinking "I" and the reading of the sign. Now, consciousnesses recognizing each other, as mentioned above, and communicating with each other, do not cease to be guided by knowledge, following the idea of intersubjectivity expressed in Husserl. If intentional consciousnesses look at something and formulate a concept capable of placing the essence of something in the concept and this being a common truth for such consciousnesses, knowledge is still the priority in the supposed dialogue, which is a paradigm for the relationship.

Now, the step achieved by active consciousness, in Hussel's considerations, founds "on the side of the self, a habituality of continuous validation, which now belongs to the constitution of objects for the self" (HUSSERL, 2013). At the stage in which consciousness is structured as intentionality, it rests, as Levinas points out, in another modality that suggests an awareness of oneself. This awareness cannot be confused with an internal perception that makes objects recover in a reflective act. But it is precisely from the active consciousness, in its addressing to the world, that the unintentional accompanies it. It is through this path that Levinas intends to deprive the subject of intentionality and put down his sovereignty, in his return to himself through intentionality.

NON-INTENTIONAL CONSCIOUSNESS IN THE CONSTRUCTION OF SUBJECTIVITY

The reference to oneself, which marks the understanding of subjectivity in the modern period, is still an element present in Husserl's philosophy. For Levinas, Husserl's work, despite being impactful and revolutionary, follows the traditional trends of Western philosophy, with regard to the ontological sense of being and its predominance. Self-centeredness reappears especially in the Husserlian notion of pure consciousness. Levinas, in turn, does not fully depart from phenomenology to reflect on his main concern in philosophy, which is the theme of alterity. On the contrary, the liberation itself from the predominance of the self, from the awakening of the subjectivity of the one-to-the-other, is

related to the influences received by Husserl, although Levinas reflects the awakening to the other, in view of aspects not deepened by the German philosopher.

Certainly, the Husserlian way is not the only one proposed by Levinas to deal with subjectivity. But it is possible to consider, from his thesis of non-intentional consciousness, a phenomenological correction that intends to divert phenomenology from its ontological destiny, in order to later suggest the moment in which subjectivity is transformed under the notion of moral consciousness, which is constituted by non-intentional consciousness. To this end, the notion of intentionality, analyzed by Husserl, serves Levinas as a model, from which non-intentionality is discussed. Now, this is part of the intentional acts of people because conscience is not conscious of all its voluntary acts.

In the article "Is ontology fundamental?", written in 1951, the French philosopher questions whether our acts are pure, if when thinking about doing something, such as reaching out to bring a chair closer, other traces are left. The maxim that there is no perfect crime immediately comes to the fore because it is adjacent to human intention, unintentional marks. Hence, in the midst of our intentional acts, we become responsible beyond our intentions. It is important to note how already in this article the French philosopher surrounds the notion of responsibility for the other, as something close to intentionality that brings non-intentionality in its core.

In order to understand how Levinas articulates his thesis, based on Husserl's phenomenology, it is important to pay attention to the way he presents the object and its access to consciousness:

> In any case, every construction of the activity necessarily presupposes, however, as a lower degree, a pre-giving passivity, and, regressing in this activity, we finally strike upon the constitution through passive genesis. That which in life, so to speak, appears to us as an already finished existing thing (apart from all the spiritual characters which make it known, such as a hammer, a table, an aesthetic creation) is given in the originality of itself in the synthesis of passive experience. As such, it is pre-given for spiritual activities, which begin with active capture. (HUSSERL, 2013, p.177)

In their mode of access to consciousness, the constitutive genesis of objects is distinguished into active and passive forms (DEPRAZ, 2007). In active genesis, it is the intentional acts of consciousness that form objectivity and its meaning. There is, however, a pre-bestowal layer adjacent to this active activity of consciousness. Husserl calls it passive, and it is this that offers, at first, the matter from which the active part will unfold. If "the finished thing," like a hammer, comes to active consciousness, it is in passive consciousness that this object in its originality offers itself. Passive synthesis is always on the march in providing the matter for the grasp of active consciousness. And in this way, the

passive pre-data does not cease to appear, despite undergoing modifications by the captures. In any case, it is important to highlight that even present in the activities of the active consciousness, the passive element does not present itself as such. This still does not escape, retrospectively, intentionality, in Husserl's thought.

Levinas' thesis of unintentional consciousness stems exactly from Husserl's insight regarding the rapid change from the unintentional to the intentional. There is for Levinas a positive meaning in the secrecy inherent in unintentional consciousness. It is not a resolution that is based on knowledge, as this is related to active consciousness, that is, exposure to apprehension and capture. In turn, unintentional consciousness takes away this hegemony from the subject, because the thought that remains in the passivity of intentional consciousness is faced with something that it cannot apprehend or grasp. That is, the presence of oneself to oneself in the unintentional consciousness is dethroned from its power of appropriation. Non-intentionality is before all willing, it is before all lack (LEVINAS, 2010)

The passivity of the unintentional, in its spontaneity, calls into question the position of hegemony of the being with intentional thought that has the domain and exposure for capture and apprehension. But not only that. The subject is also questioned in his right to be: To have "to answer for his right to be, not by reference to the abstraction of some anonymous law, of some legal entity, but in fear for others" (LEVINAS, 2010)

SUBJECTIVITY FROM UNINTENTIONAL CONSCIOUSNESS

The concept of subjectivity is important in Levinas because of its ability to go beyond the anonymity of being. We have noticed so far, however, that the autonomous and conscious Self does not represent the definitive overcoming of the neutrality that always ends up returning and preventing the distinction between interior and exterior, or between subject and object, causing the meaning of one-to-the-other to be absorbed and swallowed up by the neutrality of the impersonal being. In this I-it relationship, knowledge is at the base, and the apprehension of the game of thematization is not escaped from it. The construction of passive subjectivity in Levinas implies the fundamental word I-thou, escapes, therefore, the exclusive predominance of ontology, since it is the restlessness of the Same for the Other that breaks neutrality and anonymity. The Other, in this way, is alterity that calls into question blind fidelity to essence.

In total agreement with the unintentional consciousness, or through bad conscience, the previous experience of another is not necessary for the self to be able to challenge him to dialogue. The very meaning of tu, according to Levinas, does not derive from this same

experience either. Questioning the other is an event of the spirit, transcendence would be achieved beyond the knowledge filled by the world and in the world; On the other hand, a bad conscience is a suffering of positivity because it needs to respond to others. Non-intentionality has an impact on subjectivity, as it is undressed, dislodged, to the point that its self-assurance is compromised: its theses and theories lose their meaning, the absolutely other is responsible for breaking and implying a response (SUSIN, 1984). That is why the French philosopher insists on arguing that encounter and sociality are not the same thing as experience encompassed by intentionality, since they can be conceptualized by reason.

The crack that does not open intentionality, so to speak, evidences an extraordinary passage that surpasses any synthesis of the I think, and this would not be able to equal this ethical event. Not even the internal discourse of the cogito could be a form of dialogue with itself because it would not consist of an interlocutor distinct from itself[2]. The dialogue that consciousness knows, however, does not abdicate from reflection itself; If reflection supposes the suspension of the spontaneity of thought, the other has already acted, by supposing the reflection of the "I" by the other. Such an event would not be possible, according to Levinas, without the sociality of the self with the other.

Self-consciousness is confronted with an encounter that comes before – as "a thought thought beyond the world, for self-consciousness equals itself by equaling itself with the world. There is no possibility of coincidence or synthesis in this encounter, however, as if the knowledge of one by the other were a bad aspect; it is, on the contrary, a surplus from one to the other, "the best of one besides oneself". It is no exaggeration to say that when being interspersed in the encounter with the other, the self is born beyond itself, beyond its interiority. If the other returns the self to its real and forgotten point of origin beyond ontology, this relationship that resembles love also degenerates into hatred. It is necessary to remember that the face of the other is also a temptation to murder, in addition to implying the notion of infinity. (LEVINAS, 1982)

But doesn't love as an unfolding of the encounter of the I-Thou emerge kind of submissive to the ideas and values of the environment? For Levinas, the encounter, or the dialogue with the Other, is also the dialogue of transcendence in the sense that the very notion of good emerges through the encounter with the other. This event is the ethical moment, from which all values owe everything to this ethics itself. This reciprocity of the I-Thou relationship is certainly an opposition to intentional consciousness:

[2] Levinas questions whether the impulse of thought reflecting on itself, causing interruption, and returning, is not a prior dialogue.

> The Phenomenology of the intentional act is juxtaposed – often taking a negative modality – as it were a phenomenology of Relation. Thus, the non-reversible "polarity" of the intentional act: ego-cogito-cogitatum, in which the ego pole is inconvertible into an objective pole, is opposed to the reversibility or reciprocity of the I-Thou: the I says you to a Thou and the latter, as I, says thou to the I; the activity of saying in dialogue is ipso facto the passivity of listening, the word in its own spontaneity exposes itself to the response [...] (LEVINAS, 2002, p. 194)

The Husserlian formula of the "ego-cogito-cogitatum", which initially starts from Descartes, is shaken by the "reciprocity of the I-Thou" that inexorably sets the dialogue into activity. The saying in dialogue is not based on the sovereignty of the thinking self and its conceptual and logical intentions. The interspersed the other points to an exercise of humility, as is subtended in the Levinasian conception of alterity. In other words, listening to the other who says to the self is an exercise that implies self-control, as it involves the control of good conscience, of the intentionality that is creative in its exercise of thinking about something, to open up to what the other says. Listening to the other involves not allowing the conscience to create reasoning by listening to what the other says. In the practice of listening, the possibility of response is implicit. The first sense of responsibility lies precisely in the moment when the other is listened to, because he or she will also be able to listen and speak again in the situation of dialogue.

Even if the encounter with the Thou takes place in the world, this other is not of the world. That is why it escapes from intentional consciousness, because it approaches the object on the horizon of the world; In other words, the other is non-being. The other is not simply made present by the cogito. A human spirituality that begins not in knowledge, in intentional consciousness, but in bad conscience becomes a different way of conceiving the human psyche, in the pure I-thou relationship. Finally, the bad conscience would be the dead point where the sovereign movement of the self, of the "ego-cogito-cogitatum", or the concern with the world more than with the other – the self, returns to its point of origin beyond ontology.

Ethics, in Levinas, begins exactly in this event, because without recourse to any general principle, the value of the other is evident. The relationship with the other implies an immediacy, an obligation, without the aid of any universal principle. Subjectivity, in this way, is awakened to insomnia and, at the same time, it is a restlessness provoked by someone. In the relationship with the other, more precisely in dialogue, the self ends up thinking, without, however, embracing the other. This is the impact of non-intentionality on the construct of subjectivity.

CONCLUSION

We sought to reflect on the problems intrinsic to the theme of alterity of E. Levinas, seeking to understand its phenomenological bases. It was found that the philosopher from Kaunas started from a fixture left by E. Husserl to expose the ethical moment in which the sovereignty of the "I think" gives way to the Other who disconcerts him. This possibility directly involves the thesis of unintentional consciousness, whose resistance to intellectual understanding represents a disarticulating force of clear reason. Also called "bad consciousness" this underlies the intentionality of consciousness (the "good conscience"), and through it, the self returns to its point of origin beyond ontology.

A bad conscience is the suffering of the positivity of having to answer for someone. It reduces the self, at the same time that it gives birth beyond itself, beyond its interiority and its relationship with the world. By unintentionality, the self has to answer a question that goes beyond it. In other words, it is the bad conscience that causes the suffering imposed from outside, because the Other is not encompassed by intentionality as a mere object: it is the face that cries out for dialogue. Exactly where alterity is transformative.

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LOW-LEVEL LASER THERAPY AS A FORM OF TREATMENT FOR LOW BACK PAIN: AN INTEGRATIVE REVIEW

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ABSTRACT

Introduction: Low back pain is an important cause of disability, occurring in high prevalence in all cultures, negatively influencing people's quality of life. The low-level laser has been shown to be an appropriate choice for reducing pain. The objective of the present study was to evaluate the use of low-level laser in low back pain. Method: Integrative review using articles in Lilacs, Medline, Scielo, Cochrane Library and journals. The inclusion criteria for the clinical studies in this review were: being a randomized clinical study investigating the effect of low-level laser on low back pain, alone or as part of a treatment program; assess at least one of the following outcomes: pain, disability, and quality of life. Studies located in the period from 2013 to 2033 were included. Results and Discussion: The studies showed the role of LLLT in reducing inflammation, changing endorphin levels, reducing pain, and accelerating recovery of nerve conduction. Final Considerations: Most of the articles showed favorable effects of low-level laser on low back pain with adjuvant therapies.

Keywords: Low Back Pain. Lumbago. Rehabilitation. Low Intensity Laser. Laser therapy.

INTRODUCTION

The term low back pain refers to pain in the lumbar spine, being one of the most common symptoms of spinal dysfunctions. This is a dysfunction that affects both sexes, and can range from acute pain, if it lasts less than four weeks; subacute, lasting up to 12 weeks; and chronic, if it persists for more than 12 weeks (Pires; Samulski, 2006).

Chronic low back pain is a symptom, not a disease, that is characterized by pain, which can result from various causes. Due to the complexity of low back pain, we can classify them etiologically as structural; traumatic, musculoskeletal; Degenerative; Rheumatic; birth defects; Inflammatory; Neoplastic; reflex visceral; bone diseases; and metabolic (Costa; Palma, 2005; Caetano *et al,* 2006)

Low back pain can be caused by several factors and modified by psychosocial disorders. Studies show that around 50% to 90% of adult individuals may have low back pain at some point in their lives. In industrialized countries, low back pain is one of the leading causes of disability in individuals under the age of 45. The incidence seems to be equal in men and women, however women have a higher incidence of complaints after 60 years of age, authors state that this fact is due to osteoporosis. Low back pain is the main cause of absenteeism from work, being a cause of disability in individuals in the productive age group, causing considerable damage to the economy (Imamura; Kaziyama; Imamura, 2001); (Helfenstein; Goldenfum; Siena, 2010).

The recurrence of low back pain is a condition that can bring numerous limitations to the patient, so 90% of patients recover spontaneously within 4 to 7 weeks, however, although recovery is rapid, the tendency for recurrence of painful symptoms can occur in 50% of individuals who presented an acute episode within 1 year Recent studies, Evaluating patients followed for 6 months to 2 years, they observed that 40% to 44% of patients have chronic pain. It is estimated that 1% to 3% of patients with low back pain may be amenable to a surgical procedure. (Imamura; Kaziyama; Imamura, 2001); (Helfenstein; Goldenfum; Siena, 2010); (Da Silva; Reis, 2021).

Physical therapy intervention is important for the treatment of the cause of low back pain, as it provides pain relief, through resources that reduce muscle contracture, improve trophism, and increase flexibility and global relaxation, improving posture and improving the quality of life of patients (Lima, 2023).

Low-level laser, proposed in the studies in this review, has been widely used in patients with musculoskeletal disorders. Among the main therapeutic effects of this type of laser are the anti-inflammatory action, analgesia, and modulation of cellular activity (Lira, 2023); (Dos Santos; Invention, 2024).

For safe and effective use of low-power laser, several points still need to be clarified and standardized. Some of these topics relate to the type of LLLT, wavelength, and dose employed, which can alter the desirable effects during the application of such a resource (Yang, 2022).

Photobiomodulation therapy applied in the form of low-intensity light amplification by stimulated emission of radiation (LASER) and light-emitting diode (LED) has been shown to reduce inflammation and swelling, promote healing, and reduce pain for a number of musculoskeletal conditions. There is evidence that photobiomodulation therapy reduces pain intensity in non-specific knee pain, osteoarthritis, post-total hip arthroplasty pain, fibromyalgia, temporomandibular diseases, neck pain, and low back pain (De Oliveira *et al*, 2022).

Low back pain is an important cause of disability, occurring in high prevalence in all cultures, negatively influencing people's quality of life (Valadares *et al*, 2020).

There are several therapeutic resources available for the treatment of low back pain, such as surgical and drug measures. However, physiotherapy works through conservative treatment, with electro-thermophototherapeutic resources, kinesiotherapy through exercise programs aimed at better muscle conditioning, postural alignment, relaxation and symptomatic pain relief. However, its eligibility will depend on the patient's clinical condition and the evaluation carried out by the physiotherapist (Lima *et al*, 1999).

Among the various electro-thermophototherapeutic resources used, low-level laser has been gaining prominence in recent decades (Fumache *et al*, 2021).

The low-level laser has proven to be a very suitable choice for reducing pain. Because it is not an invasive procedure, it has shown good results in pain treatments in the area of Medicine. Therefore, its use for the treatment of low back pain is proposed, which, among the musculoskeletal pathologies, deserves special attention and can be considered a public health problem (Lino *et al*, 2023); (Ocon *et al* , 2024); (Pires *et al*, 2024); (Isabella *et al,* 2024)

Considering the aggravating factors of low back pain and the concern to verify the applicability of this resource, this study intends, through a literature review, to describe the effects of the use of therapeutic laser on low back pain.

In view of the above, the objective of the present study was to describe the effects of the use of low-level laser in patients with low back pain through an integrative review.

METHOD

For this study, the authors opted for an integrative review, a methodology that offers the synthesis of knowledge and the incorporation of the applicability of results of significant studies into the scope of the topic in question. The method emerges as an instrument of Evidence-Based Practice (EBP), which began with the work of epidemiologist Archie Cochrane, which is characterized by an approach focused on clinical care and teaching based on knowledge and the quality of evidence. With a broad methodological approach regarding reviews, allowing the inclusion of experimental and non-experimental studies for a complete understanding of the phenomenon analyzed. It can combine theoretical and empirical literature, as well as incorporate concept definition, review of theories and evidence, and analysis of methodological problems of a particular topic (Whittemore *et al*, 2005); (Brevidelli; Domenico, 2008). In this study, articles in Lilacs, Medline, SciELO, Cochrane Library and PubMed databases were used.

The descriptors for searching for articles were: "low back pain", "low back pain", "rehabilitation", "low-level laser", "laser therapy". The inclusion criteria for the clinical studies in this review were: studies investigating the effect of low-level laser on low back pain, alone or as part of a treatment programme; assess at least one of the following outcomes: pain, disability, and quality of life. Studies located from 2010 to 2023 were included.

Among the publications identified, Portuguese and English were selected. After analyzing the 238 articles found, only 7 were used in this study.

RESULTS AND DISCUSSION

Because low back pain is one of the causes of musculoskeletal disability and is responsible for being the main chronic disease worldwide, several electro-thermophototherapeutic resources have currently been investigated in order to promote the relief of pain symptoms in patients diagnosed with this disease. One of the treatments that has been giving excellent results is photobiomodulation (FBM) by low-intensity laser (LLLT) and/or intense pulsed light (LED), effective to treat the signs and symptoms of low back pain due to its photobiomodulatory effects.

Chart 1 shows the studies used to carry out this article.

Chart 1 – EFFECT OF LOW-INTENSITY LASER ON LOW BACK PAIN – São Paulo, 2023.

AUTHORS	*EVALUATION METHOD*	*COMBINATION THERAPY*	*RESULTS*
Konstantinovic et al., 2010	Pain (VAS), movement (Schober), functionality (Oswestry), quality of life (SF-36). Applied before and after intervention.	Group A (182):nimesulide and active LLLT Group B(182):nimesulide (COX-2 inibidor) Grupo C(182):nimesulida and LBI placebo	Improvement in the 3 groups, more in group A. Group C better than group B- Placebo effect
Jovicic *et al., 2012*	Pain (VAS), movement (Schober),Straight leg raise (NASS),manual muscle test. Applied before and after intervention.	Uncombined therapy. Active LBI only.	The 3 energy doses of LBI were equally effective in relieving pain, but the 4 J dose was more effective in improving activities of daily living and lumbar mobility.
Momenzadeh S *et al*., 2012	Pain(Vas),Disability(ODI)Applied before and after intervention at 6 weeks and after 6 weeks without intervention-12 weeks	Group 1(20):Active LBI Group 2(20):Active LBI + exercise Group 3(20): LLLT placebo + exercise	The disability of patients in groups 1 and 2 in the 6th week showed significant improvement compared to the beginning. The rate of pain and disability in the 12th week of the study improved significantly compared to the 6th week of the study in groups 1 and 2.
Hsieh R.; Lee, W.C., 2014.	Dor(Vas), incapacidade(Disability Oswestry),s Questionar Fear Avoidance Belifs	Group 1(25):LBI ativa + hot pack Group 2(25):LBI placebo + hot pack	The combination of the LLLT and hot pack reduces low back pain compared to placebo
Bagg *et al,* (2022)	The control group included sham laser and short-wave diathermy applied to the lumbar region and sham non-invasive brain stimulation	A total of 276 adults were randomized (in a 1:1 ratio) to clinician-administered intervention or sham procedure and clinician-administered care control groups, using laser and physical activity.	The primary outcome is that graded sensorimotor retraining, compared to a sham procedure and attention control, significantly improved pain intensity at 18 weeks with the aid of the laser.
Yang *et al*, (2023).	Randomized clinical trial.	Low-level laser acupuncture combined with auricular acupressure (LLLT) on pain intensity.	A 4-week LBI intervention reduced pain intensity and pain interference with the improvement in the quality of life of the group studied.

Source: Authors

In the study by Konstantinovic *et al*, (2010) the effects of low-level laser therapy LBI or LLLT in patients with acute low back pain and radiculopathy were investigated. A randomized, double-blind, placebo-controlled clinical trial compared three groups: one treated with nimesulide and active LLLT, another with nimesulide alone, and a third with nimesulide and placebo LLLT. The results showed that the group that received active LLLT

showed statistically significant improvement in all measured parameters, including pain intensity and lumbar mobility, compared to the other groups. The study concluded that LLLT, used as an adjunctive therapy to nimesulide, significantly improves the treatment of acute low back pain with radiculopathy.

In 2012, Jovicic *et al*. evaluated 66 patients with low back pain and acute low back pain and low back pain treated with LLLT. Patients were randomly divided into 3 groups that received three different doses of LLLT, with the following parameters: 904 nm, 3000 Hz, 25 mW, energy dose of 0.1J per point in the first group, J per point in the second group, and 4J per point in the third group. The authors noted that the three energy doses of LBP were equally effective at relieving pain, but the 4J dose was more effective at improving activities of daily living and lower back mobility.

Momenzade *et al*. (2012) reported that LLLT combined with physical exercise can be effective in low back pain, investigating 60 patients who were divided into 3 groups. One group, LBI only; another, placebo LLLT + physical exercise and the third group, placebo LLLT + physical exercise. Therapy was performed 2 times a week for 6 weeks. Pain and disability were measured at week 6 and week 12.

The disability of patients in groups 1 and 2 at week 6 showed a significant improvement compared to the beginning of the study. The rate of pain and disability at week 12 improved significantly from week 6 of the study in groups 1 and 2.

In the short term, Hsieh and Ru-Lan (2013) researched the action of LLLT on low back pain 3 times a week for 2 weeks. 50 patients received active 890 nm sessions or placebo combined with surface heat (hot pack) and were able to verify through the results that the combination of LLLT and hot pack reduces low back pain compared to treatment with hot pack and placebo. In order to analyze the effect of LLLT on low back pain, we initially sought to observe the laser parameters. Thus, the treatment protocol was verified that displayed the parameters of each laser in the selected articles. Through these data, it was observed which parameters were most used among the studies, as well as the method chosen to better evaluate the effect of LLLT on low back pain.

During the application of LLLT, in order to obtain the appropriate biological response, it is necessary to achieve the optimal radiation dose, the correct wavelength, and the number of applications sufficient to produce a therapeutic effect. In the present study, few laser parameters were analyzed, since only those most evidenced among the articles were used. This is due to the lack of standardization of treatment protocols and insufficient data among the studies (Rodrigues *et al*, 2020).

Studies have shown the role of LLLT in reducing inflammation, changing endorphin levels, reducing pain, and accelerating recovery of nerve conduction (Rodrigues *et al*, 2020); (Parizotto, 2001); (Momenzade *et al*. 2012).

Most of the articles showed favorable effects of low-level laser on low back pain, and when used with adjuvant therapies it has an improvement in quality of life (Rodrigues *et al*, 2020); (Parizotto, 2001); (Bertolini *et al*, 2008)..

Physical therapy intervention is important for the treatment of the cause of low back pain, as it provides pain relief through resources that reduce muscle contracture, improve trophism and increase flexibility and global relaxation, improving posture and improving the quality of life of patients (Parizotto, 2001).

The low-level laser, proposed in the studies in this review, is widely used in patients with musculoskeletal disorders. Among the main therapeutic effects of this type of laser are the anti-inflammatory action, analgesia and modulation of cellular activity (Parizotto, 2001).

For safe and effective use of low-power laser, several points still need to be clarified and standardized. Some of these topics are related to the type of LLLT, wavelength and dose used, which can alter the desirable effects during the application of such a resource (Bertolini *et al*, 2008).

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According to Jovicic, *et al* (2012) the efficacy of different doses of low-level LLLT laser therapy in the treatment of acute low back pain with radiculopathy was observed. A randomized, double-blind study with 66 patients divided into three groups received varying doses of LLLT (0.1 J, 1 J, and 4 J per point). The results showed that all doses were effective in reducing pain, but the 4 J dose showed better results in improving lumbar function and mobility.

In the study by Bagg *et al,* (2022) the authors highlight the importance of the effects of altered neural processing, defined as alteration of neural networks responsible for pain perceptions and conducted a parallel, randomized, 2-group clinical trial recruiting participants with chronic low back pain (> 3 months) nonspecific from primary and community care settings. A total of 276 adults were randomized (in a 1:1 ratio) to the

intervention or sham procedure and attentional control groups administered by clinicians at a medical research institute in Sydney, Australia. The first participant was randomized on December 10, 2015, and the last was randomized on July 25, 2019. The follow-up was completed on 3 February 2020. In this study, participants randomized to the intervention group (n = 138) were invited to participate in 12 weekly clinical sessions and training in their homes and were instructed to move and practice physical activity in the case of low back pain. Participants randomized to the control group (n = 138) were asked to participate in 12 weekly clinical sessions and training also in their homes that required similar time to the intervention but did not focus on education, movement, and physical activity. The control group included sham laser and shortwave diathermy applied to the lumbar region and sham non-invasive brain stimulation. The primary result was that graduated sensorimotor retraining, compared to a sham procedure and attention control, significantly improved pain intensity at 18 weeks with the aid of the laser

Yang *et al* (2023) in their study analyzed low back pain (LBP) in nurses, which is a major health problem that affects quality of life and work capacity, with consequences for their economic status, and evaluated the effect of the effect of low-level laser acupuncture combined with auricular acupressure (AAL) on pain intensity, Pain interference and quality of life in nurses with low back pain. This was a randomized clinical trial in which a convenience sample of nurses from a teaching hospital in Taiwan, China, was recruited. Participants were randomly assigned to the LAA group (n = 38) receiving low-level laser acupuncture and auricular acupressure for 4 weeks, and the control group (n = 38) receiving only sham laser acupuncture treatment with no laser energy output. The authors were able to conclude that the 4-week LAA intervention reduced pain intensity and pain interference, and improved quality of life for hospital nurses with low back pain. These effects were maintained continuously for at least 4 weeks after the intervention. Nonpharmacologic intervention, LAA, may be another effective, feasible, and noninvasive analgesic intervention for low back pain.

The heterogeneity in the results of treatment with the use of laser therapy may be due to the variation of parameters and protocols. It is important that in the next studies, all the parameters of laser application are discussed.

Although the reviewed articles presented a great variability in the physical parameters of the laser, it was possible to observe that there were favorable effects on pain, disability, and quality of life of patients with low back pain.

FINAL CONSIDERATIONS

Low-level laser has been frequently used in physical therapy treatment, due to its characteristics of relieving pain, stimulating tissue repair, reducing edema and hyperemia in anti-inflammatory processes, preventing infections, in addition to acting on paresthesias, according to this study we could observe the effectiveness of this therapy and that it can be used with adjuvant therapies.

Considering that low back pain reaches considerable levels in the world population in this study, we can observe in this study. that there are still few publications related to the subject, especially clinical trials, reproduction of results, wide variety of parameters, lack of detailed description; pointing out the need for special attention to the subject addressed, especially new research that seeks the standardization and efficacy of laser in acute and chronic low back pain. The articles used showed favorable effects of low back laser in the treatment of acute and chronic low back pain.

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PREJUDICE AND BULLYING IN HIGHER EDUCATION: AGE AS AN ANALYSIS VARIABLE

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ABSTRACT

This research aimed to verify possible relationships between age and personality characteristics, such as sadomasochism, fragility of the Self and narcissism, and between age and the type of violence manifested by higher education students throughout their school life. The sample, composed of 172 academics from 12 undergraduate courses from public and private institutions based in the northwest of Paraná, was applied the following research instruments: a division of the Fascism Scale into: Scale F of sadomasochism and Scale F of Fragility of the Self; Narcissistic characteristics scale; Scale of manifestation of prejudice, divided into the following targets: ethnicities, people with disabilities, LGBTQIA+; Moral Prejudice Scale; Bullying Scale and Bullying Target Scale. The results indicate that the increase in age is positively related to fascist behavior, prejudice against people with disabilities, against minority groups and against LGBTQIA+ people.

Keywords: School Violence. Prejudice. Bullying. Higher education. Age.

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INTRODUCTION

Violence, as a product of human activity, accompanies the historical course of school institutions, a fact observable in descriptions of sexual abuse and mistreatment, arising from disciplinary mechanisms, prejudice and *bullying,* present, for example, in Brazilian literature of the nineteenth and twentieth centuries, set in educational institutions. Despite the fictional character of this type of narrative, the aggressions portrayed there are inspired by reality, so that certain works are even considered autobiographies, since the suffering of characters is confused with that of the authors (Carvalho, 2019), as occurs in *O Ateneu* (Pompéia, 2006) and *in Doidinho* (Rego, 2018).

The hostilities that take place in schools reflect social problems and the difficulty in combating them, since the coldness that leads us not to identify with the other, according to Adorno (2006a), permeates violence of any nature, constituting a phenomenon that characterizes our time. Coldness also produces an anti-experience effect, as it takes the place of the feeling of empathy for the other. In this sense, *bullying* is becoming a serious public health issue in various parts of the world (Mello *et al*, 2017; Monteiro *et al*, 2017; Santos *et al*, 2020).

Although *bullying* is not a new phenomenon, nor is it exclusive to the school, as formal education has been democratized, in order to enable the concomitant presence of different social groups in the same space, the school has become a place of incidence of this specific type of violence, whose concept dates back to the 1970s, when different studies on this topic were promoted (Oliveira *et al*, 2017).

For Adorno (2015), at the beginning of the twentieth century, Freudian theory dispelled the liberal illusion that associated higher levels of tolerance and solidarity, automatically, with civilizational advancement. Living with human diversity, despite being important, is not enough for relationships between individuals to be respectful, a fact attested by the presence of situations of school violence such as *bullying* and prejudice in schools in different parts of Brazil and the world (Silva; Bazon, 2017). In addition to living with this diversity, in order to achieve a cathartic and formative effect, coexistence needs to be linked to the experience that strengthens the school community as a basic principle for everyone's life.

Bullying is characterized by physical, verbal, sexual, symbolic and also virtual aggressions, the latter called *cyberbullying*, systematic and repeated, without manifest motivation, in addition to evidencing the desire for destruction of an individual or a group of people in relation to others considered vulnerable and with little possibility to defend themselves from attacks, whether in relation to physical aspects, or in relation to

psychological aspects (Antunes; Zuin, 2008). As irrational violence is related to the weakness of its author's personality, Crochík (2015, p. 40) warns that the fragility of the victims "[...] it would remind the strongest of their own fragility, their own submission, which must be denied, which implies that *bullying* is also self-domination." It is observed that *bullying* refers to a type of violence that does not have a fixed target or a justification – even a fanciful one – for the aggression; there is only the desire to subjugate the weaker. In prejudice, another type of school violence, the delimitation of the target is evident, although there is also self-domination.

In relation to prejudice, more specific targets are associated with collective movements that persecute ethnic groups, blacks, homosexuals, women, among others, using stereotypes such as, for example, *the laziness of blacks*, *the avarice of Jews*, *and the corruption of the family by homosexuals*. This finding does not mean positive prejudice, nor that the victims should be held responsible, but that those who practice *bullying*, as a tendency, have a personality based on narcissism, indicating greater psychic regression, compared to the personality of the prejudiced person, whose greatest tendency is the sadomasochistic personality (Crochík, 2015).

In this sense, the understanding of prejudice and *bullying* requires the understanding that these are types of violence whose practice is related to forms of consciousness and personality and that these, despite manifesting themselves in the individual, are forms through which objective reality is expressed. Therefore, changes in the objective basis of society contribute to changes in the forms of consciousness and personality (Adorno, 2015), as well as to the replacement of experience by experience. For Crochick and Crochick (2017) and Crochick (2017b; 2021), in the period of competitive capitalism, ideology was both false and true. The truth was translated into the fact that there was a greater possibility of realizing the ideals of freedom, equality, justice and happiness; Its falsity lay in the misunderstanding that capitalism itself is an impediment to idealized objectives. On the other hand, contemporary ideology, based on monopoly capitalism – marked by the absence of competition in the sale of a product or service, therefore also characterized by the absence of a market – expresses a weakening of the central institutions for the formation of the individual (family, school, religion, etc.), indicating a greater restriction of freedom. In the words of Crochick (2017b, p. 52):

> Unlike the age of the Enlightenment, which bet on a rational society with rational individuals, the current one brings a rationality that gives rise to individual irrationality: the sacrifice of thought that, in turn, leads to irritation with the thought that doubts.

The intensification of the contradiction between the possibilities and barriers of human realization corroborates the increase in the irrationality of the individual (Horkheimer; Adorno, 1956; Marcuse, 2004), as well as harming the experience in the present time. In this sense, *bullying* coexists and is related to prejudice, but both are distinct forms of violence, presenting characteristics that define them as specific phenomena and, therefore, also demand peculiar ways to combat them, as indicated by Crochík (2015).

Deepening knowledge about school *bullying* is necessary, above all, because, although since the 1970s there have been studies on this type of violence in order to understand it and seek ways to remove it from the school environment, its solution is distant, in view of data presented by research that reveal that the problem persists at different levels of education.

Silva and Bazon (2017), based on data from national and international surveys, point out that the incidence of *bullying* in Brazilian schools exceeds that of other countries. While Brazil has a rate of 28%, countries such as the United States, Italy, Spain, Israel and Sweden have rates of 24.5%, 19.6%, 17.4%, 15.1% and 9.7%, respectively. In addition, there are indications that the manifestations of school *bullying* in Brazil, contrary to what happens in other countries, occur predominantly in classrooms, possibly many of them in the presence of teachers and under the observation of colleagues who do not appear as targets or victims, but who witness the violence (Silva; Bazon, 2017), that is, the situations in which *bullying occurs* are composed of the aggressor, the victim and the observers, which does not prevent the exchange of action between those involved. Observers, as the Portuguese research points out, can be important in the process of preventing this type of aggression (Gouveia, 2011).

Delimiting the profile of the agents of *bullying* is an important step towards unveiling the dynamics of violence that is established in school environments and that often goes unnoticed in the eyes of those responsible for the teaching and learning processes, as concluded by the investigations that analyze the discrepancy in the perception of *bullying* between students and teachers. The problem is reported on a much lower scale by teachers. The measurement of the severity of the aggressions also differs, according to the gender of the teachers. Teachers tend to evaluate *bullying* as something more serious as opposed to the milder evaluation made by teachers (Granados; Ramírez; Tomasini, 2020, Silva; Bazon, 2017).

When the characteristics of the students in relation to the cases of *bullying* and the types of actions practiced are analyzed, gender differences are also evident; the rates of involvement of girls in this type of violence are lower, compared to those of boys. Another

aspect to be observed is that girls tend to be more involved with indirect violence, such as indifference, defamation and segregation; on the other hand, the tendency among boys is to get more directly involved, such as in cases of cursing and physical aggression (Chaves; Souza, 2018).

Bullying events are permeated by the double school hierarchy (Crochick; Crochick, 2017). According to Adorno (2006b), the school routine is permeated by the official hierarchy, which involves academic performance, measured, to a large extent, by good grades in the evaluations of classroom subjects, and by the unofficial hierarchy, whose attributes are physical strength, performance in sports activities and popularity.

The aggressor is usually at the top of the unofficial hierarchy and at the bottom of the official hierarchy, while the target tends to be invisible for not showing power, belonging to the base of the two hierarchical scales. The observer, as a rule, occupies an intermediate position. Often, his coldness and indifference identify him with the aggressor, even for fear of becoming the next victim. When there is identification with the victim, there is the possibility of intervention in the situation (Author *et al*, 2020).

For Crochick and Crochick (2017, p. 72), the absence of a significant correlation between being a good student in academic disciplines and being a victim of violence is contrary to the analysis of Adorno (1903-1969), due to the assumption of victimization of these students by the "[...] who do better in the unofficial hierarchy. Perhaps the fact that they are at the top of one of the hierarchies arouses respect for colleagues, since the idea of hierarchy brings the notion of power". By analyzing the research data, the authors evaluate it as a good indicator that the appropriation of culture, through education, can favor the fight against violence of this nature.

Contradictorily, however, the very fact that the school uses the division of students by performance criteria, establishing a hierarchy and encouraging competition between inferiors and superiors, contributes to the reproduction of relations of domination, which corroborates the naturalization of school violence, as indicated by Duboc *et al* (2021). At the limit, the irrationality of institutions expresses structural irrationality (Adorno, 2008).

The conception of some teachers, a reflection of the generalization of pseudo-training, proves that the limitations of knowledge about *bullying* affect the minimization of the problem, often making the victims responsible for the violence they suffer. This fact demonstrates the absence of a reflection that produces an experience on violence within the school community, since the tendency is to value what each individual, in isolation, thinks about this phenomenon. When there is no shared tradition in the form of a narratable experience, the victim becomes the center of the action rather than the social process.

The association of *bullying* with games inherent to the students' life is recurrent; the problematization of *bullying* is understood as a fad, as if it were an appealing discourse; homosexual students are held responsible for the aggressions suffered, as a result of 'not giving themselves respect', etc. (Mezzalira; Fernandes; Santos, 2021, Silva *et al*, 2021). Ultimately, the simplification of *bullying* obscures the suffering and other negative repercussions of the problem, as well as the possibilities of actions and public policies aimed at combating it.

Students from schools where the *bullying* rate is high are likely to drop out and score 20 points lower, compared to institutions where the level of aggression is low, in the Science assessment of the Program for International Student Assessment (PISA) (Silva *et al*, 2019). In addition, the targets of aggression usually have low self-esteem, insomnia, social isolation, anxiety, depression and, in extreme cases, tend to lean towards suicide and homicide. Aggressors are prone to socialization problems, due to their willingness to dominate their peers and to commit criminal acts throughout life (Chaves; Souza, 2018).

The probability of bullying incidence reaches its peak around 14 years of age, a phase that corresponds to the completion of elementary school, considering the normal flow of schooling; in high school, the trend is for aggression to decrease, however, in the investigation developed by Monteiro *et al* (2017) it was found that human values, As elements of personality, they have a greater impact on the incidence of *bullying* than age. In other words, when the child, from an early age, is reinforced to be guided by success and prestige, he will be more likely to be involved in situations of school violence, in the role of aggressor.

In any case, the volume of research on *bullying* is greater in the final years of elementary school and high school, compared to the number of studies dedicated to studying this phenomenon in higher education, which does not mean that undergraduate students are immune to this type of violence. also because the relationships that are established between veterans and freshmen are tainted by situations of domination and aggression, especially by the perpetration of hazing (Puntucia-Pinto; Alps; Colares, 2019; Branches; Souza, 2018); even when hazing is considered 'solidarity', victims may tolerate situations of humiliation because they are afraid of gaining the dislike of students with more time in the educational institution and, thus, become targets of more embarrassing practices (Fonseca *et al*, 2017).

The study developed by Neves *et al* (2019), in Portugal, concluded that psychological harassment prevails in the university environment, sometimes with consequences as serious as those provided by other forms of violence. In a way, this

hostile environment to civility points to the failure of education, because people who should demonstrate higher levels of humanity, through the possibility of incorporating knowledge, present behaviors similar to those of children and adolescents.

The research developed by Crochick *et al* (2018) aimed to verify the permanence of the position of students in school hierarchies (school performance; sports performance and affective performance), during the course of the three levels of education (elementary school; high school and higher education). The conclusion is that the position of the students and the hierarchical structure are maintained, however, in higher education, their configuration is different from that presented in the course of basic education. In the limit, the advance in the levels of education, which presupposes a higher level of cognitive and human development, does not reduce the rates of violence observed in the universities surveyed.

Once school violence has been characterized, in the form of *bullying* and prejudice, the objective of this research is to verify possible relationships between age and personality characteristics, such as sadomasochism, fragility of the Self and narcissism, and between age and the type of violence manifested by higher education students during their school life.

METHODOLOGICAL PROCEDURES

The present investigation is part of a multicenter study, whose proponent institution was the Federal University of São Paulo (Unifesp), and its approval was made official by the Research Ethics Committee, under opinion no. 4,598,304, on March 18, 2021.

Data were collected via online questionnaire in 2021. The sample, composed of 172 academics, 142 women, 28 men and two indicated as others, from 12 undergraduate courses based in the extreme northwest of Paraná, is distributed as follows: 135 are from courses in the area of human sciences; 31 in biological sciences and six in exact sciences. Table 1 shows the distribution of subjects by age group.

Table 1: Attendance and Percentage of Students by Age Group

Age group	Frequency	Percentage
17-20	55	32,0
21-24	42	24,4
25-30	26	15,1
31-45	38	22,1
45-60	11	6,4
Total	172	100,0

Source: Prepared by the authors.

As can be seen in Table 1, approximately half of the participants in the research are up to 24 years old and most are in the first three age groups, indicating that 71.5% of the sample are up to thirty years old. Although most of the participants are of ages that correspond to the expectation in relation to the school flow, one cannot fail to consider the existence of a significant number of students over 31 years of age, indicating the presence of students who possibly resumed interrupted studies.

Regarding the research instruments, the following were applied: Fascism Scale (Scale F), divided into a part with items that mainly evaluate sadomasochism and another part composed of items that measure the existence of a more fragile self than the sadomasochistic one (this division is supported by what Adorno *et al* (1950) defend; Narcissistic characteristics scale; Scale of manifestation of prejudice, divided into the following targets: ethnicities; people with disabilities; LGBTQIA+ and Moral Prejudice; Bullying Scale and Bullying Target Scale.

These scales have the same structure, composed of Likert-type items, with a variation of points from one to six for each item; on the left side of the continuum, there is the term *disagree* and on the other side, the term *agree*. A higher score indicates a propensity to have sadomasochistic personality traits and/or marks of fragility of the Self; the greater the number of narcissistic traits; the greater the manifestation of prejudice, the greater the propensity to be the perpetrator of *bullying* and the greater the propensity to be the target of *bullying*. There is no neutral point on the scales for the subjects to express their tendencies of agreement or disagreement. Here is the description of each of them:

a) Fascism Scale (F Scale)

The latest version of this scale, presented by Adorno *et al* (1950), contains 28 Likert-type items, was created and developed by Adorno *et al* (1950) in the 1940s. Crochík (2005) translated it and used it in research with students of higher education courses. The Cronbach's alphas obtained in these studies were

0.77 and 0.84. Galeão-Silva (2007) also applied it to university students and obtained a Cronbach's alpha equal to 0.81. For the study reported in this article, this scale was subdivided into Scale F with items that mainly assess sadomasochism, for this subscale, a Cronbach's alpha of 0.84 was obtained; and Scale F with items that measure a more fragile self than the sadomasochistic one, for this other part of the scale, a Cronbach's alpha of 0.68 was found.

b) Narcissistic Personality Characteristics Scale (N Scale)

This scale, with 16 items, was elaborated by Crochík and Severiano (Crochík, 2005); These items resulted from a factor analysis, which indicated factors associated with the valorization of a healthy body, affirmation of appearance, superficial relationships; unbridled consumption; the need for models, brought about by the absence of a well-established self; and feelings of inadequacy and dissatisfaction.

In the study reported by Crochick (2005) an Alpha equal to 0.76 was obtained. Tecedeiro (2010) applied this scale to a sample of 68 Portuguese advertisers to see its relationship with the phenomenon of *burnout*, which was effectively established, thus giving another indicator of the validity of this scale. In the present study, we are using 16 items, whose Cronbach's alpha was equal to 0.73.

c) Manifestation of Prejudice Scale (P Scale)

The Scale of Manifestation of Prejudice initially consisted of 24 Likert-type items, with the following groups as targets: black, Jewish, individual with physical disability and individual with intellectual disability. It was elaborated based on literature on prejudice against the targets analyzed. In previous studies (Crochík, 2005, Crochík *et al,* 2009) the Cronbach's alphas found ranged from 0.70 to 0.90.

For the present study, the scale measured the following targets: disabled (Cronbach's alpha: 0.66); ethnic minorities (Cronbach's alpha: 0.67); homosexuality, prostitution and drug addiction (Cronbach's alpha: 0.50); LGBTQIA+ community (Cronbach's alpha: 0.66).

d) Bullying Authorship Detection Scale (Scale B)

This scale contains nine items to verify whether the participants are perpetrators of *bullying*, in addition to characterizing some of their motivations. For the constitution of their items, the following were considered: 1- the same colleagues were harassed in various ways (physical, psychological, material) for a prolonged

period; 2- if their targets could not sufficiently resist this hostility; 3- if they took pleasure in the subjugation of others; 4- If they think that *bullying* is a joke. For this study, the Cronbach's alpha of this scale was 0.86.

e) Bullying Target Detection Scale (Scale A)

This scale consisted of four items, whose agreement will characterize the targets of *bullying* and some of the feelings of these targets: 1- being harassed in various ways during a certain period of time in high school and elementary school; 2- not being able to resist hostility sufficiently; 3- feeling of fragility; 4- desire for revenge. For this study, Cronbach's alpha was 0.86.

ETHICAL PROCEDURES

We presented to each participant the objectives of the research; and they were offered the Free and Informed Consent Form, with the guarantee of anonymity, and the possibility of no longer participating in the research whenever they want; and all assistance to their well-being. It should be noted that the participants were at least 17 years old. The collection was carried out via virtual environment. The project was submitted to the Research Ethics Committee of UEM.

RESULTS AND DISCUSSION

Initially, the data that compare the scores on the scales between the various age groups will be exposed; Subsequently, the correlations found will be presented.

When we verify the means and standard deviations of the scores obtained with the scales of personality characteristics, such as sadomasochism, fragility of the Self and narcissism, by age of the research participants, important results are observed, as we can see in Table 2.

Table 2: Mean and Standard Deviation for Sadomasochism, Fragility of the Self, and Narcissism, by Age Group.

Age group	Sadomasochism		Fragility of the Self		Narcissism	
17-20 (n=55)	2,50	,71	2,78	,48	3,56	,61
21-24(n=42)	2,63	,88	2,89	,76	3,44	,74
25-30(n=26)	2,73	,83	2,90	,72	3,32	,80
31-45(n=38)	3,12	,80	3,18	,85	3,19	,83
45-60(n=11)	3,31	,86	3,54	1,08	3,47	,95
Total(n=172)	2,76	,84	2,95	,77	3,40	,75

Source: Prepared by the authors.

Through the Analysis of Variance Test, significant differences were found at the level of 0.01 between the age groups in relation to Sadomasochism (Z=4.861; 4 g.lib.; p=0.001) and Fragility of the Self (Z=3.808; 4 g.lib.; 0.005), but not in relation to Narcissism (Z=1.514; 4 g.lib; p=0.200). Observing the data in Table 2, it can be inferred that as age increases, the score obtained by the subjects in the Sadomasochism and Fragility of the Self scales is also higher. In relation to Narcissism, the values were close to each other. Also from the data in this table, it is noted that the subjects tend to have scores below the midpoint of the scale (3.5); the Narcissism scores were the ones that came closest to this midpoint.

The fact that older students are more prone to sadomasochism and fragility of the self indicates that there is no direct relationship between life time and openness to experience, with a predominance of experience, which is formed by the momentary impressions of everyday life; these experiences are indispensable, but not sufficient for the development of human individuality, which requires knowledge of social and natural objects, in order to strengthen criticism and reflection on reality, as well as on its latent possibilities (Adorno, 2006b).

According to the research data, younger students express lower scores of sadomasochistic personality and Fragility of the Self, results that lead to the hypothesis that there may be elements of the culture incorporated by them that allowed them to develop a personality less prone to prejudiced behavior, compared to older students.

However, the analyses carried out by Adorno and Horkheimer, highlighted by Crochick (2019), point out that

> social progress, based on the advancement of technology and the administration of human beings as things, leads individuals to psychic regression; the more advanced the society, the less individuated the people are (Crochick, 2019, p. 8).

In other words, this means that the social progress perceived in contemporary times does not guarantee psychic development, that is, as the technique increases, the fewer individuals differentiate themselves, and *bullying*, which is not confirmed as child's play that ceases to exist over time, is configured as an expression of social violence. At the same time, the fact that younger people are less prejudiced points to the contradiction of culture itself, signaling that its democratization is fundamental for its criticism and for confronting violence and the society that mediates it.

Social organization, with its hierarchical divisions and classifications between best and worst, can mean violent behaviors as a form of reaction. These hierarchical relations are reproduced in the school in the form of the double hierarchy - the official and the unofficial. In the university, one of the manifestations of this hierarchy and domination are the situations of hazing, which, for Ramos and Sousa (2018, p. 394), is a manifestation of violence with cultural endorsement as a rite that marks entry into the university. Dialectically, the school, by becoming a place of critical reflection on cultural deformation and on the semi-formation arising from it, according to Crochick, Dias, and Ferber (2020, p. 2), "[...] can contribute to the reflection and fight against these forms of violence and to the establishment of other destinations for aggressive impulses other than that of domination among human beings".

The fact that there is criticism of the double school hierarchy as an expression of social hierarchy does not mean that the hierarchy between teacher and student is unnecessary. By taking the place of the most knowledgeable in relation to a certain content, the teacher, in analogy to the narrator, allows the student access to a communicable experience and, therefore, the criticism of his own hierarchy and the understanding that a life based on freedom is possible:

> And this is a hierarchy that must be overcome as students incorporate the subject taught; the same can be said of the hierarchies that exist among students: if the best performers collaborate with their peers, these hierarchies can also be overcome (Crochík, *et al,* 2018, p. 5).

In this sense, the authors describe that the school as a space for the formation of a society free of injustice should be constituted of "[...] sensitive, democratic and emancipated individuals, which necessarily implies a school education that is also against violence and favorable to the knowledge of what generates this violence" (Crochick, *et al,* 2018, p. 3). However, what is perceived, according to the authors, is that the social hierarchy, reproduced in school by the double hierarchy, constitutes violent individuals.

Some reflections of the training for violence can be perceived in the data presented in Table 3, which show variations in the occurrence of specific forms of domination, due to the specificity of the age group of university students.

Table 3: Mean and Standard Deviation for *bullying* and for the various types of prejudice evaluated, by Age Group

	Bullying	Prejudice Disability	Ethnicity Prejudice	Moral Prejudice	LGBTQIA+ prejudice
Age group	Mean/Deviation				
17-20	2,04(,67)	1,86(,62)	1,67(,70)	2,67(,95)	1,23(,44)
21-24	2,01(,86)	1,85(,87)	1,73(,94)	2,64(1,04)	1,49(,95)
25-30	2,05(,82)	2,00(,71)	1,84(,83)	2,36(,88)	1,26(,57)
31-45	2,29(1,08)	2,56(1,06)	2,38(1,00)	2,64(,99)	2,32(1,48)
45-60	2,23(1,00)	2,30(,99)	2,34(1,03)	3,04(,86)	2,03(1,18)
Total	2,10(,86)	2,05(,87)	1,91(,91)	2,63(,97)	1,59(1,04)

Source: Prepared by the authors.

The Analysis of Variance Test was applied to compare the age groups of the subjects and the types of violence assessed, and it was found that there was a significant difference at the level of 0.01 for the following variables: Prejudice against people with disabilities (Z=5.174; 4 g.lib.; p=0.001); Prejudice against ethnicities (Z=4.962; 4 g.lib; p=0.001); Prejudice against LGBTQIA+ (Z=9.180; 4 g.lib.; p=0.000), but there was no significant difference for *Bullying* (Z=0.745; 4 g.lib.; p=0.563) and Moral Prejudice (Z=1.005; 4g.lib.; p=0.407). According to the data in Table 3, the older the participants, the greater the prejudice against people with disabilities, against ethnicity, and against LGBTQIA+ people. The scores, on average, are below the midpoint of the scales (3.5 points).

Regarding the prejudice exercised against people with disabilities, it should be noted that the administered society tends to repel individuals who disagree with the productive logic, or when it does not segregate them, the concern is not always centered on human well-being, but rather on the possibility of integration into productivity. Although the employability and wage income of people with disabilities can have positive repercussions, there is no direct relationship between insertion in the labor market and the valorization of the human, as can be observed in the writings of Henry Ford (1863-1947), one of the mentors of the hegemonic productive model that prevailed for much of the twentieth century, when referring to the use of the labor of the disabled (Ford, 1922).

Interpersonal relationships, by themselves, do not guarantee the fight against prejudice, but the fact that the school environment allows the insertion of students considered to be in a situation of inclusion allows for more occasions of respectful coexistence than of segregation and marginalization. This was the result of a survey carried out in four schools in São Paulo, two public and two private, with classes in the fifth year of elementary school. In this way, at least in part, inclusive education fulfills its objectives (Crochick; Crochick, 2017).

Still regarding the discrepancy in the scores of prejudice against people with disabilities, between older and younger university students, it is important to mention that the last decades have been marked by critical reflections and struggles in the social sphere against segregation and in favor of accessibility, resulting in a certain advance in public policies for inclusion, in general, and for inclusive education, in particular (Brasil, 2008; Brazil, 2015).

As a result of these policies, the younger ones were able to have the experience in the context of the school community, through living with people with disabilities in the classroom, something rarer before the 1990s, which may have positively impacted the training of younger students in the sense of overcoming stereotypes in relation to people with disabilities, as well as the vision of ableism. However, despite this positive aspect in relation to the education of younger people, the data indicate that representatives of these generations are more narcissistic, compared to older generations, whose psychological traits are more divided between sadomasochism and narcissism, and therefore less regressed than younger students.

With regard to ethnic prejudice, Crochick (2021) highlights that this type of prejudice indicates a need for the subject to identify with his or her group, as the fragility of the ego demands group cohesion as a form of protection and security, which affects the hypertrophy of the characteristics that unite them, concomitantly, underestimating supposedly negative qualities in different collectives and predisposing them to conflict, Even because the human is not recognized in external groups, because for the prejudiced, the ethnically diverse cause pain and suffering. This embarrassment that multiethnic coexistence causes to the prejudiced may also be related to the non-openness for experiences to be replaced by experience.

Regarding the data obtained, although younger people have lower scores of prejudice against ethnicities, more gratuitous violence predominates among them, compared to the predisposition to try to rationalize violence against minority groups; Despite

being an irrational rationalization, it indicates a lower level of regression compared to diffuse violence more prone to younger people.

As for the higher degree of prejudice against the LGBTQIA+ community on the part of older students, it is worth referring to the study by Lingiardi *et al* (2016), who investigated the profile of homonegativity in the Italian context, concluding that older people, less educated, with more deeply rooted religious precepts, more politically conservative and with little contact with individuals who disagree with heteroaffective behavior have a higher risk of presenting this type of prejudice. Another aspect revealed by these authors and also by research carried out in Portugal (Neves *et al*., 2019) is that the levels of homonegativity demonstrated by men are higher in relation to gays than in relation to lesbians, an issue that deserves attention, since it may be linked to stereotypes related to patriarchy and machismo. However, changes in protective legislation and the growing representativeness of this social group, especially reinforced by digital media, are important factors so that differences do not limit the relationships between individuals (Anjos, 2021).

FINAL CONSIDERATIONS

The historical path of educational institutions is permeated by distinct forms of violence that, in addition to being configured as individual problems, reflect the social structure whose basis is based on the conflict between antagonistic social groups. In this case, we perceive a rupture with the production of a collective experience on violence, to the extent that there are few or non-existent spaces and moments in which school violence ceases to be an individual problem, which involves the aggressor and the victim, and is an elaboration of experiences related to violence, therefore a form of community experience on school violence.

Prejudice and *bullying*, objects of scientific research from the twentieth century onwards, are not new phenomena, but they have intensified with the democratization of formal education, which has made it possible to expand interpersonal relationships between members of various social circles.

The hostilities present in school environments demonstrate that the coldness that corroborates the non-identification with the other expresses, in a certain way, the influence of pseudo-formation and the emptying of the meaning of experience in the processes of education, which is characterized both by the appropriation of culture itself, and by training that is limited to adaptation. Culture is fundamental to the process of constituting individuality; Knowledge is important for subjects to understand the limits and possibilities of society in which some dominate and exploit others.

The research data indicate that as age increases, the scores obtained by the subjects in the Sadomasochism and Fragility of the Self scales are higher. Regarding the association of age and the type of violence manifested by the subjects, it was noticed that the older the participants, the greater the prejudice against people with disabilities, against ethnicity and against LGBTQIA+ people. Hence the need to think of experience not as synonymous with life time, but as the appropriation of what has been lived in the form of knowledge that can be communicated to new generations and, thus, contribute to the strengthening of the individual and, therefore, to the development of autonomy, which refers to Benjamin's (2013) reflections on experience as a shared tradition and how it distances itself from experience, which is individual.

In this sense, it is essential to insist on the replacement of what is individually lived in a form of collective elaboration through communicable experiences. One way to do this is the school, because through formative processes, critical of the current model of society, we reflect on the social violence that is expressed in the school, breaking with the natural appearance of violence or the appearance of play that *bullying* and prejudice can have, based on the speech of the aggressors. Telling this story against the grain, as Benjamin (2005) said, restores, albeit in a precarious way, the old link between knowledge, individual life and community through experience, which ended up replacing what was lived in a shared tradition with the possibilities of narration.

Thus, we are led to think that the democratization of school education and the expansion of higher education, in itself, do not guarantee training for autonomy, however, it is in it the possibility of those who go through it to have their experience replaced by experience, since culture, in its historical sense, "[...] presupposes a space for the elaboration of new forms of awareness and awareness disconnected from practical/operational purposes or linked to the idea of utility", as highlighted by Rocha (2020, p. 35). Although in today's society, culture has been instrumentalized, transformed into a commodity, it still has the possibility of revealing society in its movement and, therefore, that it can come to be organized without domination being its centrality. In this sense, the craft of sharing knowledge, in a way, is similar to that of the narrator. In the case of educational institutions, the teacher must narrate to the new generations, based on their disciplinary contents, what life was like, how it is, pointing out how it can become if certain social conditions are transformed in favor of the community experience.

Thus, if cultural changes influence the resurgence of *bullying* cases, the data of this research revealed that these changes also allow lower prejudice scores on the part of younger students, which is an advance, but we can also think about the hypothesis that

younger students have a superficial thought, influenced by political correctness, perhaps have a more limited knowledge than older students.

Regarding the constitution of personality, there are indications that older students have sadomasochistic and narcissistic traits, while younger students have a predominance of narcissistic traits; Since narcissists are less developed than sadomasochists, the results corroborate the statement that higher levels of development in society, whose basis is maintained by violence, allows for higher levels of individual regression.

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CONDUCTS IN HAND TRAUMA BY EXPLOSIVE DEVICE: LITERATURE REVIEW

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ABSTRACT

Multiple hand trauma from explosive devices is a public health problem. Thus, this article presents a literature review with the objective of identifying practices in the treatment of these lesions. The search was conducted in the MEDLINE database, using specific terms related to explosion injuries, covering the last 10 years. We selected 5 studies that met the inclusion criteria, such as focusing on hand injuries and detailing treatment approaches. The selection was made based on methodological quality and clinical relevance. The studies revealed a high incidence of amputations and fractures. In addition, they highlighted the need for pharmacological and surgical interventions, with an emphasis on pain relief and infection prevention. A significant gap was also observed in the training of health professionals to deal with traumas of this nature, evidencing the need for specialized training. Despite the contributions, the review revealed the scarcity of robust research on the topic, indicating the need for more studies exploring different therapeutic approaches and rehabilitation protocols.

Keywords: Multiple trauma. Orthopedics. Bombs (explosive devices).

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INTRODUCTION

The history of trauma is intertwined with the history of humanity itself and despite being a source of suffering and death, trauma has contributed to the genetic incorporation of efficient hemodynamic, endocrine and metabolic characteristics that favor human survival (Birolini, 2012). This evolutionary history also reflects the importance that trauma has presented over time until modern medicine. That said, the literature defines trauma as any injury caused by the transfer of physical energies, such as kinetics, heat, cold, electricity, among others (Abib & Perfeito, 2012).

According to the SBCM-Brazilian Society of Hand Surgery [202-], the inappropriate use of explosive and pyrotechnic devices can cause burns of different degrees, fractures, respiratory damage, injuries to soft tissues and internal organs, and even amputations, especially of fingers and hands, in addition to blood loss that can lead to shock. Other frequent damages include burns and hearing and visual deficits. According to Merck Sharp & Dohme (MSD), there are five main mechanisms of blast injury:

Table 1. Mechanisms of explosion injury

Kind	Mechanism	Typical lesions
Primary	Impact of supersonic shock wave on the body. It preferentially reaches hollow or air-filled structures.	Bartaraoma Pulmonar Tympanic membrane rupture Middle ear damage Rupture of the eyeball Mild head trauma
Secondary	Impact of debris from the explosion on the body	Penetrating or Closed Injuries Eye penetration (overt or hidden)
Tertiary	Impact of the body thrown by the explosion on environmental surfaces or fragments	Traumatic fractures and amputations Closed and open brain injury
Quaternary	Independent processes of primary, secondary, or tertiary blast injury (e.g., burns, toxic inhalation, crush injury from entrapment under rubble, aggravation of health problems)	Burns Traumatic crush injuries with rhabdomyolysis and compartment syndrome Respiratory tract injury from inhaled toxicants Asthma, angina, or myocardial infarction triggered by the event
Quinaria	Injuries resulting from toxic materials absorbed into the body from the explosion and the post-detonation environment (e.g., radiological, biological substances)	Radiation burns or acute radiation sickness

MSD, 2023

Complex hand injuries are characterized by trauma that affects two or more functional structural systems, such as soft tissues, muscles, tendons, bone, vascular, and

nerve structures. Classifying them is essential to guide clinical management. Thus, although proposed by Entin in 1964, the classificationof hand injuries is still used in current clinical practice and divides them into curable, reconstructible, salvageable, and non-salvageable.

Although traumatic injuries that exclusively affect the musculoskeletal system rarelydetermine the risk of death to the patient, they can cause important functional losses (Barroso & Barreto Filho, 2016).

These incidents are a challenge for health management (WHO, 2012). According to Gandra (2023), a reporter for Agência Brasil, a Brazilian public news agency, the Unified Health System (SUS) recorded 1,548 hospitalizations for fireworks injuries between 2019 and 2023, which corresponds to one hospitalization per day. Additionally, the Brazilian Society of Orthopedics and Traumatology (SBOT) brought in 2019 that one in ten people who handle fireworks has one of the upper limbs amputated.

The creation of protocols in the pre- and intra-hospital phases ensures that the trauma patient receives excellent care (Stefanelli, 2012). Victims should be referred to hospitals based on the severity of the injuries, the need for immediate surgery, or the presence of pre-existing conditions that complicate care. The ideal hospital may not be the closest to the accident site, but it should be the one that offers the best care conditions (Stefanelli, 2012).

This situation requires a broad approach, since these injuries affect the individual's activities of daily living. In this sense, with the advancement of pharmacological, surgical and rehabilitation techniques, this literature review aims to carry out an investigation in the literature to synthesize information that offers a comprehensive and up-to-date view on the medical treatment of hand trauma caused by explosives.

METHODOLOGY

This is a literature review carried out between June and July 2024, using the MEDLINE database, where searches containing the single term "*blast injuries*" were consulted, restricting the search to studies published in the last 10 years. The initial search brought 1443 articles and after screening, which used as criteria: treating a hand injury and/or establishing care conduct in explosive trauma, 5 (five) studies were selected, of which 3 (three) were in English, 1 (one) in German and 1 (one) in Dutch, no articles were found in Portuguese.

The phases of this research were organized as follows: first, the appropriate descriptors were determined; Then, in a sequential manner, the search strategy was

elaborated, the databases were chosen, the most relevant titles were selected, and the texts were read completely. Finally, these stages culminated in the elaboration of the text.

According to item III of Resolution No. 510/2016, due to the use of secondary data in the public domain, it was not necessary to submit the project to a Research Ethics Committee.

RESULTS

Table 2 presents the results of the research, organizing the studies according to the year of publication and the objective. This framework was chosen for its ability to provide a comparative view of the selected studies

Table 2. Studies listed according to the year and objective of the research

Author, year	Methodology	Results
Staruch *et al*, 2017	Reassessed hand injuries sustained by improvised explosive devices on 380 service members serving in Afghanistan between 2006 and 2013	In all, 484 injuries were identified on the hands of 380 service members. The analysis of the 103 patients who suffered metacarpal injuries, phalanges or digital amputation revealed that the middle and ring fingers are the most commonly injured. Amputation of the ring finger is strongly associated with injuries to the adjacent fingers and simultaneous amputations of the middle, ring and little fingers is a commonly observed pattern. The proximal phalanges of the middle and ring fingers had a strong correlation for joint fracture.
Westrol *et al*, 2017	Describes the physics of the explosion and pathophysiology of explosive injuries	Understanding the pathophysiology of blast injuries helps healthcare providers in diagnostic and treatment decisions. In addition, in an explosion incident, early identification of the type of explosive can help identify resource needs. While this information may not be immediately available during an incident, a provider can use their knowledge of blast physics and the pathophysiology of injuries to identify patient injury patterns, which may correspond to certain types of explosives.
Más *et al*, 2017	Case series of children with injuries caused by a type of pyrotechnic explosive with a different pattern than previously known.	n=6. All male, five teenagers. The six had severe injuries in the hands with amputation of one or several fingers, determining aesthetic and functional sequelae.
Haerkens *et al*, 2016	Explanation of the mechanisms of explosion and their effects on the human body	Provide 15 tips on the key principles of blast wound treatment
Könneker *et al*, 2016	Case series of patients who suffered severe trauma to the hands and face by detonation of traps and paraphernalia (n = 9, Ø 60 years of age).	All patients with hand trauma (n = 8) had soft tissue injuries. Six of these patients also had fractures or injuries to capsular or tendon structures. Therapies included debridement as well as skin grafts or flaps to cover tissue defects.

DISCUSSION

The descriptive research carried out by Más *et al.* (2017) included patients treated at

a pediatric emergency department in Uruguay who had injuries associated with the use of explosive devices between December 2014 and January 2016. Those over 14 years of age were excluded from the study. Based on the cases analyzed, the authors prepared the following table:

Table 3. Presentation, treatment and evolution of clinical cases

	Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**
Age (years)	11	12	12	14	12	3
Sex	M	M	M	M	M	M
Origin	Paysandú	Rio Negro	Montevideo	Cannelloni	Montevideo	Montevideo
Mechanism of injury	Bomb explosion	Bomb explosion	Bomb explosion	Bomb explosion	Bomb explosion	Bomb explosion
Affected region	Right hand	Right hand	Right hand	Right hand	Right hand	Left hand
Type of injury	Partial amputation of 1st, 2nd and 3rd phalanges	Partial amputation of the 1st phalanx, injury to the 2nd and 3rd phalanx	Partial amputation of the 3rd phalanx	Partial amputation of 1st, 2nd and 3rd phalanx	Partial amputation of 1st phalanx	Amputation of 2nd, 3rd and 3rd phalanx
Associated injury	Chest and abdomen burns	Ecchymosis on the face, neck and chest	No	No	No	No
Surgery	Yes	Yes	Yes	Yes	Yes	Yes
Analgesics	Cetoprophen, dipirona	Ketoprophen, tramadol	Dipiron, morphine	Morphine	Morphine	Dipiron, morphine
Antibiotics	Cefradine	Clindamycin, Gentamicin	Clindamycin, Gentamicin	Clindamycin, Gentamicin	Clindamycin	Clindamycin
Sequels	3rd phalanx retraction	Pain, deviation of the 2nd phalanx	Aesthetic	Aesthetic	Aesthetic	Aesthetic and functional, PTSD

PTSD = Post-traumatic Stress Disorder

The researchers observed that the circumstances of the accident were identical among the five adolescents (n = 5): they all held an explosive in their right hand and were injured when trying to light it. Consequently, all (n = 6) had traumatic amputations ranging from partial amputations of phalanges to the loss of several fingers and required analgesia, imaging tests to assess the extent of damage, evaluation by a plastic surgeon,

and surgical interventions.

Regarding the management studied by Más *et al*, the supporting literature shows that polytrauma patients require rapid evaluation and immediate adoption of life support measures, such as: maintenance of the patent airway, hemorrhage control, and hemodynamic stabilization. Time is decisive in these cases and a systematized approach is recommended that facilitates communication between professionals. In team care, the presence of a leader responsible for maintaining the global view of care is essential, since those who are performing a procedure may lose this perspective and ignore other potentially fatal injuries (Abib, Monteiro & Mella, 2012).

It is crucial to follow an order of priorities that facilitates the identification of life-threatening conditions, known as ABCDE (Abib, Monteiro & Mella, 2012):

A. Airway and cervical spine immobilization;
B. Ventilation;
C. Circulation and hemorrhage control;
D. Neurological dysfunction, neurological status;
E. Exposure and control of the environment, completely undressing the patient and preventing hypothermia.

When receiving the polytrauma patient, a quick general inspection should be carried out and immobilization should be ensured, in addition to checking the level of consciousness, breathing and verbalization. It is also essential to administer supplemental oxygen by mask, usually at 12 L/min for all cases (Abib, Monteiro & Mella, 2012).

At the same time, hemodynamic stability should be assessed by observing the following signs: pallor, level of consciousness, and palpation of pulses. Findings such as cold and clammy skin, sweating, prolonged capillary refill time, and absence of peripheral pulses indicate hypoperfusion. If there is heavy bleeding, pressure should be applied to the site, perform "*wound packing*" – a technique that involves filling the lesion with hemostatic gauze to stop bleeding – or using tourniquets in uncontrollable bleeding of extremities that could not be managed by other means. Cardiac monitoring and non-invasive blood pressure measurement are essential, with special attention to signs of hypotension and tachycardia. In this sense, the calculation of the shock index, obtained by the ratio between heart rate and systolic blood pressure, is a valuable tool to identify occult shock. An index greater than 0.8 or a variation of ≥ 0.1 indicates the presence of occult shock and is associated with a higher risk of death. (Pereira *et al,* 2023).

It is essential to establish two caliber peripheral venous accesses, at least 18G. If this is not feasible, the following should be tried in sequence: intraosseous access, central

venous access and, finally, phlebotomy. It is also necessary to collect samples to assess serum hemoglobin and hematocrit levels, INR, blood typing, lactate, and arterial blood gases to check for base deficit, as well as beta-HCG in all women of childbearing age (Pereira *et al*, 2023).

Moderate to severe hemorrhagic shocks and patients who have not reached blood pressure goals even after initial volume expansion indicate the need for blood component transfusion. In severe hemorrhagic shock, it is essential to activate the massive transfusion protocol, which usually consists of the acute administration of a volume greater than one and a half times the patient's volume in less than 24 hours (Pereira *et al*, 2023).

Regarding analgesia, in the study by Más *et al*., it was found that morphine was widely used, since it acts as an agonist of opioid receptors, resulting in significant and rapid analgesia. Ketoprofen was also widely found in the conducts, a finding that corroborates what was exposed by Abib & Perfeito (2012). For the authors, the general principle of treatment is to maintain the regular use of anti-inflammatories and analgesics, and the regimen of use by patient demand should be avoided. Initially, anti-inflammatory analgesics should be used followed by the use of opioids. Safety is offered by drugs using small incremental doses, until the desired analgesia is obtained. Table 4, contained in the researchers' work, shows the analgesia conduct on an increasing scale, followed by its dosage.

Table 4. Anti-inflammatories and analgesics

Drug	**Dose venosa usual (mg/kg)**	**Adverse effect**
Dipyrone	20 to 30 every 6 hours	Leucopenia nása
Ketoprofen	1 to 1.5 every 8 hours	Epigastralgia, nephritis, sangramento
Tenoxican	0.5 to 0.4 every 12 hours	Epigastralgia, nephritis, sangramento
Morphine	0.03 to every 4 hours	Respiratory depression, constipation, urinary retention

The explosion leads to the continuity solution and in open lesions there is a greater chance of bacterial contamination that can interrupt the normal healing process (Ohara, 2008). Thus, prophylaxis against infections should be performed with broad-spectrum antibiotics. This approach could be observed in the approaches observed in the study by Más *et al*, in which clindamycin was the most commonly used antibiotic, since it ensures coverage of Gram-positive microorganisms and strict anaerobes, which have a good action on soft tissue infections.

The study conducted by Staruch *et al* (2017) documented 484 hand injuries in 380 service members who were injured on duty in Afghanistan with improvised explosive devices between 2013 and 2016. By specifically analyzing 103 patients who suffered injuries to the metacarpal structures, phalangeal or digital amputations, the researchers found that the third and fourth phalanx were more frequently injured, intensifying the data from the study by Más *et al*. In addition, it was common to observe simultaneous amputations in the third, fourth, and fifth phalanges. The research also revealed that the proximal phalanges of the third and fourth phalanges showed a significant correlation for fractures together. This research contributed to the understanding of injuries caused by explosives.

Westrol *et al* (2016) emphasized the pathophysiology of blast injuries and identified five factors that influence blast wave damage: the initial peak pressure, which determines the severity of the impact; the duration of the overpressure, which affects the extent of tissue damage; the distance from the epicenter of the blast, which determines the intensity of the wave; the reflection of the shock wave, which can amplify the damage indoors and the density of the environment where the explosion occurred, which influences the propagation of the wave.

Könnefer *et al* (2016) reported a series of nine cases of severe trauma to the hands and face as a result of the detonation of booby traps and explosive devices of patients who received primary care in the emergency department of the Faculty of Medicine in Hannover, Germany. During the period 2011 to 2015, the department's staff treated six patients who had hand trauma resulting from gun-like devices, two patients with hand injuries due to booby traps, and one patient who suffered facial injuries as a result of a gas cartridge explosion.

All patients with hand trauma due to explosives had soft tissue injuries, fractures, or injuries to capsular and tendon structures. Surgical treatment included interventions such as debridement, skin grafts, and the use of flaps to cover tissue defects. These therapeutic approaches reaffirm the findings of Más and Staruch, who emphasized in their studies the importance of reconstructive surgical treatment for this type of injury.

According to the literature, the restoration of blood flow is the top priority and circulatory conditions should be assessed through tissue staining. Arterial or venous involvement may result from arterial contusion or occlusion, as well as difficulties in venous return due to congestion (Ohara, 2008).

The debridement technique mentioned by Könnefer is performed to reduce contamination, prevent the development of osteomyelitis, and preserve the viability of

injured tissues. Initially, abundant irrigation with saline solution increases the effectiveness of the cleaning process that aims to remove all debris to facilitate the healing of tissues that can be used in future reconstructions. It is also essential to identify the presence of osteoarticular lesions that may go unnoticed, especially dislocations in less visible areas (Ohara, 2008).

The reduction of bone fragments should be performed anatomically with different methods: crossed Kirschner wires, intramedullary fixation, or bayonet interposition techniques in cases of loss of bone segments. After bone stabilization, all available repairs must be performed. In situations of multi-tissue injury or intense contamination, immediate primary suturing of the flexor tendons may be contraindicated. The presence of fractures and associated neurovascular injuries does not necessarily preclude immediate tendon repair, as long as the fracture reduction is anatomically and rigidly fixed. After bone stabilization, it is preferable to perform the necessary sutures (Ohara, 2008).

As for the grafting mentioned by Könnefer, it is clarified by Ohara (2008) who states that grafting is always preferable and that primary amputation is indicated only when there is a total and irreversible loss of blood supply. Parts of the skin of amputated segments that cannot be reimplanted can be used as a source of total skin grafting, removing all subcutaneous cellular tissue. The skin should be closed with simple stitches, which should be placed with a certain "slack" to avoid tension on the wound edges, thus preventing vascular suffering and necrosis of the edges.

Haerkens *et al* (2016) wrote their article in a context marked by the terrorist attacks that took place in Paris and Brussels in 2015, which brought to light the relevance of injuries caused by explosives and brought a view on the need for good preparation for an efficient management of explosion injuries. The author noted that the Netherlands' experience in dealing with bomb-based terrorist attacks was limited, which meant that Dutch health workers were inadequate to deal with such injuries.

After detailing the mechanisms surrounding explosions and the impacts these events have on the human body, Haerkens offered guidance on the main principles of treatment for explosion injuries, such as initial stabilization, hemorrhage control, and evaluation of associated injuries. These guidelines are essential, since effective management of these injuries can mean the difference between life and death, in addition to significantly influencing the long-term recovery of patients. Adopting these guidelines in emergency care protocols is essential to ensure that healthcare workers are well prepared to face the challenges presented by blast injuries.

In addition, the author emphasized the importance of a multidisciplinary approach to

ensure that patients receive comprehensive and continuous care. Haerkens' article, therefore, serves as a call for health services to be better prepared to deal with the consequences of incidents involving explosives.

CONCLUSION

The literature on trauma by explosive devices is still limited, which urges the need for more research, especially in Portuguese, to expand knowledge on the subject.

Epidemiological data indicated that men were the main victims, with the right hand being most frequently affected. Treatment of these lesions required a careful approach to analgesia, with morphine and ketoprofen being the most common options, while clindamycin stood out as the prophylactic antibiotic of choice. The importance of surgical referral for lesion repair was also highlighted, given that appropriate intervention significantly influences long-term results.

Understanding the pathophysiology of blast injuries is critical for healthcare professionals to be able to make informed decisions about diagnosis and treatment. In addition, the literature emphasized that safety and training are essential to ensure positive outcomes in the care of victims of explosives. Continuous training of health professionals is essential to improve the response to these emergency situations. That said, knowing the best pharmacological and surgical alternatives and care flows will not only save lives, but also contribute to a more effective recovery of victims.

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EPIDEMIOLOGICAL PROFILE OF DENGUE IN NORTHEASTERN BRAZIL FROM 2014 TO 2024

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ABSTRACT

Dengue, transmitted by the Aedes aegypti mosquito, is a serious public health challenge, especially in the Northeast of Brazil, due to social vulnerability and climatic conditions favorable to the proliferation of the mosquito. Between 2014 and 2024, more than 10 million cases were recorded. This is a retrospective study with an epidemiological aspect that aimed to describe the epidemiological profile of dengue in the Brazilian Northeast from 2014 to 2024. Methodology: The selected variables were obtained through the Notifiable Diseases Information System (SINAN). A comparison was made between the years and the descriptive analysis of the data. Results: Thus, it is observed that SINAN data indicate that the states of the Northeast have a significant contribution to the persistence of the epidemic, with Bahia registering the highest number of cases in four consecutive years. Most infections occurred in people with incomplete elementary school and in the age group of 15 to 39 years. The brown race was the most affected and the female sex had the highest number of notifications. Conclusion: Dengue remains a serious public health problem in Brazil, especially in the Northeast, due to disorderly urbanization, hot climate, and unsanitary conditions. It is crucial to strengthen public policies to improve sanitation, awareness, diagnosis, treatment and vaccination.

Keywords: Dengue. Northeast. Vaccine.

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INTRODUCTION

Dengue is an arbovirus transmitted by the bite of the female Aedes aegypti mosquito, belonging to the Flaviviridae virus family and the Flavivirus genus. According to the World Health Organization (WHO), there are four serotypes of the dengue virus: DENV-1, DENV-2, DENV-3 and DENV-4, each with different genotypes and lineages. This arbovirus is considered one of the most serious public health problems, especially in the Northeast Region of Brazil, due to its high social vulnerability (CAVALCANTE *et al*., 2018). The hot and humid climate of the region is conducive to the proliferation of the mosquito, in addition, the lack of access to adequate health services aggravates this situation, keeping this scenario increasingly alarming (BRITO et al., 2022).

In Brazil, suspected and confirmed cases of Dengue are mandatory to be notified and are registered in the Diseases and Notification Information System (SINAN), in the database of the Department of Informatics of the Unified Health System (DATASUS) of the Ministry of Health. The diagnosis is made based on the patient's clinical condition and laboratory techniques, which identify the virus (up to the fifth day of the disease) and search for antibodies from the sixth day, according to the WHO. Dengue is characterized as an acute febrile infectious disease, which can vary from mild to severe, depending on its manifestation and are classified as: classic dengue; dengue with complications; dengue hemorrhagic fever; dengue shock syndrome; dengue fever; dengue with alarm signs and severe dengue, all of which can lead to death if not treated properly (WANG *et al.,* 2020).

Dengue has more than 10 million cases reported in the period from 2014 to 2024 in Brazil, according to DATASUS. Originally considered a predominant disease in tropical and subtropical areas, dengue has expanded significantly to medium and large urban regions in recent years, as the mosquito is able to reproduce in small accumulations of water, such as tires, potted plants and bottles, since in many cities there are deficiencies in basic sanitation (LYRA; ARAÚJO JÚNIOR, 2014). As part of the group of neglected tropical diseases, dengue represents a serious public health problem, so it is necessary to understand and discuss the data that were made available in SINAN, which can help in the planning of prevention policies and specific care for the vulnerable population, such as guidance and vaccination.

Vaccinations began in the public network in February 2024, becoming part of the National Immunization Program (PNI) of the Unified Health System (SUS) after approval by the National Health Surveillance Agency (Anvisa). Its composition is through live attenuated "weakened" viruses, which guarantees an efficient and lasting immune response. As well

as, it requires the immunized person to have a low number of doses or the indispensability of boosters over time (PEREIRA *et al.,* 2024).

Thus, the objective of the present study is to conduct an analysis of the main epidemiological characteristics and sociodemographic data related to dengue in the Northeast region of Brazil between the years 2014 and 2024.

METHODOLOGY

This is a descriptive epidemiological study, based on data collected by the Notifiable Diseases Information System (SINAN) from 2014 to 2024. The objective of the study was to analyze the distribution and evolution of dengue cases in the four most affected states in the Northeast region of Brazil.

All sociodemographic and epidemiological data available in SINAN were collected, including: schooling; age group; race; sex; confirmation criteria; evolution of cases; final classification of dengue; By initial notification and after analysis of the results, the four most affected states in the Northeast region of Brazil were chosen.

The collected data and graphs were organized in an Excel spreadsheet according to the year of notification. The privacy and anonymity of individuals were guaranteed, as the records in the system are only available in absolute numbers, without personal identification. Therefore, no individual has been or will be identified throughout this study, ensuring confidentiality of the information.

RESULTS AND DISCUSSIONS

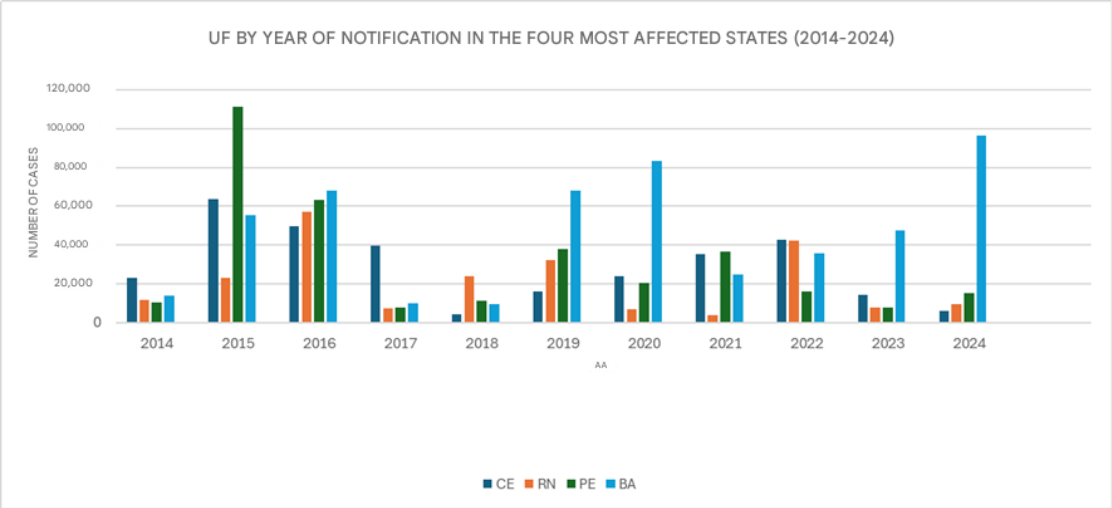
Regarding the SINAN data, it is observed that the states of the Northeast are major contributors to the persistence of the dengue epidemic. In 2014, the state of Ceará had the highest number of dengue cases. However, in 2015 Pernambuco led among the four most affected states, surpassing Ceará, Bahia and Rio Grande do Norte. In subsequent years, the scenario underwent significant changes, with Bahia emerging as the state with the highest number of cases in the years 2019, 2020, 2023 and 2024.

Specifically, between the months since 2024, Bahia has already registered more than 90 thousand cases of dengue, consolidating its position at the top of the ranking of states most affected by the disease in the Northeast.

As shown in graph 1, the states of Ceará, Rio Grande do Norte and Pernambuco, despite being part of the same region, had the highest rates of dengue cases in the period studied. In 2015, Pernambuco recorded the highest number of cases, reaching the range of 111,368 (43.93%) occurrences, while the State of Rio Grande do Norte, in that year had the

lowest number, reaching the level of 22,945 (9%) cases. In this area, it should be noted that urbanization factors, socioeconomic conditions, and environmental sanitation contribute to an increase in the detection coefficient of this or other arboviruses in states with greater endemic diseases (PEREIRA, 2023).

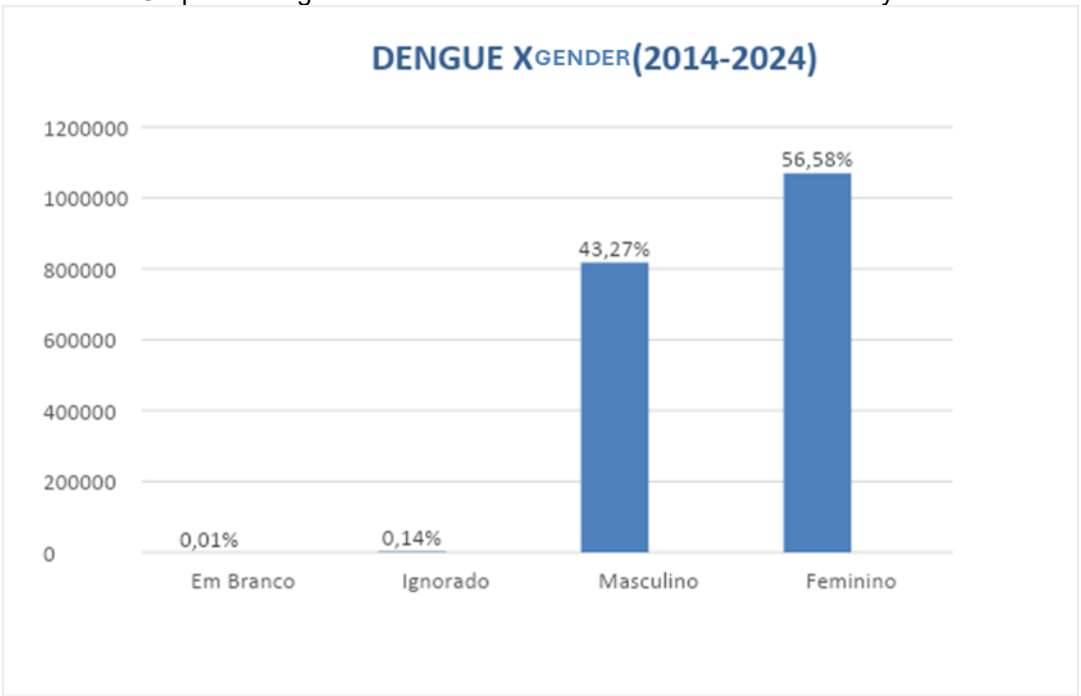
Graph 1: Cases of dengue notification in the 4 most affected states in the Northeast region of Brazil.



Source: Cases reported in SINAN 2014 – 2024.

Regarding gender, it was evident that, in the period analyzed, the number of females was higher, with a total of 1,069,047 cases (56.58%), when compared to males, which resulted in 817,485 cases (43.27%) (Graph 2)

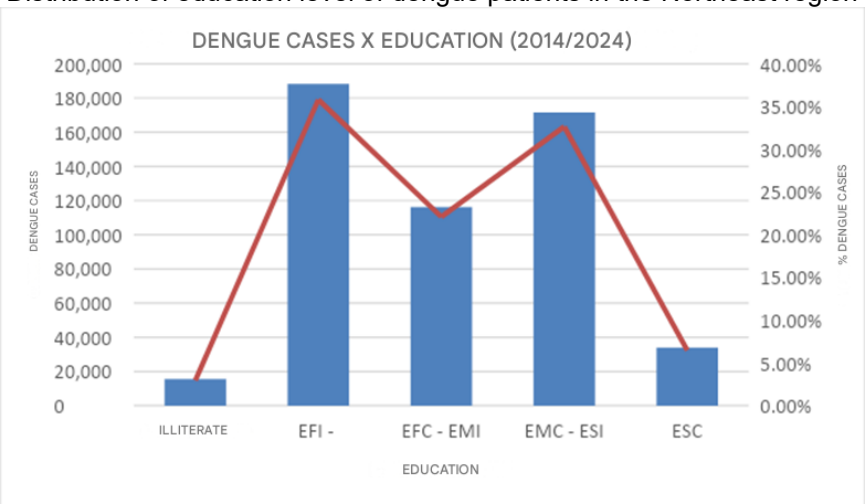
Graph 2: Dengue notification cases in the Brazilian Northeast by sex



Source: Cases notified in SINAN 2014 - 2024.

Analyzing the education data in graph 3, individuals with incomplete primary education were the most affected by dengue, totaling 188,220 cases (35.81%), followed by complete high school (32.65%), incomplete high school (22.10%) and complete higher education (6.47%).

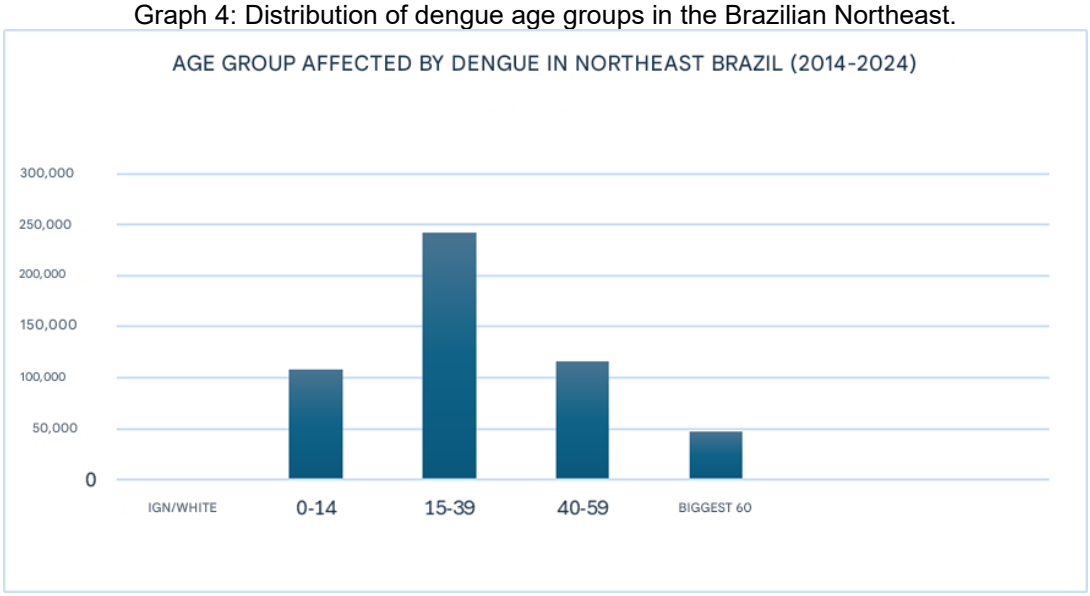
Graph 3: Distribution of education level of dengue patients in the Northeast region of Brazil.



Source: Cases reported in SINAN 2014-2024
Caption:
EFI: incomplete elementary education
EFC: complete elementary school
EMI: incomplete high school
EMC: complete high school
ESI: incomplete superior unit
ESC: complete higher education

Analyzing the age group variable, as shown in graph 4, the study identified that dengue cases are more concentrated between the ages of 15 and 39 years, with 241.978 thousand cases (47.16%). Next, the age group from 40 to 59 years old presents 115,700 cases (22.55%). Soon after, children and adolescents aged 0 to 14 years and finally those over 60 years old register the lowest number of cases 47,564 (9.27%). The literature states that dengue transmissibility is high in urban agglomerations, which explains the higher concentration of cases among individuals aged 15 to 39 years, corroborating Martins *et al., (*2015). Thus, it is noticed that this age group tends to spend more time in public environments and workplaces, increasing exposure to the Aedes aegypti mosquito. In addition, this population is more socially and economically active, which enhances contact with endemic areas and, consequently, the risk of infection, corroborating Lima (2024).

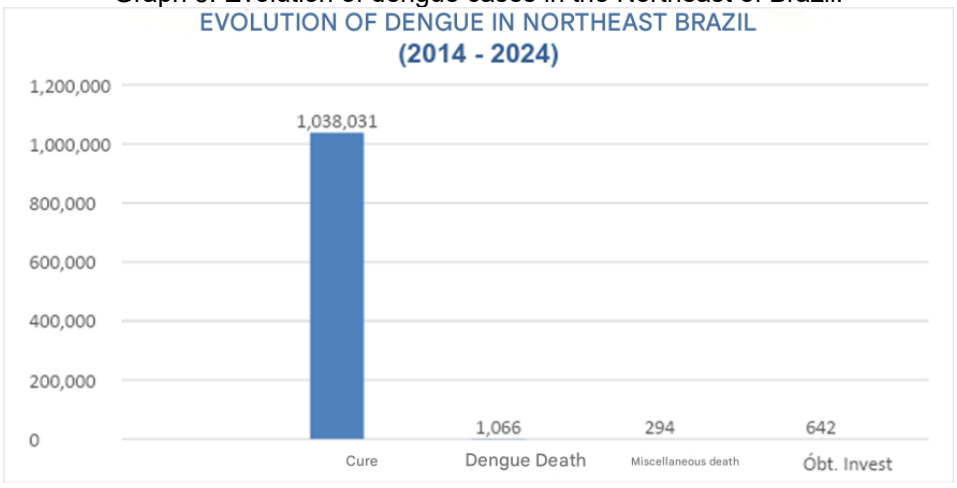
Graph 4: Distribution of dengue age groups in the Brazilian Northeast.



Source: Cases notified in SINAN 2014 - 2024.

With regard to the evolution of dengue, there was a greater number of cure cases, totaling more than 1 million, while the cases of death were around 1 thousand deaths due to the disease. These data reinforce the need to continue the control and treatment of the disease to further reduce the mortality associated with dengue, agreeing with Souza (2021). (Graph 5).

Graph 5: Evolution of dengue cases in the Northeast of Brazil.



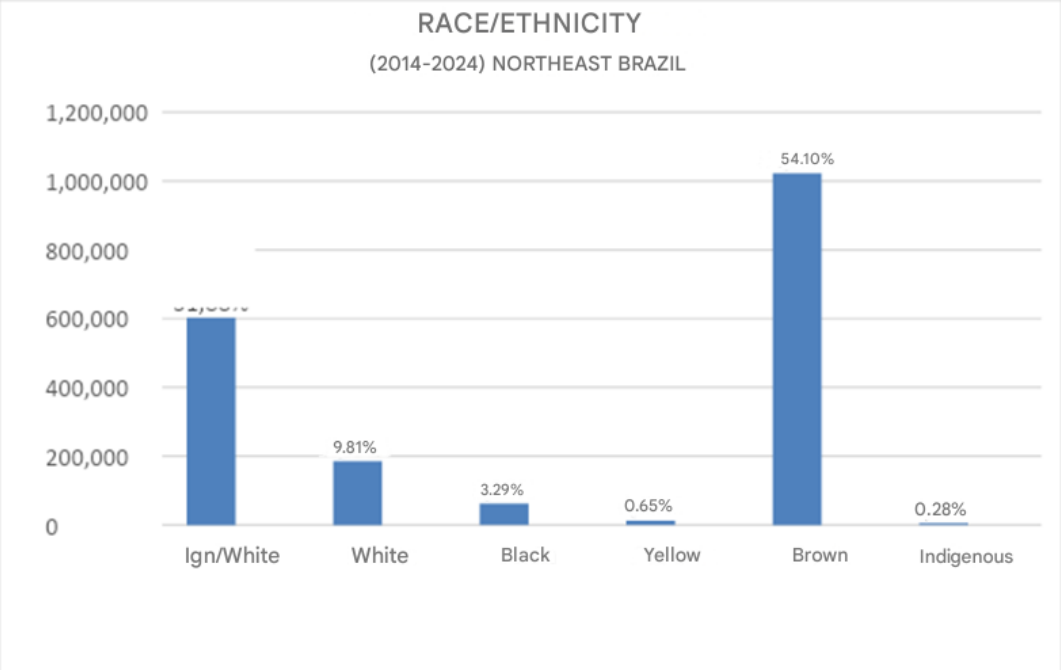
Source: Cases reported in SINAN 2014 - 2024

In the ethnicity/race graph, the brown race had the highest number of cases of the disease, in a total of more than 1 million cases, surpassing the white, black, yellow and indigenous races.

Therefore, it is worth mentioning, as shown in graph 6, the existence of 1,022,048 (54.10%) cases in individuals who self-declared themselves brown in the Northeastern population, and it should be clarified that this race has a predominance in the population

studied, as well as in the Brazilian population. Thus, justifying a higher percentage of dengue cases in this race. Subsequently, the white race appears on a smaller scale with 185,409 (9.81%) cases of dengue, which is also the second largest at the population level in the country. This is followed by the black race/ethnicity 62,166 (3.29%) and in last place are the indigenous people 5,290 (0.28%) with low rates of dengue, which corresponds to the lowest number of people in this Brazilian population group. Thus, it is noted that no specific comparison can be made between the number of dengue cases and the affected race, serving only to title the epidemiological classification of the affected races in this population (IBGE, 2017)

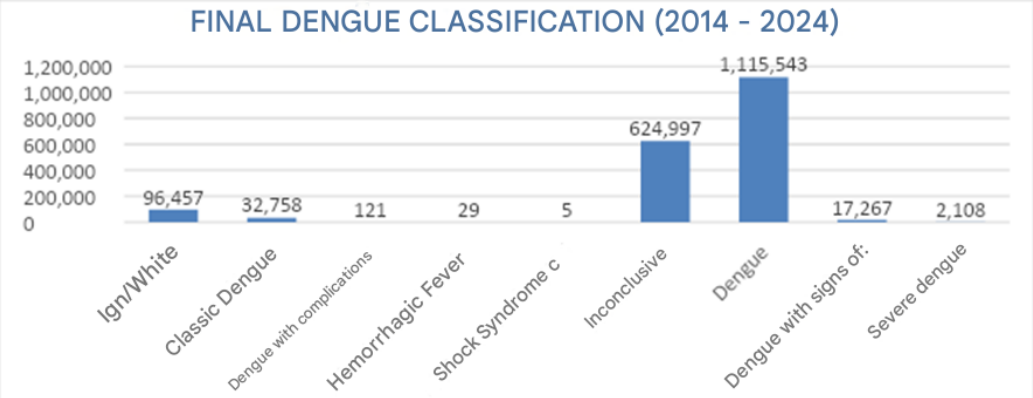
Graph 6: Distribution of race/ethnicity of dengue cases in the Brazilian Northeast.



Source: Cases reported in SINAN 2014 - 2024

For a better understanding of the virulence profile of dengue, it is necessary to focus on a more in-depth analysis of the Final Classification of the pathology, which were subdivided into: Dengue, in a generic way, with 1,115,543 (59%) cases. Inconclusive cases point to an expressive number of 624,997 (33.08%) cases. Followed by Classic Dengue 32,758 (17.33%) cases. Soon after, cases of Dengue with alarm signs with 17,267 (0.9%). It is followed by Severe Dengue with 2,108 (0.1%) cases. With 121 (0.006%) cases classified as Dengue with complications and 29 (0.0015%) cases with Hemorrhagic Fever. And finally, there is the Dengue Shock Syndrome with 5 cases (0.00023%) (graph 7).

Graph 7: Final classification of dengue cases in the Brazilian Northeast.



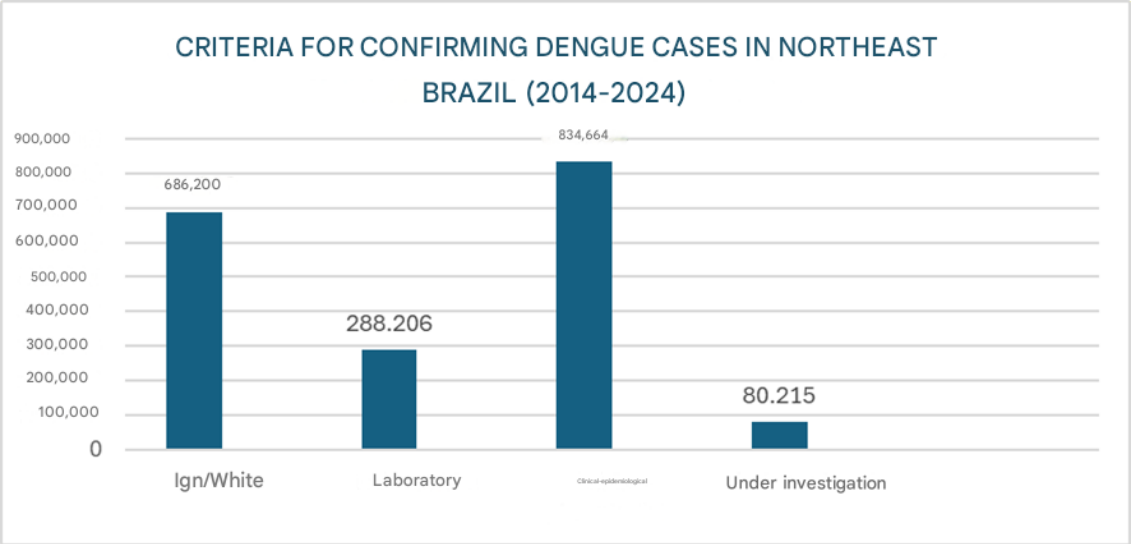
Source: Cases notified in SINAN 2014 - 2024.

As indicated in the data presented below, a significant proportion of dengue cases, totaling 834,664 (44.17%), are confirmed based on clinical manifestations, without the need for specific tests. This procedure is in line with the guidelines of the Ministry of Health (2024), which allows the clinical diagnosis of Dengue in endemic areas, based on characteristic symptoms such as high fever, retroorbital pain, myalgia, arthralgia, and skin rashes. Studies corroborate this practice, highlighting that, in areas with a high prevalence of Dengue, clinical diagnosis is highly reliable. (DAHER; ALCÂNTARA, 2024).

The diagnosis most found in the research was the clinical-epidemiological form, which is an initial diagnosis of the disease, taking into account the clinical history and the patient's condition at the time of the physical examination, which computed the number of 834,664 (44.17%) of the cases, followed by the laboratory form 288,206 (15.25%) and, finally, by the form under investigation 80,215 (4.25%) of the cases. The diagnosis of the disease requires clinical and laboratory tests, with investigation of the epidemiological situation in the region or city from which the patients with suspected dengue originated (XAVIER *et al*., 2014).

Among the available laboratory methods, the detection of viral RNA by RT-PCR is recommended up to the 5th day after the onset of symptoms, which allows direct identification of the virus and its virulence. On the other hand, the search for IgM and IgG antibodies, carried out from the 6th day onwards, is essential to confirm recent and past infections, respectively (MINISTRY OF HEALTH, 2024). Thus, it is observed that in the period from 2014 to 2024, these laboratory methods were responsible for confirming 288,206 (15.25%) cases of dengue, according to SINAN records, remaining in the second diagnostic position. In first place in the ranking was the clinical form that allows a rapid adoption of measures for the management of the disease, in view of its high lethality potential.

Graph 8: Criteria for confirmation of dengue cases in the Brazilian Northeast.



Source: Cases notified in SINAN 2014 - 2024.

CONCLUSION

In view of the results found, it is concluded that dengue and its high infection rate remain a serious public health problem in Brazil, especially in the Northeast region. The persistent infection rate may be related to disorderly urbanization, hot and humid climate, and unsanitary environmental conditions. In addition, the epidemiology of dengue demonstrates that there is no clear prevalence among races/ethnicities, but there is a significant relationship with age and unfavorable socioeconomic conditions.

The disease continues to generate high morbidity and mortality and significant costs for the Brazilian economy. In this sense, it is important that public policies are reinforced to improve basic sanitation, promote awareness campaigns, ensure quick and effective access to diagnosis and treatment, and implement vaccination strategies, such as the introduction of the vaccine in the National Immunization Program (PNI) of the SUS.

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COGNITIVE NEUROSCIENCE AND INCLUSIVE PRACTICES IN MATHEMATICS TEACHING

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ABSTRACT

This study examines the role of cognitive neuroscience in promoting inclusive practices in mathematics teaching, offering an approach that considers the diverse needs of students. With advances in neuroscience, there is a deeper understanding of processes such as working memory, attention, and visuospatial skills, which are essential for learning mathematics. These processes are key to creating inclusive teaching environments, especially for students with specific educational needs, such as Autism Spectrum Disorder (ASD), *Attention Deficit* Hyperactivity Disorder (ADHD), and Dyslexia. Exploratory and descriptive documentary research aimed to explore the intersection between cognitive neuroscience and inclusive practices in mathematics teaching, showing how these approaches can promote more accessible, equitable, and effective learning for all students, especially those who need differentiated support. Although the implementation of these practices faces challenges, such as the need for continuous teacher training, the benefits found are substantial. The publications and examples of practical implementation demonstrate how integrating cognitive neuroscience into inclusive mathematics teaching can improve student performance and motivation. It is observed that this integration not only makes mathematics education more accessible, but also contributes to a more equitable and meaningful education for all students.

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INTRODUCTION

Inclusive education has gained increasing prominence in recent decades, being recognized as essential for the development of pedagogical practices that meet the needs of all students, regardless of their abilities and challenges**.** In the context of mathematics teaching, this inclusion plays an even more crucial role, given the abstract character of the discipline and the diversity of cognitive difficulties that students may face in understanding it. Thus, to make mathematics education more accessible and effective, it is essential to adopt practices that consider individual differences and enable personalized learning.

It is relevant to highlight that educational inclusion is a right guaranteed by several international and national regulations, such as the Convention on the Rights of Persons with Disabilities, ratified in Brazil in 2008 (Brasil, 2016), and the Brazilian Inclusion Law (Brasil, 2015). Such legislation highlights the need to eliminate barriers that hinder equal access to education that promote pedagogical practices that ensure the effective participation of all students. In this scenario, the teaching of mathematics faces specific challenges due to the intrinsic characteristics of the discipline, such as the use of abstract representations, logical reasoning and complex problem solving. These aspects, which are central to mathematics, can become significant obstacles for students with specific educational needs, including those with Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), or Dyslexia.

In this scenario, cognitive neuroscience emerges as a valuable tool, offering *insights* into the mental processes underlying the learning of mathematics. By studying functions such as working memory, attention, and visuospatial processing, neuroscience allows educators to understand how these skills are activated and used to solve mathematical problems. This understanding is especially relevant for identifying and overcoming barriers that may impact the learning of students with specific needs. For example, students with ADHD may benefit from strategies that involve visual stimuli and task segmentation, while those with dyslexia may require support in developing phonological skills and using assistive technologies.

In addition, the application of neuroscience principles to education can help teachers develop more effective pedagogical practices, such as the use of multisensory resources, adaptations in the pace of teaching and formative assessment strategies. The integration of these practices in mathematics teaching favors the development of learning environments

that respect cognitive diversity and promote the inclusion of all students. By considering the specifics of brain functioning, educators can adopt approaches based on scientific evidence, increasing students' chances of academic and personal success.

Thus, cognitive neuroscience not only contributes to the development of more inclusive pedagogical strategies, but also scientifically supports these practices, ensuring that they meet the real needs of students. In this sense, this study aims to explore the intersection between cognitive neuroscience and inclusive practices in mathematics teaching, highlighting how these approaches can promote more accessible, equitable, and effective learning for all students, especially those who need differentiated support.

Over the past few years, significant advances in cognitive neuroscience have allowed for a deeper understanding of the mechanisms that influence learning. Research on brain plasticity, for example, has demonstrated that the brain is able to reorganize itself in response to learning experiences, even in individuals with conditions such as ASD or dyslexia. These findings reinforce the importance of pedagogical practices that explore the potential of each student to the fullest, adapting teaching methods to their specific needs. Another key aspect refers to the role of emotions in learning. Studies in neuroscience show that fear of failure and mathematical anxiety can activate brain areas associated with stress, impairing working memory and problem solving. Therefore, creating a welcoming and emotionally safe educational environment is critical to academic success.

Educational inclusion has become an essential pillar in discussions about equity and access to quality education, especially after the enactment of the legislation as mentioned above. In this context, cognitive neuroscience offers a robust scientific contribution to rethink pedagogical practices, especially in the teaching of mathematics, a discipline historically perceived as challenging. By better understanding how the brain processes mathematical information, educators can adapt their methodologies, promoting learning environments that value students' cognitive and emotional differences.

In this way, integrating cognitive neuroscience into inclusive mathematics teaching represents a significant step towards transforming educational practices and ensuring that all students, regardless of their abilities or challenges, can reach their full potential.

COGNITIVE NEUROSCIENCE APPLIED TO MATHEMATICS EDUCATION

Mathematical learning is a process that integrates specific knowledge, concepts and mathematical principles, along with the development of cognitive skills (Souza; Matias, 2020). In this scenario, cognitive neuroscience offers valuable theoretical subsidies to support pedagogical practices that respect the functional bases of the brain, suggesting that

methods aligned with students' neurocognitive functioning may be more efficient (Cosenza; Guerra, 2011).

Mathematics didactics, in turn, is not limited to the use of techniques and materials, but involves a deeper understanding of the teaching and learning processes. As Laborde (2007) points out, didactics incorporates not only mathematical concepts and the relationship between teaching and learning, but also considers the influence of social interactions between teachers and students, in addition to adapting mathematical content with a view to pedagogical objectives.

Still, by mobilizing mathematical cognition, didactics requires the teacher to go beyond the application of pragmatic methods, since this alone is not enough for a full teaching of students. For Silva (2015), it is necessary for the teacher to have a basic understanding of how the learning process occurs, since "[...] it is not possible to efficiently mobilize any learning without knowing at least how to learn" (p. 212), thus being able to adapt their practices to their students, in order to enhance the effectiveness of learning.

Although mathematics has its own language, formalized in the school context, its learning involves several cognitive processes, such as memory, which activates emotional components and students' personal experiences. These factors need to be considered in teaching practice, since recognition and cognitive representation initially involve other forms of logic and structuring.

Therefore, it is essential that teachers adopt a holistic view of mathematics teaching, considering the cognitive, social, and emotional dimensions in the development of their practices, seeking to adapt them to meet the specific needs of their students. In this sense, the didactics of mathematics involves more than methods and techniques; it seeks to understand the teaching and learning processes, exploring the interactions between these aspects, the epistemological implications of the concepts and the social dynamics that influence educational practice (Laborde, 2007).

ESSENTIAL COGNITIVE PROCESSES FOR INCLUSIVE MATHEMATICS TEACHING

Cognitive neuroscience, by investigating the neural bases of mental processes, offers an essential contribution to the inclusive teaching of mathematics, promoting a broader understanding of how mathematical learning takes place. Although it does not establish a rigid protocol, it provides principles that guide pedagogical practices based on more effective learning and adapted to the needs of students. This knowledge allows mathematics teaching to value and stimulate specific cognitive skills, such as logical reasoning and problem-solving, by creating a teaching environment that respects cognitive

diversity and facilitates inclusion. Thus, cognitive neuroscience supports practices that enhance the development of essential skills for mathematical thinking, favoring a more dynamic pedagogical approach aligned with the real capacities and challenges of students (Nampo; Caetano; Bezerra, 2022).

Fundamental abilities to perceive and compare quantities in a non-symbolic way are observed, and in us human beings, these abilities form the foundation for the development of symbolic numerical representations and require appropriate guidance throughout the development process. This brain system can be seen as a complex combination of specific numerical processing skills and broader executive functions, which include planning, inhibitory control, decision-making, cognitive flexibility, working memory, attention, categorization, fluency and creativity, essential competencies for learning and the construction of new knowledge (Luria, 1981; Lezak, 1982; Malloy-Diniz et al., 2010).

INCLUSIVE PRACTICES BASED ON NEUROSCIENCE FOR THE TEACHING OF MATHEMATICS

In the context of inclusive mathematics education, musicality[6] presents itself as a strategy to stimulate cognitive development. Understood not only as an aesthetic activity, musicality, in this case, is worked as a means of sensory involvement, offering experiences of listening, rhythm and body movement, aligned with mathematical foundations. This approach is inspired by music educators Willems (1968), Schafer (1991) and Gordon (2000) and aims to integrate sound activities with mathematical concepts in an accessible and practical way (Gomes; Manrique, 2014; 2016; 2017).

This integration of musicality into teaching may involve areas of the limbic system associated with emotions, and thus has the potential to create an inclusive and stimulating learning environment. Through careful and creative practices, the teacher can use musical elements to stimulate neurocognitive skills related to mathematical thinking, promoting the development of all students, regardless of their specific characteristics, guaranteeing them equal access to learning (Fernandez, 2001).

In addition, sound elements favor mental representation, enabling the activation of essential skills, such as voluntary attention, inhibitory control, and self-regulation. By incorporating these sound activities into mathematics teaching, the teacher can promote a deeper understanding of the numeration system and mental calculation, encouraging the

[6] Musicality applied to education involves aspects such as attentive listening, which stimulates neurocognitive circuits; free expression, which promotes rhythm and motor coordination; and specific cognitive processes related to mathematics, such as transcoding. Integrated into the educational environment, these elements enhance fundamental skills, especially voluntary attention and working memory.

participation and progress of each student in a truly inclusive teaching environment (Gomes; Manrique, 2017).

CHALLENGES AND PERSPECTIVES FOR INCLUSIVE PRACTICES

The interaction between emotion and cognitive performance highlights fundamental challenges for the implementation of inclusive practices in the school context. Learning experiences that involve pleasure, stimulation, and accessible challenges favor cognitive development, while situations of anxiety and stress negatively impact learning, especially for students with disabilities, who are often subject to experiences of segregation and low self-esteem. The main challenge for inclusion is, therefore, to develop pedagogical practices that meet both academic content and the construction of an emotionally safe and stimulating environment, essential for all students to be able to explore their potential in an integral way (Amaral; Guerra, 2020).

In this context, Ferreira *et al.* (2015), reports that the contemporary student who grows up in a highly visual and virtual environment demands an in-depth reflection on the educator's profile. It is vital that educators incorporate the visual arts and neuroscience of learning in the creation of teaching materials and strategies that foster student motivation and well-being, regardless of their grade level. By adopting this approach, the teacher can develop the students' skills and competencies within a perspective of inclusive education that, for the authors, is based on psychopedagogy. Thus, the teacher also builds his own conceptions about a more just and egalitarian society, relying on the understanding of his social actions as a mediator of historical-social knowledge.

For inclusion to happen effectively, educational practices must be planned taking into account the emotional impact on the learning process. Practices that contemplate affection and motivation, as well as the use of appropriate challenges, which promote autonomy and reduce the impacts of negative feelings, enabling the full participation of students. Amaral and Guerra (2020) show that to create an inclusive environment, it is necessary to integrate strategies that consider the particularities of each student, seeking to promote emotional and cognitive development and ensure that everyone, without distinction, can enjoy an enriching and inclusive education.

METHODOLOGICAL TRAJECTORY

This research is of the exploratory and descriptive documentary type, aimed at the collection and review of available materials on the specific theme. According to Mattar and Ramos (2021, p.129), internet research is classified as documentary, as it involves documents that are now available *online* and can be retrieved for analysis. It can also be

considered field research, in a virtual, *online* or digital environment. In addition, it is exploratory of a descriptive nature, as researchers investigate a set of phenomena, looking for known or unknown anomalies, describing them, which can serve as a basis for more systematic research in the future (Wlazlawick, 2021).

Thus, a review of materials already published on the CAPES journal portal was carried out. To collect data more efficiently, an appropriate search engine was established, selecting keywords representative of the theme, using the Boolean operator (E/*And*), any field option and the contains option available on the platform to improve the search results.

To delimit the scope, we focused on the works produced from 2015 onwards, and the research was carried out in the first half of October 2024, following the corresponding steps in Chart 1.

Chart 1 - Description of the searches carried out in CAPES Journals

	DESCRIPTORS	**WORK**
1	Neuroscience (*and*) Inclusive practices (*and*) Mathematics Teaching	0
2	Neuroscience (*and*) Inclusion (*and*) Mathematics	3
3	Neuroscience (*and*) Inclusion (*and*) Mathematics Teaching	3
4	Neuroscience (*and*) Inclusion (*and*) Mathematics Education	0
5	Neuroscience (*and*) Inclusive Education (*and*) Mathematics	5
6	Neuroscience (*and*) Special Education (*and*) Mathematics	5
	Total	16

Source: Authorship.

Steps 2 and 3 contain the same articles, which indicates the absence of variation in the publications analyzed between these two steps. On the other hand, in stages 5 and 6, one of the articles is identical, suggesting that, although the analysis addressed new descriptors, there were no new results. In addition, in step 6, one of the articles was an editorial entitled "Neuroscience". This repetition can be significant to understand the evolution of discussions on the subject. Thus, of the total of 16 selected studies, only 11 remained for the continuation of the analysis.

During the reading of the abstracts, we sought to identify common topics and recurring characteristics. Each abstract was analyzed in detail, with emphasis on specific information related to the topics of interest, as presented and discussed in the results.

ANALYSIS AND DISCUSSION

Based on the data collected, an analytical reading of the abstracts of each article was carried out, seeking to identify those that specifically met the established criteria. In this process, one of the articles was excluded, because it was not about studies in the area of mathematics teaching, but about written oral language. Therefore, the items that were directly relevant to this research were prioritized, adopting as exclusion criteria those that were not aligned with the study. In this way, a selection focused on the most pertinent materials for the analysis and subsequent discussion of the work was guaranteed. It is important to emphasize that this stage was conducted in an impartial and transparent manner, with the objective of ensuring the quality and representativeness of the selected works.

Chart 2 - Articles analyzed

	TITLE	AUTHOR(S)	ANUS
1	Mediator teacher training: psychopedagogical inclusion and intervention	Ferreira, A. C. L. Vilas Boas, T. J. R Silva, A. B. S. M. Araújo, T. S. Santos, L. M. Souza, D. B.	2015
2	Musicality for the stimulation of voluntary attention of mental calculations (Inclusive Mathematics Education)	Gomes, H. C. Manrique, A. L.	2016
3	Inclusive mathematics education: musicality, cognitive neuroscience and teacher mediation	Gomes, H. C. Manrique, A. L.	2017
4	Neuroscience and the teaching of mathematics: a study on learning styles and multiple intelligences	Araújo, F. G. S. Menezes, D. B. Bezerra, K. S.	2019
5	An ideological look at our studies on school mathematics and disability: from segregation to inclusion	Broitman, C. Cobenñas, P. Escobar, M. Grimaldi, V. Sancha, I.	2019
6	Factors based on Cognitive Neuroscience in the teaching and learning of mathematics: a systematic review of the literature	Nampo, D. S. O Caetano, R. S. Bezerra, R, C.	2022
7	Importance of considering cognitive processes in mathematics didactics	Costa, L. F. M. Ghedin, E.	2022
8	A look at the performance of a student who is the target audience of special education in the face of scenarios for mathematical learning, mediated by a musical environment	Morais, T. R.	2023
9	Analysis of the feasibility of using FNIRS in educational activities with children and young people with intellectual disabilities and autism	Benitez, B. Domeniconi, C. Oku, A. Y. A. Soares Junior, R. S. Mori, F. Y. R.	2023

		Sassaki, L. Moura, T. L. D. Oliveira, T. Oliveira, L. C. C. Silva, G. Sato, J. R. Caetano, M. S.	
10	The production of knowledge in neuroscience and attentional theories in the area of Science Teaching and Mathematics Education	Pereira, A. S. Fonseca, L. S.	2024

Source: Authorship (2024)

Article 1 (Ferreira *et al*., 2015) seeks to understand how fundamental factors of cognitive neuroscience can impact mathematics learning. The relevance of the theme is evident, since mathematics is a discipline often associated with learning difficulties, and the application of the principles of neuroscience can offer new approaches to improve student performance. The article also mentions several factors that influence learning, such as: organic factors, related to brain structure and the functioning of the Central Nervous System; Specific factors, such as specific disorders, in this case, dyslexia; Psychogenic factors, linked to trauma and internal conflicts; Environmental factors, such as opportunities for stimuli that favor learning. All these factors are decisive to understand the variables that can affect mathematics learning and, as interventions, can be adapted to meet the needs of students.

The results indicated that the application of pedagogical interventions based on cognitive neuroscience factors can improve performance in mathematics, and the use of sensory stimuli, such as vision and touch, is highlighted as an effective strategy to activate different areas of the brain and favor the formation of long-term memory. In addition, the research suggests that skills such as mindfulness and memory are fundamental for learning, highlighting that educators should consider such factors when planning their lessons. Personalization of teaching, taking into account the individual needs of students, can be an effective strategy.

In summary, the study offers a comprehensive overview of how cognitive neuroscience can be applied to improve the teaching of mathematics. The analysis of the factors that influence learning and the methodology of the systematic review contribute to a deeper understanding of effective pedagogical practices, also highlighting the relevance of an integrated approach that considers the various dimensions of learning, promoting a more inclusive and effective educational environment.

The intersection between musicality, neuroscience and mathematics education is what article 2 addresses (Gomes; Manrique, 2016). The proposal to use musicality as a tool

to stimulate voluntary attention in children, especially those with attention difficulties, is innovative and pertinent, since music, as a form of cultural and emotional expression, can be a powerful resource in education, promoting not only cognitive learning, but also the social and emotional development of students.

The research was conducted with students between 6 and 8 years old, including those with ADHD, allowing for a richer and more diverse analysis of responses to music interventions. However, the relatively small sample size and the limited duration of the interventions (12 one-hour meetings) limited the generalization of the results.

However, the results indicated that musicality can have a positive impact on voluntary attention and performance in mental calculations. The transformation observed in the class, as reported by the class teacher, suggests that music not only improves concentration, but also promotes a more collaborative and respectful learning environment. The implications of the study are significant for educational practice, especially in contexts of inclusion, since musicality can be an effective strategy to engage students with attention difficulties, promoting a more inclusive and dynamic learning environment. However, educators need to receive adequate training to integrate musicality into their pedagogical practices effectively.

Although the article presents an interesting and innovative proposal, it also raises questions about the need for more research in the area, that is, it could benefit from a more detailed analysis of the data collected, perhaps including quantitative metrics that support the qualitative claims. In addition, the inclusion of a broader perspective on the different forms of musicality and their applications in education could further enrich the discussion.

Article 3 (Gomes; Manrique, 2017) addresses Reuven Feuerstein's Theory of Structural Cognitive Modifiability as a theoretical basis, emphasizing that all individuals have the ability to learn and modify themselves through mediated experiences, regardless of their disabilities. The four essential criteria of the theory are: Intentionality, Reciprocity, Meaning and Transcendence, fundamental for teacher mediation and the promotion of an inclusive learning environment.

The study focuses on executive functions, such as voluntary attention and working memory, and on the Triple Code model of numerical processing, suggesting that musicality can be an effective tool to stimulate these functions, promoting a more dynamic and engaging learning environment for all students, especially those with ADHD.

It uses a qualitative approach with classroom observations, which allows a deeper analysis of the interactions and the impact of the proposed activities. The observed teacher implemented activities that integrated musicality and mathematics, resulting in a learning environment where all students actively participated, demonstrating enthusiasm and

creativity. The results indicated that the use of musical elements in mathematical activities not only facilitated the understanding of mathematical concepts, but also promoted the inclusion and participation of students with learning difficulties, highlighting the importance of didactic strategies that consider the neurocognitive abilities of students, suggesting that inclusion should be an intentional and well-planned practice.

The challenges faced in inclusive education are also mentioned in the article, such as the need for adequate teacher training and curricular adaptation to meet the diverse needs of students. The proposal for teacher training is seen as an opportunity to enhance the teaching of inclusive mathematics, promoting autonomy and cognitive modification of students. And finally, the research points out the relevance of teacher mediation and Executive Functions, suggesting that innovative and interdisciplinary approaches are essential to meet the needs of all students, since inclusion in mathematics education is not only a matter of adaptation, but an opportunity to enrich the learning process for all involved.

Article 4 "Neuroscience and the teaching of mathematics" (Araújo; Mark; Bezerra, 2019) presents an analysis of the intersection between neuroscience and pedagogical practices in mathematics teaching, highlighting the importance of understanding how students learn to improve teaching effectiveness. The main objective of the study was to investigate the relationship between learning styles and the Theory of Multiple Intelligences in the context of mathematics teaching, in which the authors seek to understand how knowledge about the functioning of the brain can be used to increase learning rates in mathematics and, thus, transform the educational experience of students.

The authors argued that neuroscience offers valuable *insights* into how students process information and learn. In this sense, understanding these processes can help teachers adapt their teaching methodologies, promoting a more effective and engaging learning environment. The survey points out that many teachers still maintain traditional conceptions of teaching, which can be limiting, requiring a *shift* towards more modern approaches based on scientific evidence. They also discuss the relevance of learning styles (visual, auditory and kinesthetic) and the Theory of Multiple Intelligences, proposed by Howard Gardner, arguing that the integration of these theories in the teaching of mathematics can help personalize learning, making it more interesting and accessible and, consequently, increase students' interest in mathematics, in addition to improving their performance.

The research was based on a bibliographic review, a methodology that enabled the authors to substantiate their arguments and propose new directions for teaching practice. The authors consider that understanding the functioning of the brain and applying teaching

strategies that consider learning styles and multiple intelligences can lead to more effective mathematics teaching, benefiting student learning, but also empowers teachers to become more effective in their pedagogical practices.

According to the authors, educators should update themselves on neuroscience findings and consider implementing methodologies that integrate this knowledge into their classes, in addition to reflecting on their own practices, promoting changes that can benefit student learning.

The authors conclude that neuroscience can be a powerful ally in mathematics teaching, offering tools and knowledge that can transform teaching practice, shifting the focus from traditional methods to more student-centered approaches based on scientific evidence.

Article 5 (Broitman *et al.*, 2019) presents a critical analysis of mathematics education, especially with regard to the inclusion of students with disabilities, discussing the need to rethink pedagogical practices and discourses surrounding school mathematics, in addition to emphasizing the importance of an inclusive approach based on human rights.

The authors made observations in classrooms and identified a widespread concern among educators about how to teach mathematics to students with intellectual disabilities. Teachers expressed a sense of powerlessness, using phrases such as "we do what we can" and "with these students, much cannot be done", which reveals a lack of training and adequate didactic strategies to deal with diversity.

The authors criticize the medical model, often applied in education, in which disability is portrayed as an obstacle to be overcome, rather than a characteristic that should be considered in the construction of inclusive pedagogical practices, a view that perpetuates segregatory practices and limits learning opportunities for these students. There is an explicit demand for continuous training for educators, who seek guidance on how to teach mathematics in an inclusive way. The authors highlight that the existing curricula do not offer adequate support for the organization of teaching that contemplates the diversity of students, and defend the creation of a learning environment that promotes the construction of a "mathematical community" where all students, regardless of their abilities, can actively participate. This implies developing practices that value cooperation and the exchange of knowledge between students with and without disabilities.

In summary, the investigations carried out by the authors not only question the current pedagogical practices, but also invite a deeper reflection on the ideological aspects that permeate the teaching of mathematics. They emphasize the importance of recognizing and challenging the inequalities that exist in the education system, promoting education that

is truly inclusive and equitable. The entire study is a call to action for educators, policymakers, and researchers, highlighting the urgency of rethinking mathematics education in an inclusive context. Education should be a space of opportunity for all, where diversity should be recognized and celebrated, moving towards an educational practice that respects and values all students.

Article 6 (Nampo; Caetano; Bezerra, 2022) refers to a systematic review of the literature on the intersection between neuroscience and mathematics teaching, highlighting how the principles of neuroscience can be applied to improve mathematical learning, whose objective was to identify and analyze pedagogical interventions based on neuroscience that impact and optimize the teaching and learning of mathematical content.

The results indicated that several factors, such as sensory stimuli, teaching strategies and emotional aspects, influence mathematical learning, such as the use of different sensory stimuli (touch and vision), highlighted as a way to activate different areas of the brain, favoring the formation of long-term memory. The article mentions specific interventions, such as the use of *Cuisenaire* Scales, which have been shown to be effective in maintaining students' attention and solving mathematical problems, and in addition, they point out that approaches that include mindfulness and memory skills can also improve math performance.

The authors suggest that the findings have significant implications for pedagogical practice in mathematics teaching, but recommend that further research be conducted, especially from randomized controlled trials, to validate neuroscience-based interventions, developing more effective teaching methods tailored to students' needs.

Article 7 (Costa; Ghedin, 2022) reveals several layers of understanding about how cognition influences mathematical learning and pedagogical practice, since these are not limited to the memorization of formulas or techniques, but involve the activation and expansion of the student's cognitive structure. The authors argue that the understanding of mathematical concepts is closely linked to the mobilization of cognitive processes, such as attention, memory, and reasoning, suggesting that pedagogical practices that consider these processes are more effective for the development of mathematical thinking.

The authors discuss the importance of semantic memory and its relationship with mathematical language, since it is essential for the understanding of new concepts and words, especially in a field such as mathematics, which has its own complex language. The lack of understanding of meanings can lead to learning difficulties, indicating that didactics must be sensitive to these nuances.

The article mentions the "crisis" in mathematics teaching in Brazil, evidenced by unsatisfactory results in large-scale assessments, pointing out that this crisis can be attributed to several factors, including the lack of meaning in conceptual definitions and the disconnection of mathematical content with the social and cultural context of students, which suggests the need for a didactic approach that integrates mathematics into the daily lives of students, making learning more relevant and meaningful.

In this vein, teacher training should include a deeper understanding of cognitive processes and how they relate to mathematical learning, that is, educators should be able to develop pedagogical practices that respect and use the way the brain learns, promoting more effective teaching adapted to the needs of students.

Based on theories of mathematics didactics, educational psychology and cognitive neuroscience, the authors emphasize that such a multidisciplinary approach is indispensable to create a more holistic understanding of mathematical learning, allowing educators to develop strategies that consider the complexities of human learning.

The analysis of the article reveals that the consideration of cognitive processes in mathematics didactics is fundamental to improve student learning, since the integration of neuroscience theories and a student-centered approach can transform pedagogical practice, making it more effective and meaningful. Thus, the continuous training of teachers and the adaptation of teaching practices to the cognitive needs of students are substantial steps to face the current challenges in mathematics teaching.

Article 8 (Morais, 2023) reveals several important dimensions about the intersection between music, learning, and educational inclusion. The study focuses on a student identified with a learning disability, specifically with an intellectual disability, and explores how a musical environment can serve as an effective pedagogical tool. The choice of the musical environment is justified by its ability to stimulate memory and attention, central aspects for learning, especially with students with specific needs.

Data collection was carried out directly at the school, with observations at three different moments: at the beginning of the study, after four and seven months of intervention. The results indicated a significant evolution in the performance of the student who, initially, had difficulties in recognizing numbers and writing, using only capital letters; and, with the musical intervention, there was an improvement in his writing ability, starting to use cursive and recognizing numerical sequences up to thirty. This evolution suggests that the musical environment not only facilitated mathematical learning, but also contributed to the development of motor and cognitive skills.

The musical environment is configured as a semiotic tool that promotes inclusion and learning, and music presents itself as a multisensory resource that can engage students with difficulties, making learning more accessible and enjoyable. Exposure to the musical environment can improve memory and attention, corroborating studies that associate music with cognitive development. These findings have significant implications for educational practice in special education contexts, as they suggest that the integration of musical environments into pedagogical activities can be an effective strategy to meet the needs of students with learning difficulties.

The article offers valuable insight into how music can be used as a powerful tool in special education, promoting not only mathematical learning, but also the integral development of the student, which reinforces the relevance of inclusive and adaptive environments that consider the particularities of each student, contributing to a more equitable and effective education.

In article 9 (Benitez *et al*., 2023), the authors reveal several expressive dimensions on the application of Functional Near-Infrared Spectroscopy (FNIRS) technology in educational contexts, especially for children and young people with autism and intellectual disabilities. Investigating the hemodynamic response of the prefrontal cortex to support educational interventions, the authors sought to identify biomarkers that would help in decision-making about learning criteria and in the teaching of skills such as reading, mathematics, and emotional expressiveness, highlighting the importance of an assessment that considers cognitive, behavioral, and environmental aspects, in line with the biopsychosocial model of disability.

The use of FNIRS is considered promising for the analysis of brain activation during educational tasks, enabling a personalized assessment of student performance, in order to allow educators to adjust their teaching approaches according to the specific needs of each student. Research indicates that neurophysiological analysis can help predict and monitor pedagogical performance, contributing to effective and individualized educational planning. The analyses included comparisons between specific tasks and rest, which allowed for a deeper understanding of how students interacted with educational content.

It is observed that the results of the research have significant implications for educational practice, since the ability to monitor cognitive effort and brain response can lead to more effective interventions adapted to the needs of students. This is essentially relevant in a context where many students face educational inequities, allowing educators to develop strategies that promote inclusion and academic success.

By integrating neuroscientific approaches with educational practices, it is possible to revolutionize the way education is planned and implemented for populations with special needs, contributing not only to the field of inclusive education, but also paving the way for future investigations into the intersection between neuroscience and pedagogy.

And, finally, article 10 (Pereira; Fonseca, 2024) reveals important dimensions about the intersection between neuroscience and education by investigating how the knowledge produced in Science and Mathematics Teaching, present in dissertations and theses, addresses cognitive neuroscience and attentional theories, providing *insights* into how students learn and how teaching strategies can be adapted to improve learning.

The results indicated that, although there is a significant production of knowledge in the area, only a fraction of the dissertations and theses directly address the relationship between neuroscience and science teaching and mathematics, which indicates a gap in knowledge that can be explored in future research. In addition, the authors highlight the importance of considering attentional mechanisms in the learning process, especially in inclusive contexts, such as teaching deaf students.

Attentional theories have direct implications in pedagogical practice, which justifies the use of teaching strategies that consider such mechanisms, aiming to promote more effective learning, such as the adaptation of teaching materials and the use of different methodological approaches can help meet the needs of diverse students, including those with learning difficulties.

The study contributes to the discussion on the magnitude of neuroscience in education, emphasizing that understanding cognitive processes can lead to more informed and effective teaching practices. For this, teacher training must include knowledge about neuroscience and attentional theories so that they can apply these concepts in the classroom.

The analysis of the work reveals that, although there is a growing interest in the intersection between neuroscience and education, there is still much to be explored, requiring more studies that integrate these fields, aiming to improve pedagogical practice and, consequently, student learning.

FINAL CONSIDERATIONS

The application of cognitive neuroscience to mathematics teaching has proven to be essential for the development of inclusive and accessible pedagogical practices, promoting respect for the particularities of brain functioning during the teaching and learning process. Understanding how the brain processes concepts and emotions makes it possible to create

strategies adapted to the needs of each student, reinforcing functions such as memory, attention, and emotional control, in addition to providing richer and more meaningful learning experiences.

To make teaching inclusive, practices that integrate sensory and emotional stimuli are needed, such as activities that use musicality, as they facilitate the assimilation of content, engaging the limbic system and promoting a welcoming and equitable learning environment. These approaches are especially beneficial for students with specific needs, reducing stress and increasing motivation.

In addition to improving mathematical learning, pedagogical practices based on neuroscience contribute to a true inclusion, where each student is valued and can develop their potential in an adapted environment. For this, the continuous training of teachers in neuroscience is indispensable, as it enables the implementation of inclusive methodologies that respect multiple intelligences and learning styles, personalizing education to make it accessible to all.

In a way, transforming mathematics education through neuroscience requires collective commitment and constant updating from educators, who play a central role in creating inclusive and welcoming practices. The continuity of this research and the application of these practices represent fundamental steps so that each student has the opportunity to learn and prosper, making inclusion a fundamental principle in education.

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THE IMPORTANCE OF THE ANCHORAGE SYSTEM FOR WORK AT HEIGHT AND RESCUE

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ABSTRACT

The anchorage system is essential for safety in work at height and rescue operations, playing a crucial role in preventing accidents and protecting the lives of workers. This system consists of a series of components designed to support and distribute loads safely, preventing falls and ensuring stability during activities.

The primary function of the anchoring system is to provide a secure attachment point to which personal protective equipment (PPE), such as seat belts and ropes, can be attached. This is vital to prevent falls from heights that can result in serious or even fatal injuries. Proper anchoring allows the worker to move safely, increasing efficiency and confidence while performing their professional activities.

In addition, the anchoring system is crucial in rescue operations, where the safety of rescue workers and victims depends on robust and reliable anchoring. In the event of an emergency, it is essential that a well-designed and maintained anchoring system can make the difference between a successful rescue and a disaster.

To ensure the effectiveness of the anchoring system, it is essential to follow the determinations of Standard NBR 16325-1 and Standard NBR 16325-2, which deal with Protection Against Falls from Height, in addition to Regulatory Standard NR 18 and Regulatory Standard NR 35. The choice of anchor points must be judicious, considering the load capacity, the resistance of the materials and the suitability for the type of work performed. Regular inspections and maintenance of equipment are equally important to ensure that the system remains in safe operating condition.

In this way, the anchorage system is a key piece in the safety of work at height and rescue operations, providing an anchor point and a lifeline that protects workers against falls and increases the effectiveness of rescues. The correct implementation and maintenance of this system are essential to prevent accidents and save lives, underlining the importance of rigorous safety practices in the workplace.

Keywords: Protection against falls from height. Rescue at height. Anchoring system. Occupational safety.

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INTRODUCTION

With the increase in the verticalization of buildings due to population growth, it is imperative to improve construction techniques for work at height and vertical techniques for rescue at height, employed by military firefighters to rescue people at risk. These situations may involve building dwellers, individuals seeking to access skyscrapers to endanger their lives, or construction workers who are trapped in poorly executed rope systems (AGUIAR, 2016).

According to Costa (2011), rescue at height is an activity performed by firefighters, which involves locating, accessing, stabilizing and transporting victims using specific techniques in elevated places. This is done based on safety standards and specific docking and lowering procedures.

The history of occupational medicine records that, from the beginning, the performance of work activities exposes workers to a variety of risks, with industrial evolutions, there have been significant advances in productivity, but also increased the dangers to the health and safety of workers.

Currently, Brazilian legislation understands that work accidents occur during the execution of activities at the service of the company and result in bodily injury or functional disturbance. These accidents can cause death, loss or permanent or temporary reduction of the ability to work. It is crucial to highlight that this definition is essential to determine the employer's responsibility and the worker's rights in cases of occupational accidents.

To minimize or avoid accidents at work, it is essential that companies adopt comprehensive preventive measures. This includes providing proper training to employees to be aware of the risks and know how to act safely. In addition, it is essential to provide and ensure the correct use of appropriate Personal Protective Equipment (PPE) for each type of activity. Performing regular maintenance on machines and facilities is also crucial to prevent failures that result in accidents. Additionally, fostering a culture of safety among employees, encouraging open communication about safety issues, and encouraging active participation in identifying and resolving issues, is key to creating a safe and healthy work environment.

Workplace accidents affect thousands of workers every year, across a wide range of economic sectors. The damage resulting from these accidents can be significant and, in some cases, irreparable. As consequences for the worker himself, the impact extends to family members, co-workers and society as a whole. It should be noted that, in addition to psychological, material and economic damage, they are among the most visible and impactful consequences.

In the workplace, several risks can trigger accidents, one of the most significant being the risk of falling from heights. This type of accident is often observed in statistics, both in terms of the number of occurrences and the severity of the damage. This underscores the importance of paying special attention to this type of risk, implementing measures aimed at eliminating or reducing the possibility of accidents of this nature to the minimum possible. Thus, the occupational safety engineering professional plays a fundamental role in applying his knowledge in the prevention of accidents in the face of the various risks present in the work environment.

The current legislation that addresses the issue of work at height is Regulatory Standard 35 (NR 35), which establishes requirements and protection measures to ensure the safety of workers who work in this condition. In addition, the Regulatory Standard – NR 6 deals specifically with Personal Protective Equipment, establishing requirements for its use, ensuring quality and effectiveness in the protection of workers.

HISTORY OF OCCUPATIONAL MEDICINE IN THE WORLD

Bernardino Ramazzini was an Italian physician born in Carpi in 1633, widely recognized as the father of Occupational Medicine. He wrote the book "The Diseases of Workers", published in 1700. In this work, Ramazzini cataloged 54 different professions and described the main health problems faced by workers in each of them. He highlighted the crucial importance of physicians understanding their patients' current and past occupations in order to make accurate diagnoses and apply appropriate treatments. This pioneering approach launched by Ramazzini established the foundations of Occupational Medicine, becoming fundamental for the understanding and prevention of occupational diseases.

The Industrial Revolution, which began in England in the eighteenth century, caused profound changes in the way production and people's lifestyles were organized. These transformations also boosted the development of Occupational Medicine. Schilling, (1981). Since then, following the evolutions and demands of production processes and social movements, Occupational Medicine has adapted its practices, incorporating new approaches and work instruments. This was done interdisciplinarily, outlining not only the field of Occupational Health, but also, more recently, that of Workers' Health. This evolution reflects the growing understanding of the importance of workplace health and safety to the well-being of workers and the effective functioning of organizations.

History records that in 1830, at the initiative of the textile entrepreneur Robert Dernham, during the English Industrial Revolution, he was concerned about the fact that his workers did not have any medical care other than that provided by philanthropic institutions,

he assigned his personal physician Dr. Robert Baker to work inside the factory, to investigate the effects of work on workers, and to create preventive measures. This was one of the first documented examples of a systematic approach to assessing and mitigating workers' health risks in the industrial environment.

This model quickly expanded to other countries, following the industrialization process. The concern with providing medical services to workers began to gain prominence on the international scene. Among other factors, the great importance of protecting workers' health motivated the creation of two important organizations worldwide: the International Labor Organization (ILO), in 1919, and the World Health Organization (WHO), in 1948. Together, these two entities established, in 1950, the objective of Occupational Health: to adapt work to man and each man to his activity. This view reflects the importance of creating safe and healthy work environments where workers can perform their duties effectively and without compromising their health and well-being.

In 1995, the concept of "Occupational Health" or "Occupational Health" was revised and expanded by the Joint Committee of the International Labor Organization (ILO) and the World Health Organization (WHO). The concept was stated in the following terms:

> The main focus of Occupational Health should be directed towards three objectives: The maintenance and promotion of the health of workers and their work capacity; Improving working conditions so that they are compatible with health and safety; The development of business cultures and work organisations that contribute to health and safety and promote a positive social climate, favouring the improvement of business productivity. The concept of corporate culture, in this context, refers to value systems adopted by a specific company. In practice, it is reflected in management systems and methods, personnel policies, participation policies, qualification and training policies, and quality management. (ANAMAT, 2024).

HISTORY OF OCCUPATIONAL MEDICINE IN BRAZIL

In Brazil, in 1921, the Labor Inspectorate was established, initially limited to Rio de Janeiro. With the constitutional reform of 1926, the Union's competence to legislate on the subject was established. In 1931, during the government of Getúlio Vargas, the National Department of Labor was created, with the responsibility of supervising compliance with laws related to work accidents, working hours, vacations, union organization and protection of the work of women and minors. A year later, regional inspectorates were established in the Brazilian states, later transformed into Regional Labor Delegations. (ANAMAT, 2024).

The obligation to report accidents of this nature to the police authority was established by decree in 1934, by the National Department of Labor, which also provided for the imposition of administrative fines. Decree-laws of 1940, for example, defined the competence of the Ministry of Agriculture to inspect and establish work standards in the mines.

The growth of industries resulted in an increase in the number of urban workers, which, consequently, brought new concerns to the Brazilian government. It is in this scenario that the Consolidation of Labor Laws (CLT) emerged in the country in 1943, which represented a milestone in Brazilian labor legislation. With the CLT, the first references to hygiene and safety at work in Brazil were established. This legislation consolidated several workers' rights and established standards to ensure decent working conditions, including measures to protect the health and safety of workers.

In the 1940s, the Internal Accident Prevention Commissions (CIPAs) emerged, organized by the companies. The Ordinance of the Ministry of Labor that created the CIPAs was structured by the Brazilian Association of Occupational Medicine and is considered one of the most effective measures in the context of actions to prevent occupational accidents. The first commissions brought good results and encouraged the holding of congresses on accident prevention. Doctors began to focus more on the specific diseases of workers, especially those that affected many people at the time, such as lead poisoning. This concern led doctors to improve their studies and companies to invest more in Occupational Health. This period was marked by significant advances in the awareness and prevention of occupational diseases in Brazil. (ANAMAT, 2024).

In 1947, the International Labour Organization (ILO) adopted Convention No. 81, which states that each member of the organization must have a system of labour inspection in industrial and commercial establishments. The experience of industrialized countries resulted in Recommendation No. 112 of 1959, also established by the ILO, which addressed "Occupational Medicine Services". This recommendation was later replaced by ILO Convention No. 161 of 1985, together with its respective Recommendation, No. 171. These conventions and recommendations highlight the importance of protecting the health and safety of workers at the international level and provide guidelines for the implementation of effective occupational health services worldwide.

In Brazil, this development occurred late and followed the model of First World countries. In the sphere of institutions, the creation of Fundacentro in 1966 stands out, which was a national version of the models of institutes developed abroad from the 1950s onwards. Fundacentro has played a crucial role in promoting occupational health and safety in Brazil by providing research, training, and technical assistance to companies and workers. Its creation reflected the growing recognition of the importance of occupational health and the need for effective measures to protect Brazilian workers. (ANAMAT, 2024).

DATA ON OCCUPATIONAL ACCIDENTS IN BRAZIL

The work environment can present a variety of risks to workers due to its characteristics or conditions of carrying out activities. When these risks are not given due importance and measures are not taken to control them, this can result in accidents involving employees.

According to Article 19 of Law 8,213 of 1991, work accidents are defined as those that occur during the development of the employee's professional activities, resulting in physical or psychological damage, whether permanently or temporarily, as stated in the aforementioned Law:

> An occupational accident is one that occurs due to the exercise of work in the service of a company or domestic employer or by the exercise of work [...], causing bodily injury or functional disturbance that causes death or the loss or reduction, permanent or temporary, of the capacity to work. (BRAZIL, 1991).

It is essential for employers to recognize and assess the risks present in the work environment and implement preventive measures to ensure the safety and health of workers. This can include providing proper training, utilizing protective equipment, keeping facilities in safe condition, and promoting a culture of workplace safety. By prioritizing accident prevention and worker protection, it is possible to create a safer work environment and reduce the risk of incidents occurring. When safety measures are neglected or ignored, accidents become more likely to occur.

Data from the National Institute of Social Security (INSS) indicated 603,825 accidents and 2,694 work-related deaths in Brazil in 2023. In addition to the consequences on the health of workers and the lives of their families, occupational accidents generate economic impacts, reducing productivity. (SESI, 2024).

According to the Smartlab platform, organized by the Labor Prosecutor's Office and the International Labor Organization, the sum of the duration of each benefit granted allows you to calculate the number of lost working days. In 2022, 17.9 million days lost due to sick pay due to work accidents and 8.4 million days lost due to disability retirement due to work accidents were recorded in the country. (BRAZIL, 2023).

From January 2022 to July 25, 2023, the São Paulo State Department of Health (SES-SP) recorded 46.9 thousand work accidents and 177 deaths resulting from work accidents. (SÃO PAULO, 2023).

RISK OF FALLING FROM HEIGHT AND OCCUPATIONAL SAFETY STANDARDS

The risk of falling from height is common in various economic activities. Construction and building maintenance services are areas where this danger is particularly evident. The consequences of these accidents often result in serious injuries and can often be fatal. Therefore, working at height should be avoided whenever possible; however, when it is indispensable, it must follow the strictest safety criteria.

According to Regulatory Standard NR-35, work at height is defined as any activity performed at a height greater than 2.00 meters in relation to the lower level, where there is a risk of falling. To ensure the safety and physical and psychological integrity of workers, the occupational safety professional is based on legislation and specific safety standards. Among the standards applicable to work at height, NBR 16325-1 and NBR 16325-2 stand out, in addition to Regulatory Standards NR-18 and NR-35. In addition, FUNDACENTRO offers technical recommendations and procedures to ensure the safety of workers involved in work at height activities.

REGULATORY STANDARD 18

Regulatory Standard 18 (NR 18) establishes guidelines for the installation of anchor points, including minimum specifications for the anchoring equipment used. In its item 18.15.56.1, NR 18 defines the requirements for the installation of anchor points as follows:

> In buildings with at least four floors or a height of 12m (twelve meters) from the ground level, devices must be installed for the anchoring of scaffolding support equipment and safety cables for the use of personal protection to be used in the cleaning, maintenance and restoration services of facades. (BRAZIL, 2015).

Regulatory Standard 18 in its item 18.15.56.2 provides that anchor points must meet the following requirements:

- Be arranged in order to serve the entire perimeter of the building.
- To support a punctual load of 1,500 kgf (one thousand five hundred kilograms-force).
- Be included in the structural design of the building.
- Be made of weather-resistant material, such as stainless steel or material of equivalent characteristics.

It is pointed out that the product's identification items must be fixed to it. These items include information about the manufacturer, the constituent material, the strength of the product, and the serial number of the anchor point (BRASIL, 2015).

REGULATORY STANDARD NR 35

The Regulatory Standard NR 35 is a fundamental tool for professionals in the area of occupational safety who deal with the prevention of accidents at work at height. It establishes minimum requirements and protective measures to ensure the safety and health of workers exposed to risks in this type of activity.

This standard covers everything from planning to the execution of activities at height, aiming to protect the workers involved directly or indirectly. It is essential that professionals in the area are familiar with the details of NR 35 to ensure the safety of workers and prevent accidents.

NR 35 addresses the responsibilities of both employees and employers in the face of the risks involved in working at height, ensuring that all employee safety requirements are met. One of the essential steps highlighted is the Risk Analysis, which must be carried out whenever activities at height are performed. In addition, it is crucial to conduct an analysis of the safety conditions related to the structure and protective equipment involved.

The Risk Analysis must contain the following observations:

- The place where the services will be performed and its surroundings;
- Isolation and signage around the work area;
- The establishment of systems and anchor points;
- Adverse weather conditions;
- The selection, inspection, form of use and limitation of use of collective and individual protection systems, in compliance with current technical standards, manufacturers' guidelines and the principles of reducing impact and fall factors;
- The risk of falling materials and tools;
- Simultaneous work that presents specific risks;
- Compliance with the safety and health requirements contained in the other Regulatory standards;
- The additional risks;
- The impeding conditions;
- Emergencies and rescue and first aid planning, to reduce the time of inert suspension of the worker;
- There is a need for a communication system;
- The form of supervision. (BRAZIL, 2014)

Another important aspect that must be considered and is equally addressed by NR 35 is the training of the employee, ensuring that he is qualified to follow the guidelines of this Standard. In addition, the Standard emphasizes that the worker must be fit and

undergo periodic examinations, as stipulated in the company's Medical Control and Occupational Health Program (PCMSO).

Before starting activities at height, it is essential to carry out inspections of working conditions, including personal protective equipment, anchor points and other accessories. Anchor points should be checked for load resistance and quality at the time of purchase, and should be inspected periodically. They must be discarded immediately if they present any type of damage.

ANCHORING SYSTEM

The anchor point is defined as the specific location where the rope is attached to a mechanical element, which can be oriented vertically or horizontally. This point must be designed to withstand the load resulting from a fall or impact. An anchor system can consist of a single attachment point or multiple attachment points, which can be distributed or grouped in a single structure.

According to Paraná (2001), the anchor point is the structure responsible for supporting all the load applied in a vertical or horizontal system. It can consist of one or more attachment points, and may or may not be grouped in the same structure. It is essential to comply with criteria such as the strength of the mooring point, the location and the type of surface to ensure adequate safety.

> Anchoring is defined as the attachment of equipment to a structure, in order to be used by firefighters in an operation, and can be carried out for the safety of operators or transposition on horizontal, vertical and inclined cables. Reliable anchoring is absolutely essential to the performance of operations. An anchorage should be carried out whenever possible, in resistant structures, such as beams, columns and cable anchoring devices, however, when there is difficulty in using these types of structures, the firefighter should create his own anchor where a minimum of safety can be obtained. Like for example, a hole in the wall. Each anchor point, preferably, should be independent. The anchors must have a reinforcement point, that is, anchor at one point and reinforce it at another point, avoiding, in the event of failure of one of them, the collapse of the system. One form of anchoring that can be performed is through a hole made in the wall, but its resistance must be observed. The hole to be made in the wall, the closer to the floor, the better, as its resistance is greater. To anchor to the wall, a lever must be used to support the opposite side of the wall. Other places that can be used are: internal doors and windows, with the help of a lever and movable doors. Pipes, where good resistance is verified (fire pipes). Furniture can also be used, if necessary and the resistance has been checked. (GONÇALVES, 2001).

The Brazilian Army (2000) clarifies that anchor points are the bases used for any mooring; In reality, anchorages refer to maneuvers performed with ropes or tapes. These points must have characteristics that make them efficient for any maneuver performed by the professional, especially with regard to safety.

Buildings are subject to legislation that defines the criteria to ensure the safety of anchor points. According to current legislation, the anchor points of buildings must comply with the following requirements to ensure a minimum level of safety:

> Art. 5 Include in NR-18 item 18.15.6 - Anchoring, with the following wording:
> 18.15.56 - Anchoring
> 18.15.56.1 Buildings with at least four floors or a height of 12m (twelve meters) from the ground level must have provision for the installation of devices for the anchoring of scaffolding support equipment and safety cables for the use of personal protection, to be used in the cleaning, maintenance and restoration services of facades.
> 18.15.56.2 Anchor points shall:
> a) be arranged in such a way as to serve the entire perimeter of the building;
> b) to support a punctual load of 1,200 Kgf (one thousand two hundred kilograms-force);
> c) be included in the structural project of the building;
> d) be made of weather-resistant material, such as stainless steel or material with equivalent characteristics.
> 18.15.56.3 The anchor points of equipment and safety cables shall be independent.
> 18.15.56.4 Item 18.15.56.1 of this regulatory standard does not apply to buildings that have specific projects for the installation of definitive equipment for cleaning, maintenance and restoration of facades. (BRAZIL, 2006).

The safety of professionals who work at height and perform rescues in emergencies depends directly on the anchorages. To ensure proper anchorage, it is crucial to observe some basic safety requirements in order to avoid accidents during operation. These requirements cover the characteristics and specifications of the anchors, such as:

- Oversized carabiners with a capacity of more than 22 kN should always be used
- At least one carabiner must always be used at each anchor point, either at the Main Point or at the Secondary Point (lifeline);
- Avoid creating lever arms. Always try to tie the anchor at a point close to the base of the structure, as anchoring at a point farther from the structural base significantly increases the force applied to the structure, compromising the safety of the operation;
- Always build the Anchor System with at least two anchor points: the Main and the Secondary;
- Try to anchor yourself directly over the place of descent to avoid large pendulums;

TYPES OF ANCHOR POINTS (ABNT NBR 16325)

The anchor point is an integral component of a structure's anchoring system. As specified by the NBR 16325 Standard, it can be defined as "the point in an anchorage system to which personal protective equipment (PPE) is intended to be connected".

This standard establishes important guidelines on the correct installation, installation sheet, documentation and periodic inspections. In addition, it determines that the anchor points must be subjected to static and dynamic tests, according to a specific methodology for each type of anchorage.

The NBR 16325 Standard presents the types of anchor points:

Type A1: is an anchoring device designed to be attached to a structure by means of a structural anchor or a fastening element in a simple way, as described in Figure 1 (NBR, 16325a, 2014).

Figure 1: Type A1 Anchor Point. (JRV SERVICES, 2017).



Type A2: It differs from the type A1 anchoring device in that it is designed to be fixed to pitched roofs (NBR, 16325a, 2014).

Type B: It is a type of transportable anchorage device with one or more anchor points, as illustrated in Figures 2 and 3 (NBR, 16325a, 2014).

Figure 2: Type B Anchor Point. (JRV SERVICES, 2017).

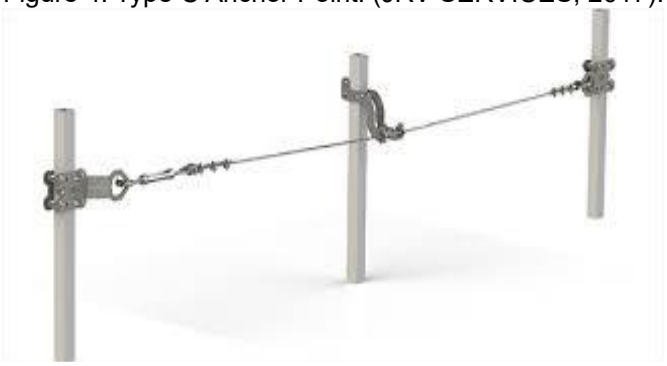


Figure 3: Type B Anchor Point. (JRV SERVICES, 2017).



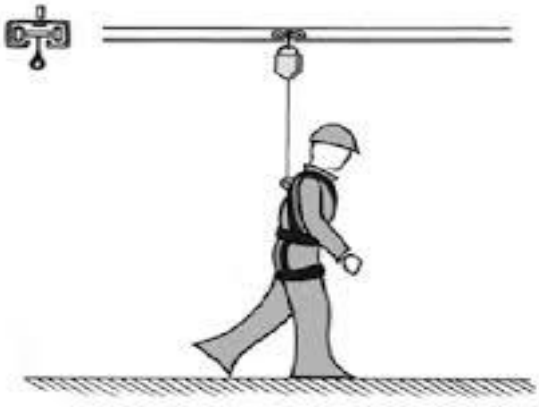
Type C: This type of anchoring device is the model used in horizontal flexible lifelines, and can be fixed to concrete or to rods fixed to concrete, as illustrated in Figure 4 (NBR, 16325b, 2014).

Figure 4: Type C Anchor Point. (JRV SERVICES, 2017).



Type D: This model of anchoring device employs a rigid anchor line that does not deviate from the horizontal plane by more than 15º. It is a rigid line made of metal rail, through which a trolley slides PPE must be connected to the trolley via an anchor point. Figure 5 exemplifies the type D anchor point model (NBR, 16325a, 2014).

Figure 5: Type D Anchor Point. (JRV SERVICES, 2017).



RESCUE AT HEIGHT

The activity of rescue at height is one of the missions of military firefighters, requiring extensive study and mastery of techniques to help victims in high places. In these scenarios, safety is essential to ensure the effectiveness of the operation. Souza (2011) points out that knowing the concept of rescue at height, anchor point, knots and equipment, whether individual or collective, is essential to arrive at the safe procedure for the practice of rescue at height. So we have:

> For the use of rescue at height, it is essential to use safety in the activity. The Military Firefighter who performs a rescue at height must ensure his own safety, not aggravate the victim's injuries and if necessary so that in no way does he run the risk of aggravating the situation, he can use and double or even triple the safety systems. (SOUZA, 2011).

Over the years, the techniques developed to improve the execution of rescue activities at height are constantly evolving, as well as the materials and methodologies applied in the vertical rescue process, resulting in a continuous improvement of rescue practices at height. (SÃO PAULO, 2006).

Thus, rescue at height is one of the activities carried out by professionals trained to access, stabilize and transport victims in emergencies. In this sense, the Military Fire Department of Santa Catarina (2010) highlights:

> Rescue at height is an activity developed by firefighters to locate, access, stabilize and transport victims through the use of rescue techniques in elevated places, based on safety standards and specific anchoring and lowering procedures. (SANTA CATARINA, 2010).

Rigoni (2007) emphasizes that, due to the high level of commitment required of professionals in rescue at height, it is essential to remember that, despite all the theoretical and technical knowledge, experience and common sense are essential. This is due to the fact that these professionals carry out their work under psychological pressure, where any mistake can have fatal consequences.

METHODOLOGY

This article was prepared based on the bibliographic research method, based on pre-existing sources and without direct practical application. According to Boccato (2006, p. 266), bibliographic research aims to develop solutions based on theoretical references already published, allowing analysis and discussions on these materials. In addition, it offers the researcher greater ease to access a wide range of information (GIL, 2002).

RESULTS

The anchoring system is essential for safety in work at height and rescue operations, preventing falls and protecting lives. Its correct implementation, in line with maintenance and regulatory standards, promotes safer and more reliable work environments, reducing accidents and meeting legal requirements. In addition to providing secure attachment for PPE, the system increases workers' confidence and efficiency, and is also vital in rescues, where its robustness can determine the success of the operation.

Its implementation reduces the number of accidents and increases the reliability of the work environment. The adoption of rigorous security practices contributes to the achievement of organizational and regulatory goals.

DISCUSSION

The anchoring system is an essential element in the safety of work at height and rescue operations, playing a vital role in preventing accidents and protecting workers. Its relevance is highlighted both for its technical functionality and for its contribution to the mitigation of risks in activity.

It consists of specific elements to resist effective forces, ensuring the safe attachment of personal protective equipment, such as seat belts, lanyards and safety ropes. Its main function is to efficiently distribute the loads generated by the worker's weight and the possible dynamic forces in the event of a fall. The reliability of this system provides workers with greater mobility and confidence to perform their duties, contributing to productivity.

In rescue operations, the robustness and reliability of the anchorage system are even more crucial. Rescues often operate in extreme conditions, where the lives of victims and the safety of rescuers depend on a well-designed anchorage in perfect working condition. In this context, failures in the system can have catastrophic consequences, highlighting the need for rigorous planning and constant maintenance.

The effectiveness of the anchoring system is intrinsically linked to compliance with technical and regulatory standards, such as NBR 16325-1 and NBR 16325-2, which establishes NR-18 and NR-35. It is important to note that regular inspections and preventive maintenance. Worn out or damaged equipment can compromise worker safety, making it essential to periodically evaluate the components and properly train the teams.

CONCLUSION

The safety of employees who work at height is directly associated with the use of an anchoring system. This system provides greater mobility during the execution of tasks, ensuring that, in the event of a slip, the worker is properly protected against falls. When it comes to working at height, the risks involved are significant and require special care to avoid accidents. In this context, the most appropriate protection and security system to be implemented is the anchoring system.

The anchoring system aims to withstand the forces applied in the event of a fall, keeping the body suspended. In this way, it is an indispensable component for carrying out activities that involve working at height.

According to the legislation in force, any work at height must be carried out with the help of an anchoring system to ensure the support and safety of the operator. According to the applicable principles, whenever a work is conducted above 2 meters in height, the use of the anchoring system will be mandatory. Examples of situations that require this measure include, among others, building, industrial and offshore maintenance, maintenance of machinery and equipment, cleaning and maintenance of roofs and facades, activities accessed by means of ropes, and rescue operations at height.

The observation of safety items and the monitoring of activities carried out at height are extremely important to ensure that work at height is performed without putting the employee's life at risk. The anchor point is indispensable in emergency rescue situations. In this way, it must be correctly distributed and installed at the main points of the structures, thus ensuring the necessary safety.

Importantly, the provision of anchor points in a workplace should not be based on faith, unfounded optimism, or guesswork. The apparent robustness of an anchor point or structure where an anchor will be installed is not sufficient if there are no technical guarantees of its reliability.

To ensure the reliability of an anchoring system, a number of requirements must be met, including the characteristics and test methodologies of anchoring devices, the design, installation and inspection of anchoring systems, as well as the documentation required for traceability, control and auditing purposes.

Periodic inspection of the anchoring system should be carried out at least every 12 months to ensure its reliability. However, in environments that are harsh on the system materials or in the event of more intense use than initially planned, it is recommended to carry out inspections at shorter intervals. These additional inspections are necessary to ensure the safety and proper performance of the anchoring system.

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DISRUPTIVE INNOVATIONS: ARTIFICIAL INTELLIGENCE, BLOCKCHAIN, IINTERNET OF THINGS, AND BIG DATA IN THE TRANSFORMATION OF ENTERPRISE FINANCE

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ABSTRACT

The research aims to analyze the applicability of the main disruptive technologies, with an emphasis on Artificial Intelligence (AI), Blockchain, Internet of Things (IoT) and Big Data, in the accounting and financial transformation of companies, highlighting their impacts on process automation, optimization of strategic decision-making and improvement of the efficiency and transparency of financial operations. Methodologically, this is a qualitative research and uses an integrative literature review to investigate how intense technological innovations are being implemented and what impacts they generate on business practices, notably accounting. The analysis focuses on the benefits, challenges, and opportunities provided by artificial intelligence, exploring its role in automating accounting and financial processes, improving the accuracy of analysis, and optimizing decision-making. In addition, the relevance of artificial intelligence in optimizing decision-making is discussed. The study also addresses the ethical implications and cultural adaptation needs that come with implementing these technologies. The results denote improved accuracy and minimization of errors in accounting processes due to the ability to identify inconsistencies and inconsistencies, highlighting the transformative potential that AIs present in the accounting and financial field, notably due to the automation of processes, the improvement of accuracy.

Keywords: Disruptive Technologies. Artificial intelligence. Digital Transformation. Innovations.

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INTRODUCTION

Disruptive Technology refers to that whose insertion in the market is capable of changing or breaking paradigms established within companies or industries, whether in their internal operations, or in their mode of production or in the delivery of their final product (Schuelke-Leech, 2018; Gawanmeh; Al-Karaki, 2021). The accelerated advancement of these technologies has significantly transformed several sectors of the economy, including the accounting and financial areas. Innovative tools are being rapidly implemented, and topics such as Artificial Intelligence (AI), Blockchain, Robotic Process Automation (RPA), Machine Learning, and Big Data dominate business discussions, especially with regard to the applicability, information security, and cost-effectiveness of these technologies (Gawanmeh; Al-Karaki, 2021; Hopster, 2021; Stroparo *et al.*, 2024, Stroparo, 2021)

In the extensive literature available, it can be seen that these disruptive technologies are being applied in several areas, with special emphasis on corporate finance. AI-based tools have been widely adopted to automate processes, improve the accuracy of analyses, and optimize decision-making in companies (Ajayi-Nifise et al., 2024; Arrieta et al., 2020; Bahoo et al., 2024; Nath et al., 2024; Sharbek, 2024). Specifically in the accounting and financial area, the impact is not limited to the automation of routine tasks; such technologies also promote new levels of predictive analysis, risk management, and transparency in financial operations (Pordeus; Stroparo, 2021; Branches; Stroparo; Cordeiro, 2021)

The use of Blockchain Accounting (BCA) is another crucial example of how accounting has been transformed. Blockchain technology offers a layer of security and immutability of accounting records, allowing for continuous and automatic audits, eliminating the need for intermediaries and ensuring greater transparency in financial records. In addition, smart contracts running on the blockchain automate processes such as paying suppliers and settling contracts, reducing delays and operational costs (Stroparo, 2024).

The impact of Internet of Things Accounting (IOTA) is also significant, with IoT sensors integrated into accounting systems, allowing for real-time inventory control and physical asset management. The combination of IoT with Big Data Accounting (BDA) makes it possible to collect and analyze large volumes of data, improving the accuracy of financial projections and allowing for a more agile response to market variations and operational demands (Hopster, 2021).

The revolution caused by these disruptive technologies is so intense that international bodies such as the International Financial Reporting Standards (IFRS) and the United Nations (UN) play crucial roles in creating guidelines and standards that harmonize the adoption of these technologies with the principles of corporate governance and social

responsibility. The International Accounting Standards Board (IASB), which is responsible for overseeing IFRS, recognizes the need to adapt accounting standards to reflect these transformations. This includes analyzing the use of algorithms in accounting decision-making and the impact of automation on the preparation and presentation of financial statements.

Furthermore, Artificial Intelligence (AI), as a fundamental disruptive technology, remains a driving force in advancing process automation, from the simplest tasks to strategic decision-making. AI is capable of analyzing large volumes of data, identifying financial patterns, and anticipating market trends, making it an essential tool for optimizing accounting and financial processes (Black; Samson; Ellis, 2024; Carolan, 2024; Stroparo, 2024; Stroparo et al., 2024; Stroparo *et al.*, 2024b)

In this context, the research aims to analyze the applicability of disruptive technologies, focusing on tools such as AI, Blockchain, IoT and Big Data, in the accounting and financial transformation of companies. By exploring the impact of these innovations on automation, operational efficiency, and improved transparency, the study aims to provide a comprehensive overview of the future of business finance and the role of these technologies in optimizing processes and decision-making.

METHODOLOGY

The present research is characterized as qualitative and uses an integrative literature review to analyze findings in similar research. Therefore, it seeks to identify and synthesize published studies and analyze

the applicability of disruptive technologies, with an emphasis on AI tools, Blockchain Accounting (BCA), Internet of Things Accounting (IOTA) and Big Data Accounting (BDA) in the accounting and financial transformation of companies.

To ensure the scope and relevance of the studies, searches for scientific articles were carried out in the Web of Science, Scopus and ScienceDirect databases, using the following descriptors: "Artificial Intelligence in Accounting", "Disruptive Technologies in Finance", "Financial Transformation", "Automation in Corporate Finance", "AI in Business Decision-Making", "Blockchain Accounting", "IoT in Accounting" and "Big Data Accounting". These descriptors were chosen in order to ensure that the studies found address in a broad and deep way the impact of disruptive technologies on accounting.

The inclusion criteria adopted were: articles published in peer-reviewed journals; studies that discuss the application of AI in accounting and corporate finance; publications in English or Portuguese; and recent and/or classic studies with a significant number of

academic citations, ensuring the timeliness and relevance of the data. Texts related to the automation of financial processes, the improvement of accounting efficiency, and the optimization of strategic decision-making through AI were also included. In this bias, articles that did not directly address the accounting or financial transformation of companies, duplicate publications, and studies with insufficient methodology or inconclusive data were excluded from the portfolio.

Official documents and guidelines issued by professional bodies and government initiatives for the regulation and regulation of AI's are part of the discussions and, in a special way, we are interested in statements made by the International Financial Reporting Standards (IFRS), the body responsible for the International Accounting Standards used to standardize and harmonize the preparation and presentation of financial statements of companies around the world and the United Nations that issued the first global standards to govern artificial intelligence in the organization's 193 member countries.

RESULTS AND DISCUSSIONS

In a scenario where organizations face an environment of high competitiveness and rapid technological changes, it is crucial that they adjust their interactions with the environment in a coordinated and integrated way. This strategic alignment is essential for them to fulfill their missions and ensure their future sustainability

According to Armstrong (2019), disruptive technology generates a lot of conflict and contestation among critics regarding the applicability of this term, as many believe that it must follow certain criteria. This technology has two main attributes which are speed and completeness that can be clearly seen in the new technologies that are emerging, where technology quickly updates or replaces old processes (Zeng *et al.*, 2023)

Among the disruptive technologies described in the academic literature are Artificial Intelligence (AI), *Blockchain***,** robotic process automation (RPA), machine learning, and *big data.*

AI is a comprehensive set of technologies that promise several advantages for organizations in terms of added value to the business (Hariri et al., 2019). Characterized as a disruptive force for companies around the world, AI appears to be underutilized in a wide range of sectors. (Gawanmeh; Al-Karaki, 2021; Hopster, 2021, 2024; Stroparo *et al.*, 2024)

Economically, AI is considered one of the most influential innovations of humanity, as it significantly impacts the financial market, particularly the technological sector. Projections indicate that the expected revenue over the next decade will increase to 2.74 billion dollars and the estimated global size of the Artificial Intelligence market stood at US$ 129.28 billion

in 2022 and is expected to exceed US$ 2.7 trillion by 2032 (Bonaparte, 2024; Stroparo *et al.*, 2024)

Research conducted by (Wassie; Lakatos, 2024) discusses how AI can support the company's internal audit (IAF) by providing substantial strategic oversight, minimizing manual procedures, and enabling additional value-added audit services. However, it shows concern about research gaps in the literature, such as limited studies on the topic, low adoption rates of AI in the IAF in different countries and regions, and a dearth of comprehensive frameworks for the effective use of AI in the IAF, as well as related to data ethics and security.

Study by (Zayed *et al.*, 2024) examined the role of artificial intelligence (data collection, automation, accurate reporting, improved efficiency, and predictive analytics) in accounting information systems in fraud detection and prevention. It used a quantitative approach in a sample of 187 financial and accounting managers in the hotel industry in Jordan. The results of the study conclude that artificial intelligence can be positively influential in detecting fraud.

Dealing specifically with the related ethical issues, such as transparency of algorithms, the potential for bias, data integrity and security, and privacy have been discussed frequently and in a warning tone. In addition, several international bodies are making official studies related to regulation on the role of accounting professionals as guardians of ethics (Bankins; Formosa, 2023; Eke; Stahl, 2024; Hinings; Gegenhuber; Greenwood, 2018)

In addition, among the applications of disruptive technologies and AI, the automation of routine accounting tasks, such as bank reconciliation, preliminary audits, cash flow analysis, and tax calculation, stands out. The available tools help in the processing of large volumes of data quickly and accurately (Ajayi-Nifise *et al.*, 2024; Hasan, 2021; Novelli; Taddeo; Floridi, 2023; Stroparo *et al.*, 2024). It was also found in the literature that the use of AI tools provides improved accuracy and minimizes errors in accounting processes due to the ability to identify inconsistencies and inconsistencies (Hasan, 2021). AI can also generate more detailed and personalized reports, meeting specific requirements, which, in theory, results in greater transparency in financial statements.

AI, applied in accounting and finance, is one of the most transformative technologies, as it has the ability to automate routine processes, such as account reconciliation, transaction verification, and financial reporting (Chen; Read; Li, 2020; Stroparo *et al.*, 2024). Examples of AI application in the business area can be cited: a) Predictive Analysis, which consists of anticipating financial trends, predicting cash flows, and identifying financial risks

using historical data patterns; b) Natural Language Processing (NLP), which aims to automate the reading and interpretation of accounting documents considered complex, such as contracts and financial statements; c) Audits aimed at detecting errors and/or financial fraud.

AI, therefore, represents a milestone in technological development, providing systems with the ability to emulate aspects of human cognition. This simulation transcends the execution of predetermined commands, allowing machines to make independent choices by analyzing trends in vast amounts of data (Barbosa; Portes, 2023). (Al-Okaily, 2024; Ballantine; Boyce; Stoner, 2024)

With regard to financial processes, companies need to carry out transactions, which include accounts payable and receivable, sales forecasting, monitoring, and expense reporting. With the implementation of smart technology, accountants have access to more accurate and detailed information to perform predictive and prescriptive financial analysis for their clients. This can make financial processes more efficient, accurate, and profitable. Predictive and prescriptive analytics are two comprehensive outcomes of the application of AI in accounting (Santos, 2023).

Within the accounting sphere, especially in management, it is crucial to consider the frequent transformations and increasing automation and technological integration. AI is one particular example that is reshaping the industry. As a result, accounting is evolving, absorbing new ideas and roles, while advanced technologies are replacing manual tasks (Stroparo *et al.*, 2024a)

Like other cutting-edge, high-risk technologies, including biotechnology, metaverse virtual realities, and nanotechnology, AI shares essential characteristics: it is a disruptive innovation; it appears relatively quickly; maintains consistency over time; it has a significant impact on society and the economy; and provokes a mixture of fear and indecision (Del Castillo, 2024).

On the other hand, blockchain technology, can be characterized as a decentralized digital ledger that securely records and verifies transactions on a distributed network, and is often described as the backbone of modern digital currency systems (Degirmenci; Recker, 2023)

Predictions from the World Economic Forum (2015) assert that since blockchain technology was first described in 2008, the banking, financial, insurance, education, healthcare, and government sectors have used it to the point that 10% of global GDP will be recorded and stored on blockchain by 2027 (Han *et al.*, 2023)

According to the *Institute of Chartered Accountants in England and Wales (ICAEW)* - in Portuguese, Blockchain is not a single technology, but rather a protocol — a way of doing things — to record transactions. Unlike the Internet, in which data is shared, on a blockchain ownership can be transferred from one party to another. Blockchain is a desirable model for several reasons. For example, in a market with many parties transacting, it could remove the need to reconcile disparate ledgers. Being distributed among all users also eliminates disruptions and removes the cost of having to pay a central authority to maintain ledger accuracy. Any participant in the ledger can track all past transactions, allowing for greater transparency and blockchain for self-auditing (ICAEW, 2018) (Han *et al.*, 2023)

Currently, it is possible to find studies relating blockchain technology in fields that require high performance, security, transparency, and cost efficiency, notably related to the Bitcoin cryptocurrency (Alamsyah; Syahrir, 2024; Bonsón; Bednárová, 2019; Han *et al.*, 2023; Lee *et al.*, 2019; Weerawarna; Miah; Shao, 2023). However, the use for accounting purposes has been notably expanded by the financial sector.

The research entitled "Accounting and Auditing with Blockchain Technology and Artificial Intelligence: A Literature Review" discusses how blockchain is transforming accounting and enterprise finance, detailing the transparency, immutability, and efficiency of accounting and auditing practices (Han *et al.*, 2023).

In this bias, BCA can also be mentioned, which is the use of blockchain technology to record, verify, and validate financial transactions on a distributed and immutable ledger. Such characteristics make BCA one of the main disruptive technologies that redefine accounting and financial practices because it eliminates intermediaries, reduces fraud, and improves the integrity of financial data (Bonsón; Bednárová, 2019)

Regarding the BCA tool, the results point to an improvement in transparency, immutability and efficiency in accounting and auditing practices. Continuous Auditing and Automation, for example, are cited as examples of areas that benefit from Blockchain because it allows real-time analysis (Han *et al.*, 2023)

Another important point is risk mitigation and greater transparency regarding financial analysis. This fact is justified by the fact that blockchain offers traceability and immutability of records, which can reduce fraud (Alamsyah; Syahrir, 2024; Bonsón; Bednárová, 2019; Gadekallu *et al.*, 2022; Han *et al.*, 2023). Therefore, BCA can make a significant impact by providing transparency, real-time tracking, and security for accounting practices. An example might be the use of BCA to automate audit processes, eliminating intermediaries and facilitating ongoing audits. One can discuss case studies of companies that already use BCA to improve the accuracy and security of their financial records.

Another technology that can be cited in this research is Internet of Things Accounting (IOTA) which refers to the use of the Internet of Things (IoT) to collect real-time data related to operational and financial processes. IoT sensors can generate financial data from assets, inventories, and operations in real time, integrating it into the accounting system

As for IOTA, it is verified that the use of IoT sensors in accounting can be expanded to **physical asset management** and **inventory control**, where data can be recorded and controlled in real time and directly [integrated with accounting systems, reducing human errors and improving financial control. Cost management can also benefit from IOTA tools to optimize operating spend, based on resource usage data. Therefore, IOTA adds a layer of automation and real-time monitoring to accounting, allowing operational data to be transformed directly into financial information without the need for intermediaries. This is highly disruptive and offers companies greater cost control, asset management, and financial predictability

On the other hand, concepts related to Big Data refer to the ability to analyze large volumes of structured and unstructured data in real time, and its use is common by the accounting and financial sectors. Applying to accounting, it is common to find **"Big Data Accounting (BDA)"** which is the use of big data for advanced analysis of financial data, combining large volumes of internal and external data to improve accounting and financial decision-making.

BDA, therefore, refers to large volumes of complex data that cannot be managed or processed with traditional data analysis tools and are usually analyzed under the scope of the 5V': a) Volume: The massive amount of data generated by various sources, such as financial transactions, social networks, IoT sensors, among others; b) Speed: Data being processed and analyzed in real time; c) Variety: It is related to the diversity of data, which can be structured (such as database tables) and unstructured (such as images, videos or texts); d) Veracity: The reliability of the information generated needs precision and accuracy and; e) Value: The usefulness and potential of data can generate competitive advantages for companies.

Chart 1 lists some examples of technology from each of the disruptive technologies discussed in this article:

TABLE 1 Technologies applicable to Corporate Finance

DISRUPTIVE TECHNOLOGY	APPLICATION	DESCRIPTION
Artificial Intelligence (AI)	QuickBooks	Automates accounting tasks, expense categorization, and cash flow analysis.
Artificial Intelligence (AI)	Xero	Simplifies accounting by automating bank reconciliations and cash flow forecasting
Artificial Intelligence (AI)	IBM Watson	Used in various industries for predictive analytics and financial risk analysis.
Blockchain Accounting (BCA)	VeChain	It offers product tracking solutions and real-time monitoring in supply chains.
Blockchain Accounting (BCA)	Chainalysis	Transaction analysis tool for regulatory compliance and fraud prevention.
Blockchain Accounting (BCA)	Ethereum Smart Contracts	Automates financial transactions and trade contracts, reducing the need for intermediaries.
Internet of Things Accounting (IOTA)	Zebra Technologies	Inventory management and asset monitoring with IoT sensors.
Internet of Things Accounting (IOTA)	Honeywell Asset Management	Monitors equipment performance in real time, assisting in predictive maintenance.
Internet of Things Accounting (IOTA)	Microsoft Azure IoT Central	Real-time asset monitoring and management platform, with integration with business systems.
Big Data Accounting (BDA)	Tableau	Visualization tool that transforms large volumes of data into visual insights.
Big Data Accounting (BDA)	Google BigQuery	A service for the rapid analysis of large volumes of data, used to understand consumption patterns.
Big Data Accounting (BDA)	Hadoop	Big Data processing and storage platform for complex analytics.

Source: The authors, (2024)

Chart 1 presents a selection of applications characterized as disruptive technologies and applicable to the context of accounting and corporate finance, highlighting AI, BCA, IOTA and BDA tools. Each technology category is represented by exemplary applications that reveal its transformative potential in different accounting processes.

In the area of AI, applications such as QuickBooks and Xero stand out, which aim to automate basic accounting processes, including expense categorization and bank reconciliations. On the other hand, the IBM Watson application further extends the application of AI by offering advanced predictive analytics capabilities, which demonstrates its potential in risk management and generating strategic financial insights.

For BCA, tools such as VeChain and Chainalysis that use blockchain for tracking and regulatory compliance have been identified. The decentralized and immutable nature of blockchain strengthens the integrity of financial records and simplifies ongoing audits, eliminating intermediaries and reducing fraud. Ethereum Smart Contracts, meanwhile, shows how BCA can automate financial transactions, making trade contracts more secure and reducing reliance on manual processes.

In the IOTA category, the application of IoT sensors, as in Zebra Technologies and Honeywell Asset Management, to manage assets and monitor inventories in real time is observed, allowing for more effective management of operational resources and providing precise cost control. In turn, Microsoft Azure IoT Central exemplifies how real-time data integration into accounting systems enables a comprehensive and up-to-date view of financial operations, increasing predictability and cost control.

Finally, bringing examples of BDA applied to the analysis of large volumes of data, there are tools such as Tableau and Google BigQuery that have the potential to transform vast data sets into visual and predictive statements. Hadoop, on the other hand, is an example of Big Data storage and processing for companies that need to manage and process varied data quickly and reliably, allowing complex analyses that directly contribute to more informed financial management.

Therefore, it is not just about automation, but about the incorporation of new technologies capable of transforming the financial structure of companies themselves, allowing unprecedented levels of precision, accuracy, security, and intelligence in accounting processes.

FINAL CONSIDERATIONS

The research aimed to analyze the applicability of the main disruptive technologies, with an emphasis on AI, BCA, IOTA and BDA, in the accounting and financial transformation of companies, highlighting their impacts on process automation, optimization of strategic decision-making and improvement of the efficiency and transparency of financial operations and the results point out that disruptive innovations — especially AI, IoT and Big Data — are redefining accounting and financial practices in companies in a profound and irreversible way.

Such technologies not only automate routine processes, but have the power to bring new possibilities for predictive analysis, risk management, and optimization of strategic decision-making.

The adoption of AI in the business context has proven to be a useful tool by transforming manual processes such as account reconciliation, audits, and financial reporting into automated activities, with greater accuracy and efficiency. Also noteworthy is AI's ability to identify patterns and inconsistencies in large volumes of data provides predictive analysis that strengthens financial management, increasing the agility of decisions and minimizing errors.

On the other hand, BCA, when implemented, enables significant improvements in terms of transparency, security, and efficiency in accounting practices, especially in audits and transaction verification. The fact that data is immutable on the blockchain allows for greater trust in financial records, reducing the need for intermediaries and promoting continuous and automated audits, while reducing fraud.

As for IOTA, the results point out that by adding a layer of real-time automation, improving the ability to monitor assets and inventories in real time allows for the optimization of costs and resources.

The BDA tool allows the analysis of large volumes of data, internal and external, streamlining strategic decision-making processes and forecasting financial trends, and this is due to the high capacity for processing and analyzing data from various sources in time.

However, one cannot abstain from ethical challenges such as algorithmic transparency, data privacy, and bias prevention, which, in fact, can be translated as critical areas that require continuous attention from governance policies and internal and external regulatory frameworks.

In short, disruptive innovations are not only transforming the way businesses conduct their finances but also shaping the future of accounting and financial practices in a more efficient, transparent, and secure way.

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CONFLICT MEDIATION IN DIVORCE CASES WITH CHILDREN: CONTRIBUTIONS OF PSYCHOLOGY

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ABSTRACT

The article aims to discuss the contributions of Psychology in the Brazilian judicial system in cases of divorce with children aged up to 18 years. For the preparation of the theoretical essay, the techniques used and the challenges encountered by professionals working with mediation practices in the judicial system were investigated, through a bibliographic review in the CAPES, Scielo and Google Scholar databases, with priority for works published between the years 2019 and 2023. The works, selected in accordance with the specificity of the study, provided relevant information about the reality of the psychologist who works as a mediator in Brazil. The results highlight the interdisciplinary nature of their work, the scarcity of longitudinal research with a robust theoretical basis for action, challenges to demarcate the limits, as well as evidenced the precarious working conditions to which mediators, mostly women, are subjected, influencing the scenario and the need for future research.

Keywords: Forensic Psychology. Mediation. Divorce.

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INTRODUCTION

The social, economic and emotional impacts of divorce can be reduced with preventive actions and with judicial procedures appropriate to cases in which there is litigation (CÉZAR-FERREIRA, 2004; FERREIRA, 2015; ALVES, 2023). The significant increase of 5.5 percentage points in the rate of judicial divorces granted in the first instance in Brazil, between 2010 and 2021, to couples who had children under 18 years of age (IBGE, 2021), justifies the discussion about the potential contribution of Psychology to the Brazilian Judicial System through conflict mediation.

Marital separation, which involves negative emotions, such as anger and sadness and often modifies the condition of family life, tends to be more harmful when the arguments witnessed by children become frequent and violent, even if verbally and psychologically. Violence is harmful to the development of all family members, aggravates and is aggravated by vulnerability factors to which the family is subject (FEIJÓ et al., 2017). Financial dependence at the time of divorce, the difficulty in balancing family and work, and material precariousness, which can worsen after divorce, are psychosocial factors that require care in most families with children, also because they can impair the joint work of raising children, which becomes more difficult in situations of continuous conflicts between parents and in a tense environment with difficulties in the exercise of parental functions (CÉZAR-FERREIRA, 2004; LIMA, et al., 2021).

Public policies to prevent and cope with divorce processes should include conflict mediation services and support for families to care for their children and their development during the divorce process and in the post-divorce period. In the equipment of the judiciary, pre-procedural and procedural mediation (BRASIL, 2015**)** can prevent the aggravation of fights and prevent disputes or prolonged litigious divorce, which is costly and emotionally exhausting. Companies and Schools should also create policies favorable to the development of people who go through divorce, especially for those who have restricted access to support networks and rights. Spouses should be provided with informative actions, dialogue groups and reflections, with specific support for those who start to take care of children alone, who may demand opportunities for work, daycare or school for children close to their home and at a time compatible with their working hours (SORIA, 2008).

Another relevant issue that may originate from a conflicting divorce process, justifying the importance of mediation, is the presence of work-family conflict. If we consider that work and family are two of the most important spheres of life for individuals, and that it is increasingly common for both spouses to have work activities in work organizations,

considering a possible conflict between these two spheres after a painful divorce process is necessary. Carvalho (2024) argues that work-family conflict is a potential stressor that emerges from the need to manage work demands and family duties/responsibilities. In his study with 438 teachers from the basic education network of cities in the southern region of Minas Gerais, he revealed, among others, that the work-family conflict had a significant relationship with the presence of common mental disorders (MCD), thus evidencing risks to the mental health of the participants.

Mediators of family cases, in addition to adequate training, must develop the ability to dialogue, empathy, the use of mediation resources and techniques, and a systemic view of human health and quality of life. In a firm attempt to maintain impartiality in dialogues with spouses in the process of divorce, they must keep in mind that people and relationships are unique, without judging them to strengthen them. Training in psychology tends to prepare professionals for the least discriminatory attitude and for dialogues in favor of autonomy, protagonism, and valuing differences (CHAVES et al., 2022).

This article is structured around research on the contributions of Psychology in the Brazilian legal context, in cases of divorce mediation with children up to 18 years old, for which theories and mediation techniques used were studied, in addition to identifying challenges and obstacles faced in these practices.

METHODOLOGY

The theoretical essay was produced after conducting a bibliographic review, with a qualitative design, which focuses on the understanding and interpretation of social and human phenomena, involving the collection of descriptive data. This follows an exploratory approach to investigate the topic in a broad and initial way, especially when there is scarce prior information available. Exploratory research plays a key role in defining focus and scoping, laying the groundwork for further investigation (SOARES, 2019).

Research sources included the CAPES, Scielo, and Google Scholar databases. Only articles in Portuguese that dealt with mediation in the judiciary were selected, with free access. The period for collecting materials was delimited by the period from 2019 to 2023. A careful evaluation was carried out to exclude works that involved the work of professionals from other areas in the context of mediation and restorative practices, selecting only those related to the area of Psychology, meeting the pre-established objectives. The keywords used in the search were "Forensic Psychology", "Mediation" and "Divorce".

According to the proposal for a qualitative study, it focused on the understanding and interpretation of social and human phenomena, involving the collection of descriptive data and exploratory conduct to investigate the theme in a broad and initial way, since there was scarce previous information available. According to Soares (2020), exploratory research plays a fundamental role in defining the focus and delimiting the scope, laying the foundations for more in-depth investigations.

Regarding the research problem, questions were listed to guide the guideline of the scientific works to be researched and the general objective was established: To analyze the contributions of Psychology in the Brazilian legal context in cases of divorce mediation with children under 18 years of age. Specifically, theories and techniques of psychological intervention used in the process of conflict mediation were investigated, and the challenges and obstacles faced by Psychology in the Brazilian Judicial System in the context of mediation of family conflicts were identified, according to the authors of the articles found. This essay focuses on conflict mediation as an important means of access to the judiciary for spouses in divorce proceedings, and those with children under 18 years of age are a population that may benefit from this practice. Other measures and policies necessary for this population and favorable to the development of their children will be pointed out as reflections generated after the bibliographic review.

In order to broaden the discussion of the theme of the study towards the proposed objectives, making considerations about concepts of related subjects becomes significant.

CONCEPT OF FAMILY

The concept of family has been transformed over time and, in the past, it used to be associated with a structure composed of a man, a woman and a child, which was in accordance with the old Constitution of 1916, but not necessarily with the different forms of family configuration that already existed. In addition to the current social legitimation of the heteronormative configuration, it is important to note that, in the past, children born out of wedlock were not considered members of the family in the legal sphere, as stated in Article 358 of the aforementioned Constitution:

"Incestuous children and adulterines cannot be recognized."

Thus, the only recognized way to form a family was through marriage between people of opposite sexes. In addition, legal separation, as we understand it today, could only occur in cases of adultery, attempted murder or serious assault, or voluntary abandonment of the marital home for a period of two continuous years, according to Article 319 of the Civil Code of 1916.

In 1988, the "Citizen Constitution" was promulgated, which, in response to social changes, established values centered on human dignity. In this context, the concept of family began to be approached in a more inclusive way, although it still maintained heteronormative characteristics. This Constitution also simplified the divorce process and recognized equal rights between men and women in marriage, as established in article 226 of the Federal Constitution of 1988.

In 2002, the Civil Code began to consider that the fundamental element in the constitution of a family is affection and responsibility, abandoning the exclusively biological perspective, which was based on the relationship of consanguineous father and mother. Instead, it began to value care, coexistence, and solidarity (VILASBOAS, 2020), generating new possibilities for legitimizing some family configurations and the growing reflection on family expectations and roles, especially related to gender, such as same-sex unions.

Same-sex unions are a way of forming a family, which in the process of social legitimation, have challenged society to understand that there are different ways of loving, of organizing oneself as a family, of dividing and performing functions, including in the education of children and in the case of adoption.

> A father is the one who educates, cares, feeds, protects, provides and participates in the physical, moral, psychic and intellectual development of the child, offering him any and all support that is necessary for his growth and evolution as a human being. In many cases, the child who lives in a state of affective possession with his parents is much better raised and socially and psychologically supported than if he were with his biological parents Vilasboas (2020, p.59).

According to Cerveny (2011), families are two or more people united by affection or consanguinity, without necessarily cohabiting. Regardless of the family configuration, relational difficulties and interpersonal conflicts will arise and may turn into disputes. Violence can also occur and in conditions of social vulnerability it tends to worsen when there is a lack of support and social legitimacy (FEIJÓ et al., 2017).

CONSIDERATIONS ABOUT THE CONFLICT

In marital relationships, whether in the heteronormative context or not, partners need to dialogue and face interpersonal conflicts, since, as highlighted by Vasconcelos (2008), conflict, which is a contingency of the human condition, stems from different perceptions and positions between individuals and is the result of their life history. According to the author, ten thousand years ago, with the development of agriculture and livestock, the transformation of sedentary nomadic communities and the development of private property and the accumulation of wealth, conflict became an instrument of power, domination and a

means to establish hierarchical relations that culminated in absolutism and its centralized power figures.

If in the first civilizations conflict was part of a culture of domination, in which hierarchy, patrimonialism, absolutism and predatory competition prevailed, in the current "Age of Knowledge", conflicts can occur between people and groups that are geographically distant or with different cultures and habits. In some places, domination and violence are still structural and current, but often discussed with different critiques of criticality, in the light, for example, of human rights and the need to build a culture of peace and collaboration. In certain groups, conflict is predominantly expressed in the form of persuasion or negotiation and, in some institutions, resources such as mediation may be used in attempts to generate mutual gains and to consider differences and pluralities (VASCONCELOS., 2008.).

Marital conflicts, as dynamic processes, in constant interaction with historical contexts, have undergone modifications, but it is possible to affirm that each couple is a couple and that the archaic coexists with the modern both in family relations (CERVENY, 2011). There are partners who have already modified certain patterns and expectations related to gender, but there are those who still reproduce most of them. Families with young children have also experienced the impact of living with a new generation, which demands a more open look at the new and attentive to the growing demand for care for psychological suffering (FEIJÓ, 2021).

Nowadays, marital relations occur, among numerous influences, through affective and parenting bonds, but this has not always been the reality. In Roman Law, the family was centered on the father figure and its formation had as its objective the production and protection of patrimony, with the wife and children being tools to achieve this goal in a passive and submissive way. This perspective of the conjugal relationship lasted later, under the influence of the Catholic Church, which characterized marriage as an indissoluble entity and accepted the affective relationship of marriage with the exclusive purpose of procreation. Thus, there was no room for discussion about marital conflict, nor about the tools for resolving these conflicts and guaranteeing rights, expressed today, for example, by the possibility of divorce and division of assets (SCHAEFER & SPENGLER, 2020).

Marital conflict is a multidimensional and multicausal phenomenon, characterized by the frequency with which it occurs, the intensity of the arguments, the cause of the conflicting situations, the recognition of the spouses about the existence or not of these conflicts, and the strategies used to resolve them. Costa et al. (2016), in a systematic review study, pointed out disagreements in child rearing, time spent together, money,

household chores, and infidelity as reasons for the disputes. Dialogues about conflicts that generate opportunities for expression and the creation of coexistence agreements are favorable to relationships or constructive, as treated in the literature. The constructive strategies for resolving marital conflict are directed towards more flexible and tolerant attitudes of the couple in the face of the problem, the recognition of the spouse's capacities and limitations, the optimistic perception of conflicts and the manifestation of mutual responsibility in the resolution strategies. Destructive strategies, on the other hand, involve individualized behaviors in the face of marital issues and competition between spouses, who assume a posture of attack and/or self-protection in order to 'win' the dispute in question. Destructive strategies often result in divorce and the end of that marital relationship (COSTA et al., 2016).

Divorce appears in history in the previously mentioned context of written culture, in which conflicts acquire rhetoric, negotiation and respect for individualities and plurality. In this context, in some families, more equitable relationships are developed with regard to the roles of spouses, with more symmetrical power relations. In addition, marriage is seen as an optional relationship, replacing the Christian notion of indissoluble marriage. Divorce comes, therefore, to meet this new historical context of marital relations (SANTOS, 2023).

In Brazil, marital dissolution appears only in 1916 in the Civil Code, in which it was allowed only in the case of death, annulment or amicable/contentious legal separation, following a series of criteria that certainly made the divorce process difficult. Subsequently, in 1977, the Divorce Law was enacted, which reduced the stiffening of the marital dissolution process by respecting the individual interest of not being in a marriage regardless of the reason, but still maintained the impossibility of forming new relationships. Currently, divorce is governed by Constitutional Amendment No. 66 of 2010, which among its prominent articles is the possibility of immediate divorce (SANTOS, 2023).

The possibility of divorce, an important milestone for the promotion of gender equality and respect for the autonomy of the individual, can mean for some, the rupture of a desired family structure and the arrival of intense feelings and difficult challenges, very often economic and care for children or people who are more dependent. In the case of relationships that constitute offspring, the quality of the marital relationship can greatly affect parenting and the quality of living with children, depending on how the divorce process takes place, the social support for the former spouses and the children and the decisions and measures to maintain psychosocial aspects that are protective and generate well-being. such as sustenance (housing, food, education, health), routine, care, development, leisure, and living with children (KOPROWSKI et al., 2020).

Divorce and marital conflict can significantly influence the emotional, cognitive, and social development of the child, depending on how these processes occur in terms of frequency of physical and verbal conflicts, intensity, and ability to resolve the child. Among the feelings most signaled by children in these situations are guilt, insecurity, sadness, isolation, and fear of aggression against themselves and between their parents, feelings that over time of exposure can make it difficult for the child to adjust psychologically (KOPROWSKI et al., 2020). In addition, it is important to highlight parental alienation as a serious consequence of divorce, in which the alienator practically excludes the other parent from living with the child, preventing his or her participation in the child's care and development (SILVA et al., 2021).

Judicial measures are necessary to minimize such consequences and the offer of conflict mediation at the beginning of divorce proceedings can reduce the intensification of disputes and, in some cases, violence. For Chaves et al. (2022), the benefits of mediation are speed, efficiency, and a change in culture in the judiciary, with a reduction in adversarial practices and an increase in consensual methods.

MEDIATION AS A CONFLICT RESOLUTION STRATEGY

Mediation, one of the appropriate means of conflict resolution, has been offered as a judicial or extrajudicial alternative in cases of divorce. These practices began to gain prominence in Brazil during the 1990s, influenced by the effectiveness already demonstrated in other countries. The performance of a professional, properly trained (CNJ, 2020), to collaborate with the parties in understanding the dispute and the relationship between them, in order to create agreed solution possibilities, characterizes most mediation processes. Providing a space for reflection capable of inducing transformations in the perspectives and behaviors of those involved is also the objective and focus of mediation processes (BRAGA NETO, 2020). In the extrajudicial form, the parties, by consensus, seek a mediator to resolve the conflict without having to take it to the Judiciary or to the presence of a lawyer or public defender (CRISTO, GUIMARÃES & GUIMARÃES, 2021).

In general, mediation is a process in which an impartial third party, properly trained, is chosen or accepted by the parties involved in a conflict. This mediator plays a fundamental role, assisting in the exposure of the problem in question and in the identification of common interests, with the objective of reaching an agreement, in the case of transformative and integrative models of mediation (SUARES, 1997; VASCONCELOS, 2008). These approaches value constructive communication, focused on resolving the conflict. They are complex procedures that require the mediator to have knowledge in

various areas, such as law, psychology, sociology, and communication. For Vasconcelos (2008), the mediator's role can be considered an art form and, in the case of family mediation, it demands knowledge of theories about families and systemic interventions and practices and, currently, narrative and restorative (SUARES, 1997; PRANIS, 2010; CHAVES et al., 2022).

There are several types of mediators' work, which differ in their epistemological and theoretical bases, which results in practical differences. The new paradigms of science and the evolution of fields of study such as systemic family therapy and narrative practices have provided new relevant contributions to practices with people who maintain continuous and intimate relationships with each other. The narrative circular mediation created by Sara Cobb is aligned with the most recent studies and practices with families, is based on systemic and complex assumptions and on social constructionist theories and narratives, and aims to strengthen the people who dispute and their bonds, without the main focus being the agreement as occurs in transformative mediation (SUARÉS, 1997).

Cahali (2018) reinforces the recommendation of mediation between people who maintain a closer and more lasting relationship, characterized by personal and legal bonds, and characterizes the integrative negotiation model, applicable in situations in which the resolution of the conflict will result in a new dynamic of rights and responsibilities for the parties involved, unlike the distributive negotiation model.

In addition to the circular narrative and integrative models, there are other proposals in the field of mediation: Facilitating or Traditional Harvard, Conciliation or Evaluative, Transformative or Circular-narrative (VASCONCELOS, 2008). The first two are mediation models directed to the agreement, in which the direct resolution of specific conflicts and the formal agreement between the parties are sought, therefore based on a more pragmatic approach and with greater participation of the mediator. The last two are mediation models directed to the relationship, and in Transformative Mediation the focus is on improving or preserving the relationship between the parties, facilitating communication and rebuilding trust between them (VASCONCELOS, 2008). Circular narrative mediation is the model that presupposes less intervention by the mediator, which aims at the greatest possible participation and protagonism of the parties in the solution of the dispute (FEIJÓ et al., 2011).

The Harvard School, derived from negotiations, points to the need to pay attention to one's own perception, emotion and communication and that of others, concentration on the interests and not on the positions adopted by the parties, to identify options in which there are mutual gains, insistence on objective criteria and finally to know their Chances of

Withdrawal (negotiation alternatives). The conciliatory and evaluative models, as well as the first Harvard proposals, rely on the effective participation of mediators in the interventions and in some cases there may be suggestions for alternatives that the parties may consider reasonable (VASCONCELOS, 2008).

Transformative Mediation, which has a more relational character and is less focused on agreement, was greatly influenced by systemic family therapies, such as the strategic one, and aims to modify interactions between people in the face of a problem situation such as a dispute, with the intention that it becomes less fierce or dissolves. The Transformative mediation model seeks to empower the parties involved in the conflict, allowing them to regain their decision-making power and promote transformation through mutual recognition, using techniques such as verification, mirroring, and summarization. These techniques aim to enhance communication and facilitate the transformation of the parties involved. The model also seeks to identify the patterns of interaction between the parties in conflict situations. Understanding these patterns can help overcome repetitive and unhealthy conflicts (VASCONCELOS, 2008).

Narrative Circular Mediation, understood as a new paradigmatic systemic practice, aims to strengthen people and their relationships, so that protagonism is promoted, which in turn can facilitate effective participation in the construction of new meanings related to the dispute, relationships, the behavior of those involved and their stories (VASCONCELOS, 2008). Such changes in meaning may help people to define the direction of the issues that affect them, including the dispute. It is the least interventionist model of mediation (SUARÉS, 1997).

There are mediators who move between models and use different resources, depending on the need of the moment and mediation. But in general, narrative circular mediators, committed to Foucault's (1979) studies on the need to deconstruct power, seek the construction of new meanings, as advocated by the narrative theory based on social constructionist theory and constructivist epistemology (SUARÉS, 1997).

Harvard's 'facilitative' or traditional mediation was used as a reference for the first mediation professionals, as well as the use of the tools developed by the Harvard School, mentioned earlier. It is characterized by the presence of an impartial mediator who does not make decisions, but creates an environment conducive to the parties expressing their concerns, interests, and needs. For this, the mediator must have some tools to help him in the negotiation. First of all, it is important to broaden the views towards solving problems, since improving relationships and solving problems can at some point generate conflicts that hinder the process. According to the Harvard model and the Conciliation model, the

mediator must be flexible and adapt the approach as necessary, and may adopt evaluation elements when requested, as long as all parties agree. Flexibility is crucial to meet the needs of the parties and the context of the conflict (VASCONCELOS, 2008).

Conciliation or Evaluative mediation is traditionally used as a complement to the judicial process and its emphasis is the search for an agreement between the parties, being widely used to resolve conflicts in financial and material terms. Unlike the 'facilitative', Conciliation has in the conciliator a more active mediation process, since he will act as a facilitator of the dialogue between the parties, helping to suggest solutions in an ethical and respectful way, and it is not only up to the parties to resolve the conflict (VASCONCELOS, 2008).

In studies and scientific publications on mediation, it is common to present proposals that combine elements of the 'traditional facilitative' model with the 'transformative' model and bases such as general systems theory, systemic family therapy, cybernetic studies, observer theory and communication theory. In the most recent publications, the main objective of mediation is not necessarily the agreement, but the improvement of the relationship and communication, which can reduce the strength of the dispute. The importance of the participation of the parties in the process has been increasingly emphasized in mediation practices, especially in the circular narrative proposal, which aims to destabilize pre-existing stories and build new narratives. The techniques applied in the model include microtechniques, mini techniques, techniques themselves and macro techniques (SUARÉS, 1997). These techniques are used to question, reformulate, legitimize, and recontextualize the histories of the parties, seeking to challenge the original histories of the parties involved in the conflict and construct a new history. The model may include a reflective team, which monitors the work of the mediators and helps to reflect on the different ways of describing or explaining what is being discussed in the sessions (VASCONCELOS, 2008).

It is important to note, in addition to the mediation models, that this process can take place publicly or privately, as provided for by the 2015 Code of Civil Procedure of Brazil. In addition, it can occur in a judicial and extrajudicial way. In the case of judicial mediation, it must be exercised by a duly trained mediator, obtained in a school or institution for the training of mediators, recognized by the CNJ (CRISTO, GUIMARÃES & GUIMARÃES, 2021). The success of mediation is directly related to the training of the mediator. The regulations and parameters for the performance and training of mediators have been expanded in Brazil in the last two decades, and the following documents can be highlighted: Resolution No. 125 of November 29, 2010 (Resolution No. 125, 2010), prepared by the

CNJ; New Code of Civil Procedure (NCPC), of March 16, 2015 (Law No. 13,105, 2015) Law No. 13,140, enacted on June 26, 2015 (Law No. 13,140, 2015). In the extrajudicial form, the parties, by consensus, seek a mediator to resolve the conflict without having to take it to the Judiciary or the presence of a lawyer or public defender (CRISTO, GUIMARÃES & GUIMARÃES, 2021).

The teachings and resources of mediation have also been useful in the restorative practices of dialogue, applicable in cases of bullying, other violence and crimes that generate social trauma and that demand that parties assume responsibilities, that relationships and contexts be transformed, to avoid new violence and the punitive criminalization of offenders, without care for the victims.

In addition to access to mediation, care is needed related to the training of mediators and broadening their view of labor rights, possibilities of family-work-leisure balance (VEZZULA, 2003). In cases involving continuing relationships, such as family relationships, mediation and the participation of Psychology professionals are relevant so that themes and relationships are treated properly, in depth, but without losing the focus of the dispute. The partnership between Law and Psychology professionals is usually very fruitful, as long as both are aligned with the purposes, methods and line of mediation chosen for working together.

INTERDISCIPLINARITY

The interdisciplinarity between psychology, law and other areas provides a broadening of interpretations and perspectives related to human behavior, which is a shared phenomenon. This collaborative approach aims to contribute significantly to improving the quality of interventions and understanding of these issues, aiming at a better quality of life and implementation of the culture of peace.

According to Cronemberger (2019), transdisciplinarity is fundamental in mediation, allowing interaction between different fields of study. Mediation is contributing to changing the paradigm of the litigating culture in Brazil, introducing a more collaborative approach to conflict resolution. In the study carried out by the same author, the analysis of theses and dissertations reveals a diversity of academic areas involved in research on Family Conflict Mediation, reflecting the need for a multidisciplinary approach.

From the 1970s onwards, in France, both psychology and other areas of knowledge began to expand their activities. In this period, interdisciplinarity emerged as a movement that sought to overcome hyper-specialist views, allowing a broader and multifaceted approach in the interpretation and contribution to the understanding of a given object of

study. One of the notable advantages of the interdisciplinary approach is the creation of transdisciplinary knowledge, which integrates knowledge from different areas of activity. For example, in the work of a lawyer in mediation of family conflicts, the knowledge of Psychology plays a crucial role in addressing socio-affective dynamics, going beyond simple biological connections. This movement in Brazil is known as the "debiologization of fatherhood" (DURI & TARTUCE, 2016).

RESULTS

In the Brazilian legal context, the role of the psychologist has been the object of analysis. Chaves et al. (2022) highlight that Psychology, in the context of family conflict mediation, has been extensively debated. Psychology needs to transcend its traditional role of preparing reports and diagnoses. It is essential that it takes an active role in promoting dialogue and cooperation between the parties to the dispute in family conflicts. The Federal Council of Psychology (CFP) reinforces this perspective, arguing that the psychologist's work in the Family Court should be broader than the production of reports, as established in its 2010 document.

Exploratory qualitative research, carried out through three semi-structured interviews with two psychologists and a lawyer who have been working in the field of mediation for more than ten years, carried out by Cronemberger (2019) highlights the crucial role of psychology in conflict mediation, promoting a more holistic and collaborative approach in the resolution of family disputes. However, this field still lacks advances, especially in terms of research and development of methodologies.

In the qualitative research prepared by Rocha (2021) based on the theoretical assumptions of Institutional Analysis based on institutional observation and semi-structured interviews, he recognizes limitations, such as the lack of a more robust theoretical basis. However, he hopes that the results, although limited, can be a starting point for future research and contribute to the improvement of the working conditions of judicial mediators, regardless of their areas of expertise.

The systematic review conducted by Schutz et al. (2023) highlights the effectiveness of mediation in resolving conflicts related to child custody in the judicial system. The importance of dialogue, bonds between parents and children and the maintenance of agreements is emphasized. However, the work of the psychologist in this context lacks a solid basis that allows mediators to evaluate the relationship between the proposal of mediation and the role of the psychologist.

A study conducted by Neto et al. (2021) sought to understand the perspective of individuals who participated in judicial mediation in child custody cases. Most of the interviewees positively evaluated the mediation process, highlighting the benefits, such as the resolution of issues related to child support, the guarantee of children's rights and the encouragement of dialogue.

It is evident that mediation offers a differentiated quality service within the judicial system, contributing to the rapid resolution of procedural disputes and improving the well-being of the participants and their children, when successful. Therefore, it is crucial to promote the wide dissemination of mediation, emphasizing its objectives and benefits, both within the Judiciary and in other contexts of human relationships (NETO et al., 2021).

As for family mediation in the judicial system, it is observed that it is conducted in several courts by volunteer mediators, professionals from different backgrounds who do not receive remuneration. This approach aims to alleviate the workload of the Judiciary. However, concerns arise about the possible misuse of the technique, the risk of its trivialization, and the inappropriate use of psychological knowledge and practices (ROCHA., 2022). The authors highlight that family mediation is based on theoretical principles of Psychology, incorporating techniques such as active listening, stimulating the autonomy of the parties, maintaining a positive approach and restructuring the problem. Also for the authors, this approach uses concepts from disciplines such as Communication Theory, Conflict Theory and Family Law as a basis for their practices, as many conflicts that result in mediation have origins related to psychological and social issues.

With the transformations in the family structure, which include separations, subsequent marriages, adoptions and changes in perceptions of gender and sexuality, various family configurations and affective relationships emerge. These changes affect family dynamics, creating the potential for everyday conflicts and tensions. In this scenario, the judicial system plays a crucial role in resolving family conflicts, particularly when the parties are unable to reach an agreement on their own. Some family courts have multidisciplinary teams, which include professionals such as psychologists and social workers. However, judges still make the most significant decisions, according to Rocha and Dimenstein (2022).

The interface between divorce and work has also been studied by authors who deal with the importance of work-family balance, but not all mediators are familiar with labor laws and the most recent actions in search of quality of life and appreciation of the family of those who work.

Knowledge about work-family balance and the consequences of non-balance becomes relevant to the mediator's knowledge. Several studies indicate that the lack of this balance causes conflict and this, in turn, influences the mental health of workers, which is probably the situation of one of the spouses, or even of both (ZANELLI & KANAN, 2018; RIANDA & FITRIA, 2023; CARVALHO, 2024; RYU, 2024). According to Zanelli and Kanan (2018), work-family conflict is configured as a potential stressor and, consequently, as a psychosocial risk that can lead the individual to illness. Divorce, depending on the present situation, can favor or aggravate the presence of work-family conflict and should deserve the mediator's attention.

Organizational Psychology has been bringing significant contributions to the prevention of psychosocial risks at work. Among these risks, the work-family conflict stands out. Goulart Jr. et al. (2013) explain that many organizations promote actions aimed at minimizing this conflict. According to the authors, considering the organizational policies that can improve the work-family relationship, the policies of flexibility of time and space stand out, which allows the employee to have a flexible schedule in the face of training needs, family emergencies, leaves to take care of small, sick or incapacitated children, part-time work and reduced working hours to social benefit policies that include life insurance, retirement plans and health insurance for the partner, children and in some situations even for ascendants. Other actions concern corporate policies for professional support to workers, such as offering advice and training to employees to deal with family situations, through legal, financial, psychological and career counseling. Finally, the authors highlight family service policies that would focus on reducing the burden of "extra-work work", for example, through the creation of daycare centers in the organizations themselves. In these actions, the organizational and work psychologist have a leading role together with a multiprofessional team.

Thus, the psychologist plays a relevant role in mediation, due to his in-depth understanding of the subjective dimension of the parties involved. This understanding is key to protecting rights and promoting citizenship, aspects that are often neglected by the conventional judicial system due to bureaucratic processes and power dynamics, as evidenced by Chaves et al. (2022).

Acting as a psychologist in family mediation involves creating opportunities that allow people to explore options for dealing with their relationships and disagreements, emphasizing the importance of dialogue. This function is remarkably rich in subjective and sensitive aspects, aligned with the skills and knowledge acquired during training in Psychology. It is important to highlight that most of these disputes cause significant

emotional distress to the parties involved, thus underlining the importance of the presence of mediators with a background in Psychology to deal with these needs, as pointed out by Meotti and Costa (2019).

THEORIES AND TECHNIQUES

Mediation and Psychotherapy are distinct practices, although they share common factors, such as bonding and cooperation. A fundamental distinction lies in the purpose: psychotherapy is aimed at curing or modifying behaviors considered problematic and that harm the individual's health. On the other hand, mediation is not primarily focused on promoting these changes, but rather on facilitating dialogue between the parties involved, aiming to increase the likelihood of dialogue (REZENDE, 2015; CHAVES, 2022). Both processes can have therapeutic effects, but mediation has well-defined time limits and scope, while psychotherapy is a longer treatment, which requires time to deepen emotional and social issues, which may result in changes in patterns of behavior, relationship, and self-image. Self-knowledge, coping with losses and grief, reviewing histories of violence and trauma, are some examples of psychotherapeutic demands, for which psychology professionals are prepared to work, but there are not always disciplines on conflict mediation in the curriculum of the training institution. The lack of a solid theoretical basis and the scarcity of training in family mediation for psychology students have been identified as problems, particularly when compared to law students, who generally receive more comprehensive information about alternative methods of conflict resolution (CHAVES et al., 2022).

The training of mediators is still recent and its contents are still little explored in higher education courses. Thus, there are challenges in the training and performance of mediators, whose formal work spaces in Brazil have been slowly created in the last 10 years. They often lack theoretical depth and essential skills to conduct effective mediation, such as negotiation techniques, communication theories, systemic theories and narratives applied to practices with families, so that they can act with disputes involving divorce: alimony, complaints related to custody, child visitation, separation and dissolution of stable union (CÚNICO et al., 2012).

Systematic review by Schutz et al. (2023) comes to the conclusion that the articles analyzed do not offer detailed information about the psychologist's role as a mediator in relation to the reasons that lead people to mediation. However, it is implied that due to the multidisciplinary nature of the work, psychologists tend to focus on the emotional aspects of conflicts, while objective and legal issues are handled by legal professionals.

The reviewed studies focus mainly on the techniques used in conflict mediation, with an emphasis on the interview as the main approach of mediators. Active listening is considered fundamental, allowing the mediator to promote dialogue and assist in the resignification of the conflict. However, there is a lack of detailed information about how individual or joint interviews are conducted. Few articles provide specific guidance on the mediation process, such as the negotiation of parental responsibilities, division of assets, and financial issues. In general, the articles analyzed provide general concepts about conflict mediation and its importance in family issues. However, there is a lack of clarity about the role of psychologists and a lack of recent empirical studies in this area. It is concluded that more research is needed for an in-depth understanding of the psychologist's role as a mediator, its techniques, and conflict resolution, especially in cases of child custody disputes (SCHUTZ et al., 2023).

The research conducted by Cronemberger (2019) sought to understand how the knowledge and techniques of Psychology contribute to Conflict Mediation and identify its limits. Both the literature review and the interviews show that theory and practice are aligned, highlighting a solid theoretical appropriation by the mediators. According to the author, psychology plays a relevant role in Conflict Mediation, focusing on the subjectivity and integrality of those involved, taking into account emotions and feelings. Many of the techniques used in Mediation have their origins in Psychology, such as active listening, interpretation of non-explicit speeches and reflection on emotions.

However, there are still many challenges to be overcome. Conflict Mediation in Brazil is in a structuring process, with important milestones such as Resolution No. 125 of 2010 and Mediation Law No. 13,140 of 2015, which expanded its reach beyond the legal field, allowing the participation of professionals from various areas, including Psychology, but challenges still persist, such as the recognition and adequate remuneration of this profession.

Rocha (2021) highlights that the shift from adversarial culture to a more collaborative approach to mediation is still in its early stages. Mediators often report feelings of unease in the work environment, including distrust on the part of some magistrates, lack of remuneration, devaluation, lack of recognition and poor working conditions.

Rocha (2021) mentions the issue of gender in the field of judicial mediation, where the majority of mediators are women. This reflects and reinforces the gender inequalities associated with social roles, which still persist in the field of work, especially in judicial mediation. This gender inequality reveals that women's work has historically been devalued

compared to men's, reinforcing women's association with volunteering and work related to family issues, often considered to belong to "feminine nature".

Research in the context of mediation of family conflicts in Brazil faces a notable lack of empirical studies, with a predominance of theoretical works, especially in the legal field. However, valuable lessons can be drawn from international research. For example, in the United States, mediation has been shown to be effective in changing parents' perceptions of divorce conflicts, which can benefit children. Mediation is seen as an effective tool to promote change in cases of custody disputes. In Sweden, children's participation in mediation processes is examined, concluding that their participation can bring benefits, despite the challenges in determining what is best for them (SCHUTZ et al., 2023).

Research carried out in Italy has highlighted that the success of family mediation is related to the moment it is introduced into the conflict and the mediator's posture. Some authors in Europe and Brazil defend shared custody, even when the parents do not agree. In Portugal, research has observed that mediation can reduce the intensity of disputes in divorce and child custody cases. In addition, the importance of multiprofessional and interdisciplinary approaches in divorce and custody cases is emphasized, along with the need for mediation interventions in situations of parental alienation (SCHUTZ et al., 2023).

Psychology plays a significant role in family mediation in Brazil, however, it is crucial to reflect on these interactions to ensure that it does not contribute to a greater judicialization of family issues. Instead, Psychology should be a critical and ethical professional and scientific field that promotes social transformation and new forms of relationship between individuals and the Judiciary (CHAVES et al., 2022).

It is important to note that, despite this diversity of research, there are still few longitudinal studies and there is a lack of standardization of indicators to assess the transformative impact of Mediation. Therefore, it is imperative that more research and studies be conducted to analyze the changes resulting from the institutionalization of family mediation in Brazil and the role of Psychology in this context, as highlighted by Chaves et al. (2022). The search for a more comprehensive approach, as pointed out by Cronemberger (2019) and the training of consistent mediators is crucial to assess the transformative impact of Mediation and promote the evolution of this field in the Brazilian scenario.

CONCLUSION

The contributions of Psychology in the Brazilian judicial system, especially with regard to conflict mediation in cases of divorce with young children, represent one of the

multiple areas in which Psychology plays a crucial role. These contributions are manifested through their technical knowledge, critical analyses and diverse interpretations, thus contributing to a more comprehensive view of this phenomenon and fostering the practice of an interdisciplinary approach in the judicial system.

Psychology, when associated with legal professionals, broadens the understanding of the object of study, since it brings an approach that focuses on the subjectivity of the parties involved and the well-being of all. This perspective enriches the mediation process by taking into account not only legal aspects, but also emotional and psychological aspects, which are fundamental in family conflicts, especially when there are minor children involved.

The study portrayed here , by revealing the contribution of Psychology in the judicial context, which goes beyond the preparation of documents and reports, is significant. Especially if you consider that a divorce situation represents a complex context, involving different people with different ways of thinking and acting. Therefore, Psychology plays an essential role in promoting dialogue, seeking collaborative solutions, and mitigating conflicts in litigation situations, especially when children are involved.

This study highlights the need to strengthen the interface between Psychology and Law, promoting a broader approach to mediation, with the possibility of creating new knowledge and transforming paradigms in both areas. However, it also points out that the psychologist's role in mediation lacks a more robust theoretical basis and specific methodologies, despite its ability to promote citizenship and a culture of peace.

Another relevant point is the distinction between psychotherapy and mediation, highlighting that, although they share similarities, these approaches have different purposes and require different sets of skills. In addition, it is essential to provide specific training to conflict mediators and to include content on mediation and its applications in the training of psychologists.

The challenges faced by psychologist mediators include a lack of recognition, inadequate remuneration, lack of knowledge of the work they do, and the poor conditions in which they often operate. In addition, there is still some resistance on the part of some judicial professionals.

Psychology professionals are needed in the judiciary, but also in companies and in the instances of creation and monitoring of public policies, as it is necessary that ex-spouses can monitor the development of their children and that the family experiences the balance between work-family-leisure-rest for adults, and between education, leisure, family life and among peers, adequate food, housing and health for children and young people. It is relevant to consider that family and work are important areas of people's lives and they

influence each other, and therefore, what happens in one of the spheres will undoubtedly reflect on the other.

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THE USE OF CANNABIDIOL IN NEURODEGENERATIVE PATHOLOGIES AND THE ROLE OF THE PHYSIOTHERAPIST

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ABSTRACT

The document explores the use of cannabidiol (CBD) in the treatment of neurodegenerative pathologies, highlighting its therapeutic potential in conditions such as epilepsy, multiple sclerosis, Parkinson's and Alzheimer's disease. CBD, a non-psychoactive compound from the Cannabis sativa plant, interacts with the endocannabinoid system, exhibiting anti-inflammatory, neuroprotective, and anxiolytic properties. In physiotherapy, CBD emerges as a complementary approach that can improve functionality, reduce neuropathic pain and spasticity, as well as contribute to the control of motor and behavioral symptoms associated with these diseases. The work also addresses challenges related to response variability, lack of standardization of dosages, and the need for more long-term research. Regulations from agencies such as COFFITO and ANVISA are mentioned, reinforcing the safety and applicability of CBD by trained physiotherapists. The study concludes that CBD has significant potential, but that scientific and regulatory barriers still need to be overcome for its full integration into clinical treatments.

Keywords: Cannabidiol (CBD). Neurodegenerative pathologies and physiotherapy.

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INTRODUCTION

Cannabidiol (CBD) is one of more than 100 chemical compounds known as cannabinoids, found in the *Cannabis sativa* plant. Unlike tetrahydrocannabinol (THC), CBD does not produce psychoactive effects and has stood out in the healthcare industry for its therapeutic potential in various medical conditions, especially neurological disorders (GEVEHR, 2022).

Brucki et al. (2021), describe that CBD can alleviate symptoms of conditions such as epilepsy, multiple sclerosis, Parkinson's disease, and Alzheymer's disease. With the growing interest in CBD, both in the scientific community and in the general public, it is necessary to broaden the understanding of its therapeutic impacts, safety profile, and potential clinical uses, as well as to identify existing knowledge gaps and provide information on advantages and disadvantages.

In physiotherapy, the use of CBD can enhance the improvement of patients' functionality and quality of life, especially when associated with treatment plans for motor and pain disorders, being essential for the neurofunctional rehabilitation process.

Silva et al. (2024), in their research, describe that CBD has a favorable safety profile, with minimal toxicity, which reinforces its value as a supplemental approach in physiotherapy interventions.

Therefore, this chapter sought to describe the most recent scientific evidence on the properties, safety and uses of CBD in neurodegenerative diseases, delving into clinical and preclinical research on the potential benefits of CBD in diseases such as epilepsy, multiple sclerosis, Parkinson's disease and Alzheimer's disease.

DEVELOPMENT

EPIDEMIOLOGY OF MAJOR NEURODEGENERATIVE DISEASES

Neurodegenerative diseases are characterized by progressive loss of the structure and function of nerve cells in the central or peripheral nervous system, and often course with epilepsy, affecting a significant portion of the population with significant functional and autonomy impairments, compromising independence, quality and length of life.

Below are the estimated percentages of people affected by some of these conditions:

Epilepsia

Epilepsy is one of the most common neurological diseases in the world. It is estimated that about 1% of the world's population is affected by this condition. This corresponds to approximately 50 million people globally, according to data from the World

Health Organization (WHO, 2022). In low- and middle-income countries, prevalence may be higher due to factors such as central nervous system infections and lack of access to adequate medical care.

Multiple Sclerosis (MS)

Multiple sclerosis affects approximately 2.8 million people worldwide, or about 0.04% of the global population. Prevalence varies considerably between different regions, being more common in high-latitude countries, such as those in Europe and North America. The Multiple Sclerosis Atlas 2020, published by the International Multiple Sclerosis Federation (MSIF), indicates an increasing global prevalence, especially in specific regions (MSIF, 2020).

Parkinson's disease

Parkinson's disease is the second most common neurodegenerative disease, after Alzheimer's disease. The estimated global prevalence is about 0.3% of the general population, but this rate increases significantly with age, affecting approximately 1% of people over the age of 60. Globally, it is estimated that more than 10 million people are living with Parkinson's disease (GBD, 2019; PARKINSON'S FOUNDATION, 2023).

Alzheimer's Disease

Alzheimer's disease and other dementias affect approximately 55 million people worldwide, which corresponds to about 0.7% of the global population. Alzheimer's Disease International (ADI) predicts that this number could triple by 2050, due to population aging, especially in low- and middle-income countries (ADI, 2022).

Prevalence increases exponentially with age, affecting about 5% to 8% of people over the age of 65.

THE ENDOCANNABINOID SYSTEM AND CANNABIDIOL

CBD is a non-psychoactive chemical compound found in the Cannabis sativa plant, which acts primarily on the endocannabinoid system, which is responsible for regular physiological functions such as pain, mood, appetite, and memory. Studies have demonstrated its anti-inflammatory, antioxidant, neuroprotective, and anxiolytic properties (BRUCKI et al., 2015).

The endocannabinoid system, discovered in the 1990s, is composed of endocannabinoids, cannabinoid receptors, and enzymes responsible for the synthesis and

manipulation of these compounds. CBD, by interacting with CB1 and CB2 receptors, modulates the activity of this system, influencing processes such as pain and inflammation (ALVES et al., 2019). In addition, CBD interacts with other signaling systems, such as serotonin and vanilloid receptors, which may explain its anxiolytic, antidepressant, and analgesic effects (ALVES et al., 2019; SCHLESNER et al., 2022).

The use of CBD in medicine has gained prominence due to its effects on various neurological conditions. Initially, it was used to treat drug-resistant epilepsy, but recent research indicates its potential in pathologies such as multiple sclerosis and Alzheimer's, due to its anti-inflammatory and neuroprotective actions (COSTA et al., 2011; LUZ et al., 2020).

THE USE OF CANNABIDIOL IN PHYSIOTHERAPY

As provided by the Federal Council of Physical Therapy and Occupational Therapy (COFFITO), properly trained physical therapists can prescribe therapeutic cannabis, including CBD, as part of an integrated and individualized treatment. This practice is especially relevant in the management of chronic diseases and in the rehabilitation of neurological conditions, where CBD acts as an adjunct in pain control, reduction of inflammation, and improvement of motor function (CREFITO 2, 2024).

The Regulations of the National Health Surveillance Agency (ANVISA) ensure that the prescription is carried out properly, requiring information provided about the patient and the dosage in the prescription, ensuring safety in the therapeutic use of these products. With the evolution of treatments and the increasing accessibility of medical cannabis, the role of the physiotherapist expands, enabling more comprehensive and practical approaches in health promotion and rehabilitation (CREFITO 2, 2024).

CBD has shown promise in the management of neuromotor conditions, as well as in the involvement of spasticity and chronic pain. Patients with neuromotor sequelae, such as spastic tetraparesis and encephalopathies, are often treated with muscle relaxants and antispasmodics, however, long-term use of these drugs can cause harmful side effects. CBD emerges as a less invasive therapeutic alternative, with the potential to improve the quality of life of these patients, relieving spasticity and controlling pain (SILVA et al., 2024).

According to Silva et al. (2024), research indicates that the endocannabinoid system, activated by CBD, can promote the recovery of motor and cognitive functions. The authors describe in a case report of a patient with spastic tetraparesis, treated with CBD oil, demonstrated significant improvement in spasticity, cognition, and sleep pattern, as well as a reduction in the use of other medications, such as trazodone and tizanidine.

The analgesic potential of CBD is also relevant, especially in cases of neuropathic pain, resistant to conventional painkillers. Although there are still discussions about the optimal dosage and duration of treatment, CBD has been shown to be effective in reducing pain limits and controlling spasticity, expanding the therapeutic options of physiotherapists in the treatment of complex neurological conditions (SILVA et al., 2024).

THE USE OF CANNABIDIOL IN EPILEPSY

The use of CBD in the treatment of epilepsy, especially in cases resistant to conventional treatments, is extremely trained. Clinical studies have shown that CBD can significantly reduce the frequency of epileptic seizures. In Dravet syndrome, for example, CBD impairs seizures by up to 50% in some patients (SAMPAIO et al., 2024). In patients with Lennox-Gastaut syndrome, CBD also showed positive results, with a significant reduction in seizures (SILVINATO et al., 2022).

While CBD is generally well-tolerated, adverse effects such as death, fatigue, and diarrhea have been reported in some cases. The safety and efficacy of CBD treatment continue to be investigated (OSHIRO et al., 2022).

THE USE OF CANNABIDIOL IN MULTIPLE SCLEROSIS

Multiple sclerosis (MS) is a chronic autoimmune disease that affects the central nervous system, causing muscle spasms, pain, and fatigue. CBD has been shown to be effective in relieving these symptoms, especially in controlling muscle spasticity and neuropathic pain. A study of MS patients who used CBD alone reported a significant reduction in neuropathic pain (LEVADA et al., 2022).

However, the variability in patients' response to treatment and the lack of standardization in dosages are challenges to be overcome in future research (LAFUENTE et al., 2022).

THE USE OF CANNABIDIOL IN PARKINSON'S DISEASE

Parkinson's disease is a neurodegenerative condition that affects motor control, causing tremors, muscle tremors, and bradykinesia. Studies indicate that CBD can improve quality of life and reduce psychosis in Parkinson's patients (RIEDER, 2020). Additionally, preclinical research suggests that CBD may have neuroprotective effects, slowing disease progression (TAVARES et al., 2023).

THE USE OF CANNABIDIOL IN ALZHEIMER'S DISEASE

Alzheimer's disease is characterized by progressive loss of memory and other cognitive functions. Preclinical studies in animal models have shown that CBD can reduce inflammation and the accumulation of beta-amyloid plaques, characteristics of the disease (TAVARES et al., 2023). Additionally, CBD can improve behavioral symptoms such as improvement and aggression in Alzheimer's patients, providing improved quality of life for both patients and their caregivers (KIM et al., 2019).

RELATIONSHIP BETWEEN SUCCESS AND FAILURE OF CANNABIDIOL RESEARCH IN THE TREATMENT OF NEUROLOGICAL PATHOLOGIES

Below we present a table that summarizes the research related to the use of cannabidiol (CBD) in the treatment of neurodegenerative pathologies, highlighting both the successes and failures observed in clinical and preclinical studies researched.

Pathology	Study/Authors	Success (Positive Results)	Failure (Negative Results)
Epilepsy (Síndrome de Dravet e Lennox-Gastaut)	SAMPAIO et al. (2024); SILVINATO et al. (2022)	Significant reduction in the frequency of epileptic seizures in up to 50% of patients with epilepsy resistant to conventional treatments.	Reported side effects include destruction, fatigue, and diarrhea. In some cases, patients have not responded to treatment.
Multiple Sclerosis (MS)	FILIPPINI et al. (2022); LEVADA et al. (2022)	Significant improvement in muscle spasticity and disruption of neuropathic pain in MS patients. Reduced inflammation and improved quality of life.	Variability in treatment response observed among patients. Further studies are needed to standardize dosages and evaluate drug interactions.
Parkinson's disease	RIEDER (2020); TAVARES et al. (2023)	Improvement in quality of life, reduction of psychosis and neuroprotective effects observed in preclinical studies. Relief of motor and non-motor symptoms.	Studies on initial forecasts. Some patients did not respond to treatment. Variability in response to CBD. Need for larger-scale studies.
Alzheimer's disease	CHEN et al. (2023); TAVARES et al. (2023)	Reduction of neuroinflammation and beta-amyloid plaque accumulation in animal models. Improvement of behavioral symptoms, such as improvement and aggressiveness.	Limited clinical studies. Lack of standardization of effective dosages. Human studies still in their early stages.
Neuropathic Pain	SILVA e cols. (2024); BRUCKI et al. (2021)	Efficacy in the control of neuropathic pain, especially in chronic pain conditions associated with neurological pathologies. Reduced use of opioids and other analgesics.	The determination of the optimal dosage is still uncertain. Some patients say limited response to treatment with CBD alone.
Neuromotor Spasticity	SILVA and cols. (2024); CREFITO 2 (2024)	Significant improvement in spasticity and motor function in patients with spastic tetraparesis. Reduction in the use of traditional medications, such as muscle relaxants.	Some patients participated in mild side effects such as death and dry mouth. Variable responses among patients.

About the Successes, we can highlight:

- **Epilepsy**: The use of CBD in patients with drug-resistant epilepsy, such as Dravet and Lennox-Gastaut syndromes, has been shown to be one of the greatest successes, with a significant reduction in epileptic seizures.
- **Multiple Sclerosis**: Several studies indicate that CBD can improve symptoms of spasticity and neuropathic pain in MS patients, providing significant relief and improved quality of life.
- **Parkinson's disease**: Early research suggests that CBD may have neuroprotective effects and reduce psychosis in Parkinson's patients, which improves quality of life.
- **Alzheimer's disease**: Preclinical studies suggest that CBD may help reduce inflammation and the buildup of beta-amyloid plaques, which are hallmarks of the disease, as well as improve behavioral and behavioral symptoms.

About the Failures we can highlight:

- **Epilepsy**: Although many patients responded positively, some studies reported side effects such as defeat and diarrhea, as well as a limited response in some cases.
- **Multiple Sclerosis**: Variability in patient response and lack of standardization in dosages pose challenges, and some patients were not asked for any significant improvement.
- **Parkinson's and Alzheimer's disease**: While the studies are promising, they are still in early designs, with inconsistent responses among patients and the need for more research to confirm the benefits and determine optimal dosages.

FINAL CONSIDERATIONS

The growing body of scientific evidence on the use of cannabidiol (CBD) in complex neurological pathologies such as epilepsy, multiple sclerosis, Parkinson's and Alzheimer's disease points to its promising therapeutic potential. CBD has been shown to be effective in reducing debilitating symptoms such as epileptic seizures, muscle spasticity, neuropathic pain, and behavioral disorders, offering patients an alternative or complement to conventional treatments. In addition, its anti-inflammatory, neuroprotective, and anxiolytic properties reinforce its relevance in the management of neurodegenerative and chronic diseases.

In physiotherapy, the use of CBD opens up new possibilities for intervention, especially in the treatment of neuromotor disorders and conditions associated with chronic pain. CBD can be integrated into rehabilitation plans as an adjunct resource, contributing to the collapse of symptoms and, consequently, to the improvement of patients' functionality and quality of life. CBD's ability to modulate the endocannabinoid system and other signaling systems in the body makes it a valuable tool for the physical therapist, who can prescribe its use in a safe and individualized manner, as regulated by the Federal Council of Physical Therapy and Occupational Therapy (COFFITO).

However, despite the promising results, there are still considerable challenges that need to be overcome in order for CBD to be fully integrated into clinical practices safely and effectively. Among these challenges, the variability in patient response, the lack of standardization in dosages, and the lack of long-term studies that can confirm the reported benefits and ensure the safety of prolonged use stand out. CBD's interaction with other medications should also be carefully monitored, especially in patients with concomitant therapies, such as those suffering from chronic or neurodegenerative diseases.

In addition, it is necessary that future studies focus on well-designed clinical trials, with larger samples and longer follow-ups, in order to establish more precise therapeutic guidelines based on solid evidence. The research should also involve different population subgroups, considering factors such as age, gender, comorbidities, and genetic variations that may influence the response to CBD treatment.

Therefore, as knowledge about CBD continues to expand, it is possible that its use in neurological treatments will advance in a more consolidated way, becoming a therapeutic option of choice for physiotherapists and other healthcare professionals. The integration of CBD into physiotherapy treatment plans could represent a significant advance in the search for safer, more practical, and patient-centered therapeutic approaches, especially in the context of complex and multifactorial neurological diseases. As research matures and clear clinical protocols are established, the use of CBD can transform the landscape of neurofunctional rehabilitation, offering new hope for patients suffering from debilitating conditions.

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THE USE OF OZONE THERAPY IN MUSCULOSKELETAL DISEASES: PHYSICAL THERAPY INTERVENTION

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ABSTRACT

Ozone therapy has been established as an innovative therapeutic approach, especially in the treatment of musculoskeletal diseases. This technique consists of applying a mixture of oxygen (O_2) and ozone (O_3), generated by specific equipment, which has analgic, anti-inflammatory and antioxidant effects, and is minimally invasive. This chapter discusses the mechanisms of action and application of ozone therapy, its indications and contraindications, and compares it with other treatment modalities used in the physical therapy approach to musculoskeletal diseases.

Keywords: Ozone therapy. Musculoskeletal diseases and physiotherapy.

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INTRODUCTION

Musculoskeletal injuries, which include a wide range of conditions affecting bones, muscles, joints, and connective tissues, are a leading cause of chronic pain, physical disability, and reduced quality of life worldwide. These conditions not only directly impact the health and well-being of patients, but also entail high indirect costs for society, such as prolonged absences from work and loss of productivity (WHO, 2022). Given this scenario, the search for effective, accessible, and minimally invasive treatments has intensified, especially in the field of physical therapy, which plays a key role in the rehabilitation and management of musculoskeletal disorders.

In recent years, ozone therapy has emerged as a promising and innovative therapeutic approach, standing out for its anti-inflammatory, analgesic, and antioxidant properties. Using a controlled mixture of oxygen (O_2) and ozone (O_3), ozone therapy has been gaining increasing acceptance in clinical practice, especially among physiotherapists, who seek to integrate new technologies and techniques to optimize the recovery of their patients. This minimally invasive therapy acts directly on inflammatory and degenerative processes, promoting tissue regeneration and pain relief, essential factors in the treatment of musculoskeletal injuries (FERREIRA, 2020).

The relevance of ozone therapy for physiotherapy is justified not only by its direct therapeutic effects, but also by its complementarity with other traditional rehabilitation techniques, such as kinesiotherapy and muscle strengthening. By being applied in an integrated way to these approaches, ozone therapy enhances the results, promoting a faster return to daily activities and improving the patient's functionality. Studies have shown that, in addition to its effectiveness in relieving pain, ozone therapy also accelerates the healing and tissue regeneration process, which makes it a powerful ally in the therapeutic arsenal of physical therapists (ANZOLIN; BERTOL, 2018).

In Brazil, the use of ozone therapy was recently regulated by Law No. 14,648, of 2023, allowing physiotherapists to use this technique in their clinical practices legally and safely (COFFITO, 2023). This represents an important milestone for the profession, expanding the possibilities of intervention and offering patients an effective and innovative alternative in the treatment of musculoskeletal diseases.

In this context, this e-book aims to explore the fundamentals of ozone therapy, its mechanism of action, forms of application, indications and contraindications, in addition to discussing its integration with other therapeutic modalities in the field of physiotherapy. In the end, it is hoped that the reader will understand the benefits of this intervention and how

it can be effectively incorporated into the treatment of patients with musculoskeletal injuries, promoting faster and more efficient rehabilitation.

THEORETICAL FOUNDATION

MECHANISM OF ACTION

The mechanism of action of ozone is still a subject of debate, and most studies focus on the dosage and applicability of the therapy, s

in a conclusive definition of its interaction with biological structures (BOCCI, 2018). Ozone therapy works mainly by offering oxygen to the affected areas, which improves infections, ischemia, and oxidative stress (PASEK et al., 2022).

The therapeutic action of ozone occurs through three main mechanisms: oxidation of the bacterial cell membrane, peroxidation of the viral capsid, and increased production of 2,3-diphosphoglycerate in red blood cells, which improves the supply of oxygen to tissues (SHETE et al., 2016). In addition, ozone stimulates the production of prostacyclins, reducing the action of free radicals and promoting vasodilation and vascular neoformation, which favors tissue recovery (LEHNINGER, 2013).

In pathologies such as osteoarthritis, ozone stimulates the production of antioxidant enzymes and reduces the production of inflammatory prostaglandins (ANZOLIN; BERTOL, 2018). In the case of herniated discs, ozone acts by denaturing the nucleus pulposus, reducing its volume and promoting nerve decompression, relieving pain (SEYAM et al., 2018).

HOW OZONE THERAPY ACTS AT THE CELLULAR LEVEL

Ozone therapy has a series of mechanisms of action at the cellular level that are responsible for its therapeutic effects. Below are some of the key mechanisms that explain how ozone, when applied in a controlled manner, interacts with cells and tissues:

Modulation of Oxidative Stress

Ozone, when administered in adequate doses, induces a light and controlled production of reactive oxygen species (ROS), such as hydrogen peroxide (H_2O_2). This generates an adaptive response in the body, stimulating the production of antioxidant enzymes, such as superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPx). In this way, the body's endogenous antioxidant system is strengthened, protecting cells from severe oxidative damage and reducing oxidative stress in injured tissues (PASEK et al., 2022).

Increased Tissue Oxygenation

Ozone, when it comes into contact with tissues, quickly decomposes into oxygen. This increases the supply of molecular oxygen (O_2) in the treated areas, improving local oxygenation. In addition, ozone stimulates red blood cells to produce 2,3-diphosphoglycerate, a compound that decreases hemoglobin's affinity for oxygen, facilitating the release of O_2 into tissues (SHETE et al., 2016). This is particularly useful in areas with hypoxia, such as chronic musculoskeletal injuries, where low oxygenation impairs healing.

Anti-inflammatory Action

Ozone modulates the inflammatory response by inhibiting the production of pro-inflammatory mediators, such as tumor necrosis factor alpha (TNF-α), interleukin-1 (IL-1), and interleukin-6 (IL-6), which are responsible for amplifying inflammation (PAOLUCCI et al., 2021). By reducing these mediators, ozone therapy decreases the intensity of the inflammatory response, which translates into less pain and edema in the affected tissues. In addition, ozone promotes the release of prostacyclins, which act as vasodilators and anti-inflammatories, improving blood flow and healing (LEHNINGER, 2013).

Immunomodulatory Action

Ozone therapy can have immunomodulatory effects, stimulating the activity of immune cells, such as macrophages and lymphocytes. Ozone can increase the production of anti-inflammatory cytokines, such as interleukin-10 (IL-10), which helps balance the local and systemic inflammatory response (PAOLUCCI et al., 2021). This is especially important in chronic inflammatory diseases, where the immune system is overactive and needs to be regulated.

Antimicrobial Action

Ozone has a potent antimicrobial action, due to its ability to oxidize and destroy the cell membranes of pathogenic microorganisms, such as bacteria, fungi, and viruses.

In the case of bacteria, ozone destroys the cell envelope by lipid oxidation, leading to their death. In viruses, ozone acts by oxidizing the viral capsid, preventing its ability to replicate (SHETE et al., 2016). This mechanism makes ozone therapy a useful tool for the treatment of infections associated with chronic lesions.

Neoangiogenesis and Tissue Regeneration

Ozone stimulates the production of growth factors and promotes the formation of new blood vessels (neoangiogenesis). This improves blood perfusion in the injured areas, contributing to tissue regeneration (ANZOLIN; BERTOL, 2018). In addition, ozone promotes the proliferation of fibroblasts, essential cells in the healing process, and accelerates collagen synthesis, which favors the repair of musculoskeletal injuries.

Nerve Decompression

In cases of herniated discs, ozone can be injected directly into the nucleus pulposus of the intervertebral disc. Ozone denatures the proteins of the nucleus pulposus, reducing their volume and, consequently, the pressure on the nerve roots. This relieves nerve compression and associated pain (SEYAM et al., 2018).

ENFORCEMENT MECHANISMS

The application of ozone therapy can be carried out locally or systemically, depending on the route chosen. The main forms of systemic administration include autohemotherapy, rectal or vaginal insufflation, and ozonated saline solution (FERREIRA; DICK; ANDRADE, 2021). Local routes include intramuscular, intra-articular, paravertebral, and intradiscal injections, which are widely used for the treatment of musculoskeletal pain (JEYARAMAN et al., 2024).

In cases of musculoskeletal injuries, the preferred routes are intramuscular, intraforaminal and intradiscal, which have shown promising results in reducing pain and recovering patients' functionality (AKKAWI, 2020).

INDICATIONS AND CONTRAINDICATIONS

Ozone therapy has been widely used in the treatment of various musculoskeletal conditions, such as osteoarthritis, tendonitis, ligament injuries, and herniated discs (SEYAM et al., 2018). Its anti-inflammatory and analgesic action makes it an effective alternative for pain relief and for accelerating tissue recovery (FERREIRA, 2020).

However, there are some relevant contraindications. The therapy is not recommended for pregnant women, patients with active autoimmune diseases, individuals with glucose-6-phosphate dehydrogenase (G6PD) deficiency, and people with bleeding disorders or who use anticoagulants (SANTOS et al., 2021). In addition, ozone inhalation is completely vetoed due to its toxicity in this application method (ISCO3, 2020).

COMPARISON WITH OTHER PHYSICAL THERAPY TREATMENTS

Ozone therapy can be associated with other physical therapy practices, such as kinesiotherapy, which involves active mobilization, muscle strengthening and the use of biomechanical devices (SEYAM et al., 2008). The combination with traditional physical therapies enhances the rehabilitation effects, modulating symptoms and accelerating the functional recovery of patients (FERREIRA, 2020).

Although ozone therapy is very effective in isolation, its association with other techniques, such as kinesiotherapy, tends to generate more consistent and long-lasting results, especially in cases of chronic and degenerative lesions (SEYAM et al., 2018).

Ozone therapy, as a complementary or alternative treatment, has gained prominence in several areas of health, especially in the management of musculoskeletal diseases. By comparing it with other conventional treatments, such as traditional physiotherapy, pharmacotherapy, and surgical interventions, it is possible to identify its advantages and limitations. The following are the main comparisons between ozone therapy and other therapeutic approaches.

Comparison with Kinesiotherapy and Conventional Physical Therapy

Kinesiotherapy, which involves therapeutic exercises and active mobilization, is one of the main pillars of physical therapy for the treatment of musculoskeletal diseases. This approach aims to improve muscle strength, flexibility, joint mobility, and physical endurance.

Rapid anti-inflammatory effect: Ozone therapy is able to reduce inflammation more immediately than therapeutic exercises, especially in acute inflammatory conditions such as tendonitis and bursitis (SEYAM et al., 2018).

Quick pain relief: In many cases, the analgesic effect of ozone therapy is observed soon after the first sessions, which can be helpful for patients who experience high levels of pain and have difficulty performing exercises (FERREIRA, 2020).

Complement to physiotherapy: Ozone therapy can be used as an adjuvant treatment to kinesiotherapy, enhancing the results. While kinesiotherapy helps to rehabilitate motor function and strengthen muscles, ozone relieves pain and reduces inflammation, making it easier to perform exercises without discomfort (SEYAM et al., 2008).

While ozone therapy helps relieve symptoms, such as pain and inflammation, it does not replace the need for active rehabilitation, which is essential for restoring muscle strength, flexibility, and overall functionality (FERREIRA, 2020).

Studies indicate that ozone therapy presents better results when used in conjunction with other therapeutic approaches, such as exercise and mobilization, than when used alone (ANZOLIN; BERTOL, 2018).

Comparison with Pharmacotherapy (Anti-inflammatories and Analgesics)

Pharmacotherapy commonly involves the use of nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroids, and analgesics for the control of pain and inflammation in patients with musculoskeletal injuries.

Fewer side effects: Long-term use of medications, especially NSAIDs and corticosteroids, is associated with several adverse effects, such as gastric ulcers, liver damage, and kidney failure. Ozone therapy, on the other hand, has a low complication rate and rarely causes serious adverse effects (STEPPAN et al., 2010).

Non-pharmacological treatment: For patients who have contraindications to the use of medications or who prefer to avoid excessive use of drugs, ozone therapy offers an effective alternative for the control of pain and inflammation (SEYAM et al., 2018).

Regarding the limitations, we can mention:

Localized action: While anti-inflammatory drugs can act in a systemic manner, ozone therapy usually has a more localized effect, depending on the route of administration (AKKAWI, 2020). This may limit its applicability in generalized or systemic conditions.

Need for multiple sessions: Although ozone therapy can offer quick relief, several sessions are usually needed to achieve lasting results, while medications can provide immediate pain relief with a single dose (FERREIRA; DICK; ANDRADE, 2021).

Comparison with Surgical Interventions

In severe cases of musculoskeletal diseases, such as herniated discs, fractures, or severe ligament injuries, surgery may be indicated to correct the structural problem that is causing pain and dysfunction.

Less invasive: Ozone therapy is a minimally invasive technique and usually does not require general anesthesia or hospitalization, unlike surgical interventions (SEYAM et al., 2018). This makes it an attractive option for patients who prefer to avoid the risks and complications associated with surgeries.

Shorter recovery time: After surgery, recovery time can be prolonged, including restrictions on activities and postoperative physical therapy. Ozone therapy, as it is less invasive, allows for a faster recovery, with less downtime (STEPPAN et al., 2010).

Reduction in the volume of the nucleus pulposus: In cases of herniated discs, ozone therapy can be used to reduce the volume of the nucleus pulposus, promoting nerve decompression without the need for surgery (SEYAM et al., 2018).

Regarding the limitations, the following can be verified:

Limited effectiveness in advanced cases: In very advanced musculoskeletal conditions, such as severe fractures or injuries requiring surgical repair, ozone therapy cannot replace surgery. In these cases, surgical intervention is inevitable to restore structural function (AKKAWI, 2020).

Does not correct structural deformities: While ozone therapy can relieve pain and reduce inflammation, it does not correct significant structural deformities, such as severe misalignments or complete ruptures of tendons or ligaments (FERREIRA, 2020).

Comparison with Other Complementary Therapies (Acupuncture, Manual Therapy, Laser Therapy)

Complementary therapies such as acupuncture, manual therapy, and laser therapy are widely used in the management of musculoskeletal conditions, often in conjunction with conventional physical therapy.

Anti-inflammatory and regenerative effects: Ozone therapy not only relieves pain but also promotes tissue regeneration and the creation of new blood vessels (neoangiogenesis), something that not all complementary therapies can do as effectively (ANZOLIN; BERTOL, 2018).

Versatility in applications: Ozone therapy can be applied in several ways, including local injections, rectal insufflation, and auto-hemotherapy, which makes it a very versatile therapy in different conditions and needs (FERREIRA; DICK; ANDRADE, 2021).

Among the limitations are:

Less popular acceptance: Despite its effectiveness, ozone therapy is still not as widely accepted or available as other complementary therapies, such as acupuncture or laser therapy, which may limit its use in some regions (FERREIRA, 2020).

Need for specialized equipment: Ozone therapy requires the use of specialized equipment for the generation and administration of ozone, which can increase costs and limit access in places where these resources are not available (COFFITO, 2023).

COFFITO'S OPINION

The regulation of ozone therapy in Brazil was sanctioned by Law No. 14,648, of August 4, 2023. According to this legislation, ozone therapy can be practiced by higher-

level health professionals, including physiotherapists, as long as they are registered with their respective councils and using equipment approved by Anvisa (COFFITO, 2023).

The Federal Council of Physical Therapy and Occupational Therapy (COFFITO) has authorized, since 2010, the use of ozone therapy by physical therapists, reaffirming the importance of this technique as a valid and effective therapeutic tool in the rehabilitation of patients with musculoskeletal diseases (COFFITO, 2022).

FINAL CONSIDERATIONS

Ozone therapy is consolidated as a relevant therapeutic modality in the treatment of musculoskeletal pathologies, offering an effective, safe and minimally invasive approach. Its ability to reduce inflammation and pain, coupled with the promotion of tissue regeneration, makes it a viable option for patient rehabilitation.

The practice of ozone therapy by physiotherapists is supported by Brazilian legislation and COFFITO, being an important alternative within rehabilitation strategies. However, to maximize its effects, the association with other therapeutic modalities, such as kinesiotherapy, is highly recommended.

The mechanisms of action of ozone therapy at the cellular level are diverse and complex, involving the modulation of oxidative stress, the improvement of oxygenation, the reduction of inflammation, the regulation of the immune system, as well as antimicrobial and regenerative actions. These mechanisms make ozone therapy a valuable therapeutic tool, especially in the field of physical therapy, where it can be used to treat a wide range of musculoskeletal conditions, promoting pain relief, accelerating healing, and improving patients' functionality.

Ozone therapy, when compared to other treatments, offers a number of advantages, mainly because it is a minimally invasive technique, with a low risk of side effects and with proven effectiveness in relieving pain and inflammation. However, it does not completely replace other therapeutic approaches, especially in cases that require structural correction or active rehabilitation. The combination of ozone therapy with traditional techniques of physiotherapy, pharmacotherapy and, in necessary cases, surgical interventions, can offer better results for patients with musculoskeletal diseases.

In summary, ozone therapy stands out as a valuable complementary tool in the arsenal of treatments available to physiotherapists, especially when integrated with more conventional approaches, enhancing functional recovery and symptom relief.

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BETWEEN ALLEYS AND HOPE: EXPERIENCING THE RESILIENCE OF SANTA LUZIA

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ABSTRACT

This study explores the community of Santa Luzia, located in Brasilia, Brazil, as an emblematic example of the intersection between socio-environmental challenges and agro-ecological resilience. The community faces inadequate urban infrastructure, with unpaved roads and a lack of basic sanitation, resulting in precarious housing that is vulnerable to environmental adversities. Despite these adverse conditions, the community is remarkable for its ability to adapt and innovate in the face of scarce resources and institutional neglect. The practice of agroecology has emerged as a sustainable solution to combat food insecurity and promote biodiversity, potentially strengthening the community's autonomy and contributing to ecological balance. The environmental analysis revealed a complex interaction between urban challenges and sustainability, emphasizing the need for more effective urban planning. The study proposes specific interventions, including the development of an agro-ecological corridor to sustainably integrate residential areas with the surrounding environment. This planning aims not only to improve residents' quality of life, but also to strengthen the community's environmental resilience, highlighting the fundamental importance of community participation and innovation for a sustainable future.

Keywords: Social vulnerability. Disorganized occupation. Basic sanitation. Land regularization.

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INTRODUCTION

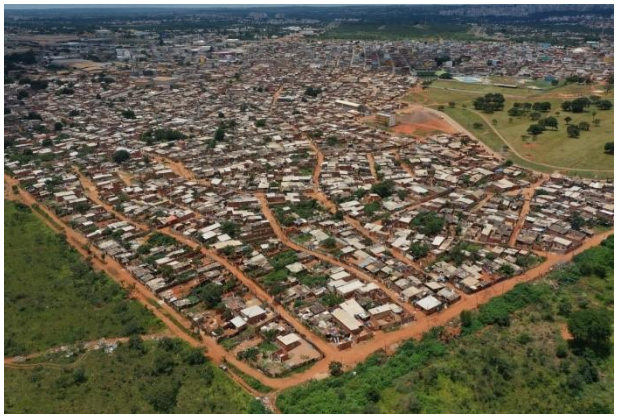
Vila Santa Luzia, also referred to as Chácara Santa Luzia or simply Santa Luzia, emerged in 2002 and faces serious challenges related to social, environmental and health vulnerability. The area is marked by geographical marginalization, disorderly land occupation and unregulated property subdivision practices. Currently, the population of approximately 16,000 lives in inadequate housing and without access to basic sanitation infrastructure. The situation is even more critical due to the community's proximity to the deactivated Brasília landfill, which intensifies the problems that already exist. The complexity of the scenario is amplified by the issue of land regularization, a delicate issue given the tension that arises due to the Vila's location in the vicinity of one of the Federal District's most important conservation areas, the Brasília National Park.

According to Andrade [1], Santa Luzia is experiencing the “peripherization of the periphery”, which means that residents live in extremely precarious conditions, aggravated by the constant threats of removal due to its location, with the government justifying the contamination of the soil due to the Estrutural garbage dump and the risk of degradation of the Brasilia National Park.

Vila Santa Luzia emerged as an extension of Estrutural, a neighborhood that recently underwent a regularization process. However, Vila Santa Luzia, due to its location adjacent to the Brasilia National Park, remains in an irregular situation and is the subject of legal litigation due to possible risks to the park, setting the stage for a complex socio-environmental and health conflict.

The socio-environmental and health conflict under analysis manifests itself in the tension between the quest of the residents of Santa Luzia (Figure 1) for the recognition and realization of fundamental human rights and the need to reconcile these rights with the preservation of the environment. This dilemma is deeply rooted in the Brazilian legal framework, notably in the Federal Constitution, the Organic Law of the Federal District and other relevant legislation, outlining a complex scenario of disputes and negotiations.

Figure. 1 - View of the Santa Luzia area. Source: Valmor Pazos, 2023.



In this context, this micro-project emerges as a strategic intervention aimed at the pressing needs of the Santa Luzia community. Specifically, it aims to address the structural challenges that negatively impact residents' quality of life, proposing to identify and implement viable and sustainable solutions that can significantly improve local infrastructure. With a scope that ranges from the rehabilitation of deteriorated public roads to the optimization of water supply and basic sanitation systems, this micro-project aims to develop an integrated plan that addresses the multiple dimensions of local infrastructure, thus fostering the holistic and sustainable development of the region.

Furthermore, by laying the foundations for a brighter future in Santa Luzia, this micro-project recognizes infrastructure not only as a response to the population's basic needs, but also as a critical vector for sustainable economic growth, the continuous improvement of quality of life and the strengthening of the community's social fabric. Thus, through the implementation of comprehensive and integrated infrastructure solutions, the aim is not only to meet the immediate demands of the population, but also to promote community development that is inclusive, resilient and aligned with the principles of sustainability and social justice.

METHODOLOGY

In order to achieve the proposed objectives, the research was structured into three distinct phases. Initially, the first phase consisted of aerial surveying and photogrammetry, using a drone, in order to acquire accurate and up-to-date geospatial data. In the second stage, a comprehensive bibliographical survey was conducted, which included a review of the relevant literature on the topics that most impact the condition of Santa Luzia, such as the state of urban infrastructure, environmental analysis and the topic of agroecology for the region. Finally, the third phase focused on producing a map of possible solutions for Santa Luzia, based on the information obtained in the previous stages. This step-by-step

approach enabled a systematic and complete analysis, contributing to a more in-depth and grounded understanding of the problem under study.

The aerial survey and photogrammetry were carried out using a drone, an Unmanned Aerial Vehicle (UAV) in Brazil, as stipulated by the relevant legislation (Air Information Circular AIC N 21/10). According to ANAC [4], a UAV is any aircraft designed to operate without a pilot on board. To carry out the aerial survey and photogrammetry, it was necessary to draw up a specific flight plan for the region (Figure 2), using the Drone Link software.

Figure 2. Santa Luzia Flight Plan. Source: Valmor Pazos, 2023.



The primary data, generally made up of photographs, elevation angles and support points in the field, was processed until results were obtained such as the Digital Surface Model (DSM), Digital Terrain Model (DTM) and Point Cloud and Orthomosaic (NPO), generating three-dimensional spatial data to be used in GIS applications, documentation of cultural heritage and production of visual effects, as well as indirect measurements of objects at various scales [5]. The primary data collected in the first phase was processed using Agisoft Metashape software, which generated the orthomosaic (Figure 3) used to analyze the area.

Figure 3. orthomosaic of Santa Luzia, Federal District, Brazil. Source: Valmor Pazos, 2023.



This orthomosaic was generated, capturing the precise division between Santa Luzia and the National Park. Its purpose is to clearly and visually illustrate the territorial restrictions imposed on the Santa Luzia area in relation to the National Park. This cartographic work highlights not only the physical border, but also emphasizes the importance and delimitation of environmental conservation zones, highlighting the commitment to preserving biodiversity and the unique ecosystems present in this region.

The second stage of the study consisted of surveying and analyzing existing articles, periodicals, dissertations, theses, books, legislation and official documents. This stage had the character of a theoretical and historical review of the theme addressed in this study.

In the third phase, the visual infrastructure improvement plan is proposed, which consists of guidelines for architectural and urban improvements that could favor the protection of the National Park through the implementation of the agro-ecological corridor, among other solutions specified in section 4 of this study.

EVALUATION OF THE CASE STUDY

SURVEY OF URBAN INFRASTRUCTURE

Disordered population growth in cities often results in the occupation of areas unsuitable for housing, such as steep slopes, valley bottoms, squares, viaducts, among others. Zmitrowicz [6], when analyzing the structuring of urban space, argues that economic growth, together with social development, causes an increase in migration, leading to concentrated population growth and, consequently, a shortage of housing. To respond the demand for housing, the urban area expands, often followed by a lack of infrastructure due to the scarcity of resources for city management. In this scenario, slums, tenements and precarious housing on the outskirts of the city emerge; generally consisting of one or more buildings constructed on urban lots, with precarious access to and use of unbuilt spaces,

inappropriate sanitary facilities, circulation problems and poor infrastructure. This can result in water contamination due to poor sanitation conditions, leading to health problems.

A detailed analysis of the area known as Vila Santa Luzia (Figure 4) reveals a reality in which urban planning adopts an informal form, characterized by the irregular layout of housing and notable spatial heterogeneity. This heterogeneity manifests itself through a variety of architectural styles, plot sizes and land uses, reflecting an urban development that occurred organically and autonomously, in the absence of structured urbanization guidelines. This spontaneous growth translates into significant spatial diversity within the community, where different areas have evolved under different influences and needs, resulting in a rich tapestry of urban environments.

Figure 4. View of the central area of Santa Luzia. Source: Valmor Pazos, 2023.



The access roads to Vila Santa Luzia, most of which are unpaved, stand out as a symbol of the community's vulnerability to adverse weather conditions. This characteristic makes the roads susceptible to becoming impassable after episodes of heavy rain, which in turn seriously compromises the mobility of residents, as well as access to essential and emergency services. The situation highlights the urgent need for infrastructure interventions that can improve the community's resilience to such environmental and social challenges.

The region is significantly lacking in essential infrastructure, with a notorious deficiency in basic sanitation systems. It can be seen that the houses are architecturally and materially diverse, reflecting the autonomy of the residents in the construction of their homes and highlighting the economic differences between them. In addition, the scarcity of green areas and the scarcity of trees compromise not only air quality, but also the well-being of the population, which is deprived of spaces for recreation and contact with nature, essential elements for maintaining an ecologically balanced environment.

Although some residences try to mitigate this shortfall with small vegetable gardens and the planting of trees, these initiatives are insufficient to offset the general lack of vegetation in Santa Luzia, a situation that worsens even with the proximity of the National

Park, where greenery is more abundant. The environmental challenges are accentuated by the area's inadequate drainage, which increases the risk of flooding, especially due to the topographical configuration that places the houses at a lower elevation in relation to the roads. This layout increases the vulnerability of homes to rainfall events, aggravating already precarious living conditions. The housing density reveals a dense community where, despite the possibility of strong social ties, residents live in extremely precarious conditions, facing constant threats of eviction.

These threats are justified by the government on the grounds of soil contamination, a direct consequence of the proximity to the Estrutural garbage dump, and the potential risk of environmental degradation that the occupation imposes on the Brasília National Park. These government justifications place residents in a position of continuous uncertainty and tension, oscillating between the struggle for recognition and the defense against forced displacement, highlighting the complexity of the socio-environmental conflicts that mark the region.

ENVIRONMENTAL CHALLENGES AND POTENTIAL SOLUTIONS IN SANTA LUZIA: AN INTEGRATED ANALYSIS

The environmental issue of space in the Santa Luzia region is complex and multifaceted, marked by significant challenges and a dynamic interaction between human development and the environment. The first and most obvious environmental issue is the lack of green infrastructure. The scarcity of green areas and afforestation in the region not only compromises air quality, but also negatively impacts local biodiversity and the well-being of residents. Green spaces are crucial to the ecological health of any urban area, providing benefits such as reducing pollution, improving the microclimate and providing spaces for leisure and relaxation for the community.

Green infrastructure plays a key role in promoting the climate resilience of cities, while contributing to the creation of healthier environments and improving local quality of life. This is due to the various environmental services that these infrastructures offer, such as regulating the microclimate, managing rainwater, reducing greenhouse gas emissions, among others. They also provide social benefits, such as strengthening social cohesion [7].

In addition, its proximity to Brasília National Park (Figure 5) raises questions of environmental conservation. While the park offers a natural counterpoint to urbanization, the pressure exerted by urban sprawl and the lack of adequate regulation in Vila Santa Luzia threatens the integrity of this important ecosystem. The situation is exacerbated by the presence of the former Estrutural garbage dump, which raises concerns about soil and

groundwater contamination, affecting the quality of life of residents and the health of the surrounding ecosystem.

Figure. 5 - View of Santa Luzia and Brasilia National Park. Source: Valmor Pazos, 2023.



In addition, the informal occupation of Santa Luzia is situated in the watershed of the headwaters of the Córrego Cabeceira do Acampamento, a location that defines the urban ecosystem of the area. In response to the pressure exerted by the Public Prosecutor's Office of the Federal District and Territories, which points to an increase in environmental impacts, the Federal District government is committed to relocating the occupants through a 3.2 km long linear social housing project, as a mitigating measure.

However, according to Rezende [8], Santa Luzia is not primarily responsible for the environmental degradation of the watershed, which contradicts the state's argument for removing the community because of the damage caused to water resources and local biodiversity. This highlights the importance of debating the possible permanence of the community in the area.

Faced with these challenges, Santa Luzia presents itself as a vibrant and dynamic community, whose infrastructure challenges directly affect the quality of life of its residents. With a constantly growing population, it becomes essential to address infrastructure issues to ensure a safe, healthy and prosperous environment for all residents.

Land irregularities and disordered growth also contribute to environmental problems. Without proper planning, development in the region occurs haphazardly and often to the detriment of the environment. This results in problems such as inadequate waste management, a lack of efficient drainage systems and the degradation of natural areas, which can lead to environmental disasters such as flooding and soil erosion.

Additionally, the reality of precarious housing in Santa Luzia highlights the issue of the environmental vulnerability of residents. Houses built without adequate consideration for

safety and sustainability standards are more susceptible to environmental damage, such as flooding and landslides, especially in risk areas.

In synthesis, the environmental situation in Santa Luzia is an intricate web of urban and ecological challenges. It requires a holistic approach that considers both the need to improve urban infrastructure and the living conditions of residents and the preservation of the surrounding natural environment, balancing human development with ecological sustainability.

AGROECOLOGY IN SANTA LUZIA: CHALLENGES AND POTENTIAL FOR SUSTAINABLE DEVELOPMENT WITH NATURE-BASED SOLUTIONS

According to Wolf, Rauf and Hamel [9], Nature-Based Solutions (NBS) are “actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems that address social, economic and environmental challenges in an effective and adaptive manner while providing human well-being, ecosystem services, resilience and biodiversity benefits” [10].

The researchers found examples of six different types of SbN already implemented in informal settlements in the Southeast Asian region: constructed wetlands, open green spaces, community gardens, street trees, rehabilitation of riparian or waterside vegetation and infiltration devices. Community gardens were the most frequently used solutions, followed by waterfront revegetation projects. Constructed wetlands were applied in informal settlements in Indonesia, Fiji and Vietnam under the RISE (Revitalizing Informal Settlements and Their Environments) program. Researchers and practitioners collaborated with residents to co-design wastewater treatment systems. These systems use a range of components, including biofilters, septic tanks and surface and subsurface wetlands, to collect and treat wastewater locally in the informal settlements.

In Brazil, the research started with studies carried out by Andrade [11] on spatial patterns and ecological infrastructure techniques in the urban environment, in order to achieve water-sensitive urban design. Studies were carried out using technical data sheets produced by the EPA's (Environmental Protection Agency) “Water-Sensitive Urban Design” Program [12], 2008, as well as on “Smart Growth: good practices for managing water resources and densities”, the “Water for a sustainable world” report. This research was part of the construction of the manual “Designing with Water: Spatial Patterns and Techniques for Ecological Infrastructure” and so far includes 52 patterns, coordinated by Professor Liza Andrade.

In the Santa Luzia region, agroecology is emerging as a fundamental practice, not only for food resilience and nutritional security, but also as a pillar of sustainability and environmental conservation. Growing food in small gardens enables residents to partially meet their food needs, promoting a more diverse and healthy diet. This direct approach to food production also plays a crucial role in preserving local biodiversity and contributing to the maintenance of soil and water resources, especially important in areas facing severe environmental challenges.

Mireya et al. [13] point out that the 1st National Meeting of Agroecology emphasized the importance of a “model of sustainable and democratic rural development”, in which agroecology plays a key role as an approach and strategic component. This alternative model of rural development, which seeks to be both sustainable and democratic, serves as the political basis for agroecological mobilization.

The research group led by Mireya and Cavanesi [13] aims to disseminate knowledge about agroecology and its relevance to society. In 2024, they founded ERA: Rural Extension and Agroecology. The rural extension and agroecology research group at UnB (Figure 6) highlights the importance of the agroecology chain of equivalence (Figure 7).

Figure 6. ERA Group - Rural Extension and Agroecology Research Group at UnB (2024). Source: ERA Group, 2024.



Figure 7. Chain of equivalences and importance of Agroecology. Source: Bittencourt, 2019.



Eduardo Sevilla Guzmán [14] addresses a rural development approach when he states that Agroecology constitutes the field of knowledge that promotes the ecological management of natural resources, through forms of collective social action that present alternatives to the current crisis of modernity.

Agroecology is not limited to agricultural practices; it encompasses a significant educational dimension, increasing environmental awareness among residents. Through it, residents learn about sustainable practices and the importance of a balanced relationship between humanity and nature. This educational aspect is vital for building a more informed and ecologically aware community.

In addition to its environmental and educational benefits, agroecology in Santa Luzia is an instrument of empowerment and local development. By providing skills and knowledge about food cultivation, it enables greater self-sufficiency and can even open up avenues for income generation. This is especially relevant in areas with limited economic opportunities.

These agroecological practices are also an effective strategy for dealing with the effects of climate change. They promote climate resilience through crop diversification and improved soil water retention, which are crucial for adaptation in areas vulnerable to extreme weather events.

A notable aspect of agroecology in the region is its focus on resource reuse and recycling. In a context of limited resources, the creative use of materials and waste not only reduces implementation costs but also reduces the environmental impact of agricultural practices.

However, despite the numerous benefits, agroecology in Santa Luzia faces significant challenges. Issues such as the lack of suitable land for cultivation, resource scarcity, and the need for technical training in efficient and sustainable agricultural practices are barriers that need to be overcome in order to maximize the potential of agroecology in

the region. Therefore, for agroecology to fully reach its transformative potential, it is essential that there is support, training and adequate allocation of resources.

PROPOSAL FOR REFLECTIONS AND PATHS IN SEARCH OF THE EVOLUTION OF URBAN INFRASTRUCTURE

Investing in urban infrastructure improvements is a key strategy for transforming Santa Luzia into an example of a modern, sustainable, and inclusive city. The development of structural projects that address essential needs in transportation, basic sanitation, energy supply, communications, and revitalization of public spaces not only enhances urban functionality and aesthetics, but also significantly promotes the well-being and quality of life of citizens.

In the Integrated Plan: Housing and Agroecological Corridor (Figure 8) proposes the creation of an agroecological corridor, designed to function as an effective buffer zone in the protection of the Brasília National Park. This proposal aims to harmonize the coexistence between housing areas and the environment, promoting biodiversity conservation and sustainable development. The agroecological corridor is designed to offer multiple benefits, including the preservation of habitats, the promotion of sustainable agriculture, and the creation of a natural barrier that minimizes the negative impacts of human activities in the park.

Figure 8. Integrated Plan: Housing and Agroecological Corridor. Source: Valmor Pazos, 2024.



This innovative approach not only strengthens environmental protection, but also fosters a more balanced and sustainable relationship between urban and natural spaces. The implementation of this agroecological corridor represents a significant step towards integrated environmental management, ensuring the conservation of nature while meeting the needs of the local community.

For Santa Luzia to achieve this goal, it is essential that urban infrastructure planning is carried out in an integrated manner, considering the interconnection between different

areas and the long-term impact of each project. This implies a holistic approach that takes into account not only technical aspects, but also social, economic and environmental ones, ensuring sustainable solutions that meet the present and future needs of the population.

Community participation in the planning and implementation process of these improvements is another crucial pillar. Involving the inhabitants of Santa Luzia in decision-making ensures that projects reflect the real needs of the population, in addition to fostering a sense of belonging and collective responsibility for the city. This can be achieved through public consultations, workshops and digital platforms for civic engagement, promoting participatory and transparent governance.

Focusing on sustainable solutions, as we propose in the Infrastructure Improvement Visual Plan (Figure 9), is equally important. Adopting green technologies, promoting energy efficiency, and prioritizing public transportation and non-motorized means of transportation are examples of practices that contribute to urban resilience. In addition, creating green areas and public spaces that encourage social interaction and outdoor recreation improves air quality and contributes to the physical and mental health of residents.

Figure 9. Visual Infrastructure Improvement Plan. Source: Valmor Pazos, 2024.



Elevated Walkways: Elevated structures that allow people to move above the level of potential flooding, ensuring the mobility and safety of the community during periods of heavy rain.

Rainwater Management Areas: Spaces designated for the control and direction of rainwater, reducing the risk of flooding and improving local water management.

Community Gardens: Areas dedicated to the cultivation of plants and food by the community, which in addition to providing sustenance, also contribute to the management of stormwater and the creation of green spaces.

Natural Buffer Zones: Strips of native vegetation, which we call agroecological corridors, and green spaces between the housing area and the natural surroundings, functioning as barriers to protect biodiversity and prevent uncontrolled urban expansion.

Simple Housing Improvements: Updates and repairs to existing homes that improve the quality of life of residents at no great cost, using local materials and sustainable techniques.

Therefore, it is imperative that local authorities, businesses and the wider Santa Luzia community continually collaborate and invest in urban infrastructure improvements. This multidisciplinary collaboration is key to overcoming existing challenges and ensuring a vibrant, prosperous and sustainable urban future for all its habitants. By adopting a strategic and inclusive vision, we can transform Santa Luzia into a model of a smart and resilient city, prepared to prosper in the decades to come.

CONCLUSION

Improvements to urban infrastructure play a vital role in the transformation and ongoing development of cities around the world, including Santa Luzia. Such investments aim not only to enhance the physical functionality of the urban environment, but also to foster a more inclusive, sustainable and resilient environment for its habitants. In Santa Luzia, these improvements are essential to addressing contemporary urban challenges, covering critical areas such as transportation, water and sanitation, energy, communications and public spaces.

In terms of transport, Santa Luzia benefits from investments in road infrastructure, expansion of public transport networks, cycle paths and accessible sidewalks. These initiatives not only improve urban mobility, but also reduce congestion and pollutant emissions, promoting a more active and healthy lifestyle. The modernization of public transportation systems, in particular, offers a sustainable alternative to the excessive use of private vehicles, helping the city to reduce its carbon footprint.

In relation to water and sanitation, Santa Luzia is committed to universal access to safe drinking water and adequate wastewater treatment. Investments in water supply networks and treatment systems are vital to prevent diseases and improve public health, highlighting the importance of this infrastructure for the quality of life in the city.

In the field of energy, Santa Luzia seeks to modernize and diversify energy sources, with an increasing focus on renewable solutions. The transition to clean energy sources not only supports environmental sustainability, but also places the city at the forefront of the fight against climate change.

The expansion and modernization of telecommunications networks are essential for Santa Luzia, promoting digital connectivity and inclusion in all spheres of urban life. Access

to high-speed internet and a robust communications infrastructure are fundamental for economic development, education and access to digital public services.

In addition, public spaces in Santa Luzia are valued as centers of social cohesion and community interaction. Investments in parks, squares and leisure areas not only enrich the urban fabric, but also promote the well-being and quality of life of citizens, strengthening community bonds.

In conclusion, urban infrastructure investment is essential to build a more inclusive, sustainable and resilient Santa Luzia. By prioritizing projects that meet needs in transportation, water, energy, communications and public spaces, Santa Luzia can overcome contemporary challenges and create an environment conducive to economic growth, social equity and a quality life for all its habitants.

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RIGHTS OF THE CHILD WITH FUNCTIONAL DIVERSITY

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ABSTRACT

Objective: To describe relevant aspects of the rights of children with functional diversity. Methodology: This is a descriptive, exploratory, cross-sectional study with a quantitative approach and the purpose of evaluating the rights of 95 children with functional diversity in an outpatient clinic of a public health institution. The research was approved by the UPE Research Ethics Committee opinion number: 2.753.756 and CAAE 67017117.8.0000.5192, part of the information came from those responsible, after the application of TALE/TCLE in compliance with resolution CNS 466/12. The data were descriptively analyzed through absolute and percentage frequencies. To evaluate the association between two categorical variables, Pearson's Chi-square test or Fisher's exact test were used when the condition for using the Chi-square test was not verified. Results: It was seen that most children were having access to health, education, leisure and quality housing, however there are still children with different realities facing difficulties to guarantee these rights, especially low-income children. Conclusion: Although children are having rights, health care had a low percentage of children being monitored at the Basic Health Unit through childcare.

Keywords: Intellectual Disability. Rights of the Child. Child.

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INTRODUCTION

Functional diversity is the term used to designate people with disabilities, regardless of type or degree, in a non-pejorative way. In the first civilizations, such people were despised and excluded from social life. Nowadays, the situation has improved and inclusion is conquering its space, however there are still barriers to be deconstructed (PEREIRA, 2009).

To address functional diversity, however, it is necessary to first understand some diagnoses that are corresponding. Autism Spectrum Disorder (ASD) is a diagnosis that encompasses autistic disorder, Asperger's disorder, pervasive developmental disorders, among others. The incidence of ASD is 1 in 68 children and its diagnosis is clinical by observing behavioral symptoms (REIS et al., 2019). Attention Deficit Hyperactivity Disorder (ADHD) can coexist with ASD or it can come as an isolated diagnosis. The child with this disorder may be predominantly inattentive or impulsive or have both characteristics in combination (HORA et al., 2015)

Down Syndrome, in turn, is a genetic alteration in the chromosomes and causes mental retardation, typical physical characteristics, comorbidities, etc. The proportion is 1 in every 1000 live births. Intellectual development delay can be classified as mild, moderate or severe (COELHO, 2016).

Among many shortcomings, these examples were chosen to contextualize their needs. The development of children with functional diversity does not depend only on the degree to which they are intellectually affected, because in a more systemic view, several factors are considered affecting their development, the main one being the family environment (FRANCO, 2016). In addition, it is known that the first years of a child's life constitute a critical period in their cognitive development, and the role that the family plays in this period is of fundamental importance, especially to defend their rights (Bhutta ZA et al., 2013).

The well-being of children is also related to the place where they live and the quality of play is fundamentally shaped by the environment where it takes place (LIMA, 2015). However, public policies need to be active, as this play and children's learning, in addition to their closer relationships and social interactions, depend on the quality of the spaces and places they inhabit (AMADO, 2017).

Entering, then, the field of the rights of people with functional diversity, the current educational policy encourages school practices that promote inclusion. For this new direction, the 1988 constitution established a path with enrollment for children with disorders or syndromes in regular classes, along with neurotypical students, and a support

of specialized educational care to complement or supplement schooling (KASSAR, 2011).

Children have the right to education, aiming at their full development, preparation for the exercise of citizenship and qualification for work, ensuring them equal conditions for access and permanence in school; the right to be respected by their educators; to contest evaluation criteria, being able to appeal to higher school instances; the right to organize and participate in student organizations; access to free public schools close to their residence; according to the Statute of the Child and Adolescent of 1990.

Children are also entitled to receive from the Unified Health System a preventive service through the necessary vaccination to avoid diseases (LAW N° 8.069, OF JUNE 13, 1990), for greater validity to the preservation of health. It is essential that children are immunized, according to the vaccination schedule recommended by the Ministry of Health, in order to avoid the occurrence of vaccine-preventable diseases (MINISTRY OF HEALTH, 2014).

In public health, screening means identifying, in an asymptomatic population, individuals who are at risk of developing a certain disease. Based on this, in 2001, the Ministry of Health created the National Neonatal Screening Program (PNTN), aiming to guarantee all newborns universal access to such identification, additional investigation, immediate preventive or therapeutic action (BOTLER et al., 2010).

The United Nations Committee on Economic, Social and Cultural Rights states that it is an essential obligation of the State to guarantee society access to a minimum, nutritionally adequate and safe essential food, and to guarantee access to housing, sanitary conditions, and drinking water, thus providing minimum health conditions. The guarantee of the child's right to health refers to the need for comprehensiveness in care and the empowerment of caregivers and families, through the construction of knowledge and strengthening of competencies and skills related to care and attitudes of defense, in which the professional plays the role of facilitator and mediator, seeking to promote and guarantee the right to health (SANTOS, et al, 2015).

Thus, the importance of a multidisciplinary team to act in the assistance of this development is emphasized in order to guarantee the social rights of these children. Thus, together with the service, the family can offer the basic conditions correctly with special support from nursing, acting decisively to connect with other services and meet these needs. Health professionals need to broaden the concept of their practice to truly comprehensive care, in the understanding that health is an expanded concept. As a result, the health and human team of the service is questioned about the preparation to care for these children and act in the conditions of these families (TAVARES et al., 2021).

Historically, the population with any type of functional disability, especially intellectual disability, has had its rights denied by society. If we take into account the past, much has been done to mitigate inequalities, but it is a fact that there is still much to be done (PEREIRA, 2009). As seen in the paragraphs above, the right to comprehensive health, quality housing, education, among others, are recorded in the laws. However, it is important to question whether this right is applied in practice.

To this end, the objective of this article was to describe relevant aspects of the rights of children with functional diversity by characterizing the sociodemographic profile of their families, the profile of health care that these children receive, the analysis of their dietary profile and their access to education, in addition to measuring the attainment of leisure and family assistance.

METHODOLOGY

This is a descriptive study by establishing the relationship between variables, exploratory involving interviews with people, cross-sectional with a quantitative approach. Which aimed to evaluate the rights of children with functional diversity in an outpatient clinic specialized in child health, of a public health institution. This descriptive research aimed to contextualize various situations and relationships that occur in the lives of children with functional diversity, according to information provided by the mother or companion, in addition to the descriptions that evidenced the relationships between the functional diversity of children and their clinical, demographic and sociocultural conditions. It was characterized by the use of the quantitative approach to the collection of information for the use of statistical techniques, being complemented by the descriptive study seeking to translate into numbers the quantification of the data and information related to the study.

The study was carried out at the Pediatrics Outpatient Clinic of the Amaury de Medeiros Integrated University Health Center – CISAM, belonging to the University of Pernambuco (UPE). This institution was chosen because it offers availability and access to carry out the research. Mainly because it is a specialized outpatient care service.

The population of this study consisted of 95 children up to 10 years of age, with a diagnosis of functional diversity, who were treated at the institution. Part of the information came from those responsible.

The data were descriptively analyzed through absolute and percentage frequencies. To evaluate the association between two categorical variables, Pearson's Chi-square test or Fisher's exact test were used when the condition for using the Chi-square test was not verified. The margin of error used in the decision of the statistical tests was 5%. The data

were entered into the Excel 2010 spreadsheet and the program used to obtain the statistical calculations was the IMB SPSS in version 23.

Data collection was carried out through interviews, guided by an instrument of specific elaboration to respond to the objectives of the research, in the outpatient clinic, at the time of idleness, where the mothers wait for their health care.

The research met the recommendations of Resolution 466/12 of the National Health Council/Ministry of Health – CNS/MS, which deals with research carried out with human beings, in order to guarantee their anonymity, privacy, confidentiality, the right to withdraw at any time without any penalty, as well as to ensure the absence of burdens related to their participation, with the use of TALE and ICF. Its realization was approved by the Ethics and Research Committee with human beings of the UPE opinion number: 2.753.756 and CAAE 67017117.8.0000.5192.

As this is a research with a face-to-face questionnaire, each family was approached in an individualized environment, avoiding possible constraints depending on the interpretation. For these, protective clarifying arguments were thought of and in the end, no eventuality occurred. As for the confidentiality and secrecy of the identity of the interviewees, they were respected. The benefit of this study was the identification of the current situation of children with rights not respected and opportunities for guidance and clarification after data collection.

RESULTS

Of the 95 children studied, the majority (72.6%) were male. Almost all (91.6%) had a confirmed diagnosis of functional diversity and of this total the most frequent diagnoses were: autism/hyperactivity (46.3%), Down syndrome (18.9%) and other diagnoses (25.3%) and most (80.0%) of the diagnoses were made by the doctor.

Regarding the economic situation, the income range of 1 to 2 minimum wages was the most prevalent, with 57.9% of the group, followed by those who had an income of less than one minimum wage (33.7%) and the remaining 8.4% had an income of more than 2 to 3 minimum wages; 38.9% received the Continuous Cash Benefit (BPC) and the remaining 3.2% lived with other government aid.

Regarding housing, the majority (63.2%) lived in their own house, followed by 30.5% lived in a rented house and 6.3% lived in a rented house. The majority (96.8%) had masonry housing and the remaining 3.2% were made of wood/rammed earth; the most frequent type of floor was ceramic with 64.2%, followed by 29.5% with cement and the remaining 6.3% were made of beaten earth; The majority (63.2%) of the access to the

household was asphalt and the remaining 36.2% was dirt. A little less than half (49.5%) had 5 to 6 residents in the household, followed by 31.6% who had 7 to 11 residents and the remaining 18.9% had 2 to 4 residents. All had electricity in their homes, most had running water (94.7%), basic sanitation (88.4%) and garbage collection (86.3%).

Table 1 – Distribution of socioeconomic and clinical variables of children with functional diversity treated at the specialized pediatric outpatient clinic of CISAM, Recife-PE.

Variable	N	%
TOTAL	**95**	**100,0**
Child's age group		
Up to 4	33	34,7
> 4 a 8	44	46,3
> 8	18	18,9
Sex		
Male	69	72,6
Female	26	27,4
Confirmation of the diagnosis of functional diversity	87	91,6
Diagnostics		
Autism/hyperactivity	44	46,3
Down	18	18,9
Mental deficit	1	1,1
Other	24	25,3
Attend school	60	63,2
It has a health booklet	90	94,7
BMI Classification		
Adequate	56	58,9
Not suitable	39	41,1
Practice of physical activity	18	18,9
Vaccination updated according to age group	76	80,0
Number of professionals the child is monitored		
None	5	5,2
1 a 3	53	55,8
4 a 8	37	39
Children accompanied by a nurse	15	15,8
Children who attend USF where they live	66	69,5
Children who have had neonatal tests		
Performed	90	94,7
Didn't perform	5	5,3
Types of infections/diseases acquired during childhood		
No	40	42,1
Viral and/or bacterial	37	39
Other (congenital/allergies/surgeries)	18	18,9
	63	66,3

Use of medication (antidepressants/antipsychotics/sedatives/stimulants/ diuretics)		
Reconciles sleep well	74	77,9
Number of meals per day		
3 a 5	42	44,2
6 a 8	53	55,8
Children who received exclusive breastfeeding		
Did not breastfeed	23	24,2
Less than 4 months	41	43,2
Up to 6 months	31	32,6
Children were breastfed		
Did not breastfeed	23	24,2
Less than 4 months	27	28,4
Up to 6 months	45	47,4
Children who have had supplementation		
Didn't	19	20,0
Vitamins and/or iron	76	80,0
Children who frequent public places	92	96,8
Children who have hobbies (hobby)	90	94,7

Table 2 shows a significant association between diagnosis and time of diagnosis, and for this variable it is highlighted that: the percentage that was less than one month old was 66.7% and ranged from 2.3% to 16.0% in the other diagnoses and the percentage that was more than 2 to 4 years old was 34.1% among those who had autism/hyperactivity, it was null among those with Down syndrome and 24.0% among the other diagnoses. Regarding the professional who made the diagnosis, the majority (87.4%) was performed by a physician.

Table 2 Characterization of the children's outpatient care in terms of the professional who made the diagnosis, time of diagnosis, number of professionals who accompany and who follow up with multiprofessional stimulation according to each diagnosis of children with functional diversity attended at the specialized pediatric outpatient clinic of CISAM, Recife-PE.

	Diagnosis								
Variable	**Autism/Hyperactivity**		**Down**		**Other**		**Total Group**		**P value**
	n	%	N	%	N	%	N	%	
TOTAL	**44**	**100,0**	**18**	**100,0**	**25**	**100,0**	**87**	**100,0**	
Professional who made the diagnosis									$p^{(1)}$ = 0,390
Doctor	38	86,4	18	100,0	20	80,0	76	87,4	
Psychologist	1	2,3	-	-	1	4,0	2	2,3	
Other professional	5	11,4	-	-	4	16,0	9	10,3	

Diagnosis time									$p^{(1)}$ < 0,001 *
< 1 month	1	2,3	12	66,7	4	16,0	17	19,5	
1 to 6 months	13	29,5	3	16,7	8	32,0	24	27,6	
> 6 months to 2 years	10	22,7	3	16,7	5	20,0	18	20,7	
> 2 to 4 years	15	34,1	-	-	6	24,0	21	24,1	
> 4 years	5	11,4	-	-	2	8,0	7	8,0	
Number of professionals the child is monitored									$p^{(1)}$ = 0,286
None	1	2,3	-	-	3	12,0	4	4,6	
At	12	27,3	4	22,2	1	4,0	17	19,5	
2 a 3	15	34,1	6	33,3	11	44,0	32	36,8	
4 a 5	11	25,0	5	27,8	7	28,0	23	26,4	
6 a 8	5	11,4	3	16,7	3	12,0	11	12,6	
Frequency in the space of therapies or follow-up of multiprofessional stimulation									$p^{(2)}$ = 0,672
Yes	30	68,2	13	72,2	15	60,0	58	66,7	
No	14	31,8	5	27,8	10	40,0	29	33,3	

(*) Significant difference at the level of 5.0%
(1) By Fisher's Exact Test
(2) By Pearson's Chi-square test.

The results in Table 3 were presented in order to show the relationship between diagnosis and certain data. It was seen that the largest age group of children with Down syndrome (44.4%) was up to 2 years old, while this same age group was null among children with autism/hyperactivity. Another fact is that males were the most frequent in all diagnoses.

Table 3 – Description of the sociodemographic and clinical profiles according to the diagnosis of children with functional diversity attended at the specialized pediatric outpatient clinic of CISAM, Recife-PE.

	Diagnosis								
Variable	**Autism/Hyperactivity**		**Down**		**Other**		**Total Group**		**P value**
	n	%	n	%	n	%	N	%	
TOTAL	**44**	**100,0**	**18**	**100,0**	**25**	**100,0**	**87**	**100,0**	
Child's age range (years)									$p^{(1)}$ < 0,001*
Up to 2	-	-	8	44,4	5	20,0	13	14,9	
> 2 a 4	5	11,4	5	27,8	5	20,0	15	17,2	
> 4 a 6	13	29,5	4	22,2	3	12,0	20	23,0	
> 6 a 8	14	31,8	-	-	7	28,0	21	24,1	
> 8	12	27,3	1	5,6	5	20,0	18	20,7	

Sex									$p^{(2)}$ = 0,206
Male	36	81,8	12	66,7	16	64,0	64	73,6	
Female	8	18,2	6	33,3	9	36,0	23	26,4	
Sanitation									$p^{(1)}$ = 0,302
Yes	40	90,9	14	77,8	23	92,0	77	88,5	
No	4	9,1	4	22,2	2	8,0	10	11,5	
BMI Classification									$p^{(1)}$ = 0,108
Marked thinness	2	4,5	-	-	1	4,0	3	3,4	
Thinness	2	4,5	2	11,1	1	4,0	5	5,7	
Adequate	21	47,7	7	38,9	14	56,0	42	48,3	
Risk of overweight	2	4,5	6	33,3	1	4,0	9	10,3	
Overweight	6	13,6	-	-	3	12,0	9	10,3	
Obesity	8	18,2	3	16,7	2	8,0	13	14,9	
Severe obesity	3	6,8	-	-	3	12,0	6	6,9	
Reconciles sleep well									$p^{(2)}$ = 0,684
Yes	33	75,0	14	77,8	21	84,0	68	78,2	
No	11	25,0	4	22,2	4	16,0	19	21,8	
Going to the cinema									$p^{(2)}$ = 0,006*
Yes	21	47,7	4	22,2	3	12,0	28	32,2	
No	23	52,3	14	77,8	22	88,0	59	67,8	
The child received exclusive breastfeeding until what age?									$p^{(2)}$ = 0,336
Did not breastfeed	8	18,2	5	27,8	9	36,0	22	25,3	
Up to 6 months	13	29,5	6	33,3	9	36,0	28	32,2	
Less than 4 months	23	52,3	7	38,9	7	28,0	37	42,5	
Up to what age was the child breastfed?									$p^{(1)}$ = 0,254
Did not breastfeed	8	18,2	5	27,8	9	36,0	22	25,3	
Up to 6 months	21	47,7	8	44,4	13	52,0	42	48,3	
Less than 4 months	15	34,1	5	27,8	3	12,0	23	26,4	

(*) Significant difference at the level of 5.0%
(1) By Fisher's Exact Test
(2) By Pearson's Chi-square test.

Table 4 shows a significant association between going to school and the age group, where it is emphasized that: the percentages of those who had already gone to school ranged from 6.7% to 16.7% in the two youngest age groups up to two years and 2 to 4 years and ranged from 88.9% to 91.3% in the other three age groups.

Table 4 – Description of school attendance according to the age group of children with functional diversity attended at the specialized pediatric outpatient clinic of CISAM, Recife-PE.

	Going to school						
Child's age group	**Yes**		**No**		**Total Group**		**P value**
	n	**%**	**N**	**%**	**n**	**%**	
Up to 2	1	6,7	14	93,3	15	100,0	$p^{(1)} < 0,001$*
> 2 a 4	3	16,7	15	83,3	18	100,0	
> 4 a 6	19	90,5	2	9,5	21	100,0	
> 6 a 8	21	91,3	2	8,7	23	100,0	
> 8	16	88,9	2	11,1	18	100,0	
TOTAL	**60**	**63,2**	**35**	**36,8**	**95**	**100,0**	

(*) Significant association at the level of 5.0%
(1) By Pearson's Chi-square test.

DISCUSSION

In child health care, attention to their essential needs is essential (SANTOS, 2015). The child has the right to protection of life and health, through the implementation of public social policies that allow birth and healthy and harmonious development, in conditions worthy of existence (ESTATUTO DA CRIANÇA E DO ADOLESCENTE, 1990).

There is no health without income. Therefore, Social Security guarantees the Continuous Cash Benefit (BPC-LOAS) to citizens with long-term impediments, whether physical or intellectual, that hinder full participation in society. However, there are a series of criteria to grant such a benefit, which means that not all children with functional diversity will have this right (PINHEIRO, 2016). In the current survey, approximately 40% of the children were receiving the BPC, which enables a better quality of life for them and their families, however this survey has limits, not answering whether the 60% who were not covered by this policy are living safely.

However, it is understood that public policies are evolving in the country and have a role of great importance in territorial development, but they cannot be seen as the main agents of this development, their role is restricted to creating mechanisms that facilitate the quality of life in societies (Costa, J.B. et al, 2024) and this society needs to evolve by creating its path.

The right to school for children with functional diversity is already a reality for Brazilian civil laws, however, in addition to the presence of the child in school, it is also necessary to adapt the curriculum and provide professional training so that the laws are properly applied in practice. For this reason, inclusive education has been widely debated

since the 80s and today it seeks to ensure inclusive care that meets the special educational needs in regular schools (SIQUEIRA, 2015).

A survey carried out in Ecuador brought the importance of implementing large physical activities in schools. Research shows the benefits of exercise in children with functional diversity. The stimulation of motor skills favors motor coordination, sensory aspects and cooperates with intellectual development (RIVERA, 2019). Thus, less than 20% of the children participating in the data collection performed physical activities, that is, this act still needs to be encouraged among the disabled and neurodivergent.

Food is another extremely important factor for the development of the child in early childhood. Therefore, breastfeeding and an adequate food introduction at the correct time corroborate the growth and health of the individual. Complementary foods should be rich in iron, zinc, calcium, vitamins and folic acid and should be offered in a consistency appropriate for the age (LIMA et al., 2012).

Childhood overweight and obesity are factors that are of great concern to society in general, however this problem seems to be even more pertinent in children with functional diversity. The average BMI is usually higher among children with ASD and ADHD than in neurotypical children (KUMMER et al., 2016). In addition, the relationship between obesity and Down Syndrome has also been described by several authors. One cause that is usually pointed out is the possible clinical manifestation of hypothyroidism (CHAVES, et al., 2008). To minimize these problems, it is necessary to have an adequate diet and physical activity.

Playing is, for the child, the main physical exercise, but it is also an important way to develop the emotional and intellectual side. Therefore, it is essential that children have access to public leisure spaces, since not all of them have the financial conditions to attend private spaces. It is also essential that children have hobbies. Playfulness and lightness are typical of childhood and fundamental to stimulate independence, companionship and, in general, learning (GAMA et al., 2014).

Entering the data from the clinical field brought by the research, the data collection confirmed the information brought by the literature that ASD has a ratio of 4-5 men for every woman (REIS et al., 2019). In addition, the entire sample was mostly male.

According to data analysis, most of the children were receiving multiprofessional follow-up. It is important that they are offered treatments such as speech therapy, psychotherapy, occupational therapy, physiotherapy, psychopedagogy, etc., according to the patient's clinical needs. With the necessary multidisciplinary follow-up, few cases require drug treatment (OLIVEIRA; SANT'ANNA, 2020)

A low percentage of the children were being monitored by a nurse. These data are worrisome, since every child must be monitored at the Basic Health Unit through childcare, which aims to monitor growth and development, health education, disease prevention actions, and promote child health (MOURA et al., 2018).

FINAL CONSIDERATIONS

The research sample was satisfactory and its objectives were achieved. It was seen that most children were having access to health, education, leisure and quality housing, but there are still children with different realities facing difficulties in guaranteeing these rights, especially low-income children.

In today's society, income is the main factor to enable quality of life. Therefore, the State has the duty to cover this neediest portion of the population, minimizing inequalities. With regard to health, it is necessary not only to offer services, but also to carry out an active search by Primary Care to bring the patient the different possibilities of multidisciplinary follow-up.

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RACISM AGAINST INDIGENOUS PEOPLE AND AFRO-DESCENDANTS IN SWEDEN, BRAZIL, AND MEXICO

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ABSTRACT

This article explores how racism and stigmatizing discourses and practices are articulated and normalized in colonizer and colonized countries. The research compares the cases of Sweden, Brazil, and Mexico from a combination of frameworks -- the Critical Race Theory (Walton, 2019; Ansley, 1997), the neo-Marxist concept of institutional racism and racialization (Cole, 2016 and 2020), and a decolonial framework and methodology (Fanon, 1968; Tynan and Bishop, 2022). Racism has been structural and systemic in Latin American societies since colonization when religious and royal authorities legitimated Indigenous and African slavery in the colonies. After independence, modern free republics converted religious legitimation of racism in pseudoscientific Eugenics and the invention of human races and racism continue oppressing Indigenous and African descendants. Currently structural racism continues to be the normal behavior in Western societies, not an exception.

The objective of this research is to identify and compare racism reveled in behaviors and the speeches behind them in two colonized societies – Brazil and Mexico – and Sweden, a colonizing society. The question orienting the comparative research is how and in which ways racism and stigmatizing discourses and practices are articulated and normalized in colonizer and colonized countries. Understanding the main persistent trends in these societies on eugenic somatic characteristics such as hair type, body part sizes (e.g. head), as well as other collective social and religious symbols, behaviors, attitudes and cultural customs, used as discriminatory markers.

The qualitative methodology includes 69 interviews and six focus groups in the three countries. Results were analyzed form a critical reflexivity about how colonialism and eugenics impact the lived experiences and realities of both groups in colonized and colonizer countries, through historic and current practices. racism has the same routes of functioning, structuring unequal relationships, distortions in the perception of the other, marginalization and suffering.

Keywords: Racism. Eugenics. Decolonization. Indigenous. Afro-descendants. Sweden. Brazil. Mexico.

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INTRODUCTION

CONCEPTUAL FRAMEWORK

The main approaches adopted in this research are Critical Race Theory (Walton, 2019; Ansley, 1997), and the neo-Marxist concept of structural racism and racialization (Cole, 2016 and 2020), questioning colonial, patriarchal and racist legacy reproduced from the medieval Christian religions until eugenics in modern states – as a pseudoscience. The article adopts also a decolonial framework and methodology (Fanon, 1968; Tynan and Bishop, 2022).

Colonialism and racism have persisted jointly for centuries, from the medieval religious and royal legacy of no-European people as colonized, without souls and non-human. In the modern era, this divine inferior classification changed to a pseudoscientific concept of races, based on the biological, moral and cognitive inferiority of non-European people, in contrast with the White or European “supremacy”.

Eugenics justified oppression, exploitation and slavery of inferiorized groups and colonized spaces, based on their supposed immorality and incapacity for self-rule. For more than five centuries, based on subsequential religious and pseudoscientific explanations, the combination of colonialism, slavery and racism has been a long-term project of power, which reproduces structural and systemically social, economic, political, racial and ethnic inequalities and domination through establishing social hierarchies. Non-white people are likely to be suspected of criminal behavior; victims of police violence, and lethal force, accusations, conviction, imprisonment, stereotyping, micro-aggression, segregation, poverty, and receiving fewer or inferior public and private services. “Problematic” sub-human groups need to be catechized, civilized and controlled by the colonizers. Explicit and subtle practices of racism and unfair treatment in both public and private spheres have reproduced inequalities in all social and economic spheres for centuries. This research tries to explain how racism is the “normal” behavior in Western colonizing and colonized societies, not an exception.

Structural racism, according to the MacPherson report, means the “collective failure of an organization to provide an appropriate and professional service to people because of their color, culture, or ethnic origin. It can be detected in processes, attitudes and behavior which amount to discrimination through unwitting prejudice, ignorance, thoughtlessness and racist stereotyping which disadvantage minority ethnic people”. (MacPherson, 1999). This concept has been extended and developed by Racism Critical Theory and Marxist approaches.

Racialization recognizes a historical process of legitimizing and universalizing racism to understand the complexities of groups that are racialized through colonization and slavery (Ashe and McGeever, 2011), but also through land occupation in modern societies.

> "This racialization process is not limited to skin color and can be color-coded, non-color-coded or hybridist, and must be referred to economic and political factors related to developments and changes, historically and contemporaneously, in national, continent-wide and global capitalism" (Cole, 2020).

The concepts of structural racism and racialization have been discussed to articulate the analysis on racism and discrimination against the Indigenous, Afro descendants and other historically discriminated people from Western European colonization until eugenics hegemony and today.

Even considering their economic and social disparities, both colonizers and colonized populations had one common and universal trait that frames the racialized system of inequalities from the first years of colonization in all continents: structural racism and racialization were made universal through Christian religions from the 16th to 18th centuries, followed by its subsequent legitimation by science from modernity to the present day. This universal framework is analyzed in this article, comparing racism against Indigenous and Afro descendant people in one colonizer and two colonized countries, searching for racism continuities and specificities in extremely diverse economic, social, cultural and historical societies.

METHODOLOGY

This research was conducted as a reflexive process, situated within socio-historical, cultural, and political contexts, opened to ancestral or cultural wisdom, deep listening and engagement, and the analysis took time to integrate the lessons offered within the decolonizing literature and interviews, establishing relational interactions between the researchers with others' worldviews present in communal conversations deepen our individual and collective understanding. (de Leeuw, 2012).

This study applied interviews and focus groups on Sweden, Brazil, and Mexico to explore experiences, behaviours, and motivations on racism and discrimination. Focus groups explore collective experiences between research participants, exchanging and commenting on each other's experiences, generating consensus and divergences through group interaction.

Face-to-face interviews and focus groups were unstructured, starting with a simple question about racism and following up with questions to promote discussion; they were

audio-recorded, with the consent of the participants, who were previously were informed and agreed to participate voluntarily, and to be recorded.

In each country Indigenous and Afro-descendant participants were selected using the snow-bow method in localities previously selected due to the high concentration of Indigenous and Afro descendants.

Interviewers were self-identified themselves as Indigenous and Afro descendants, anti-racism activists who were trained in qualitative techniques and ethical protocol.

In Sweden, ten Sami Indigenous people and ten Afro-Swedes were interviewed, as well as fifteen Indigenous and fifteen Afro-descendants in Mexico, four Indigenous and fifteen Afro-descendants in Brazil. In each country a focus group was organized, one with Indigenous people and one with Afro-descendants.

Ethical procedures included information and oral agreement to interview, record and publish, protecting identification.

RESULTS

SWEDEN

Lutheran church has shaped values, beliefs and influencing the Nordic universalism, welfare state and social democracy in Nordic countries. (Markkola, 2015). The ideological core of Swedish Social Democracy remained reformist and universalistic but linked to an industrial democracy and an exclusionist concept of social welfare, considered a reformist socialism oriented by the values of productivity, social efficiency, and a healthy society. At the same time, the legitimacy of rising social expenditure justifies the exclusionist eugenic policies, or social eugenics — a welfare community for 'the fittest,' legitimatized by biological, scientific, and social concepts. This kind of Social Democracy ensures an amalgam of support for social policies with which even members of the right-wing could identify. (Spektorowski and Mizrachi, 2004).

And it is also the base of the Lagom culture of egalitarianism — the Nordic exceptionalism, meaning just the right amount for all, the non-written Swedish mild-mannered culture and rules that are muted. Exceptionalism establishes a Nordic difference compared to other Europeans on white colonialism, supremacy and anti-black racism, and presupposes a culture of egalitarianism based on tolerance, never hating anyone, acceptance and support for refugees, humanitarian efforts, policies to build an egalitarian multiculturalism, and a political culture for equality as sameness that also includes a racism-sexism denial or an anti-racist intellectualism.

Swedish exceptionalism also includes welcoming refugees and providing asylum. However, during the refugee crisis of 2015, the massive Syrian immigration created fears of a "system collapse" (Elmilsson, 2019) and the revival of extreme right wings movements with so many members exhibiting explicit racism and xenophobia (Tomsom, 2020).

Indigenous in Sweden, the Samis

In contrast to Muslims, the Sami Indigenous people and African diaspora have been neglected in literature, data, registers, communication media, and policies.

The Sami are Indigenous groups who have been living in the north for thousands of years, fishing, hunting, and mainly caring for land and reindeer, environment, as part of their history and identity.

The total number of Indigenous Sami people is estimated at between 75,000 and 120,000 leaving in the Northern parts of Norway, Sweden, Finland and Russia. (Young and Bjerregaard, 2019). Sami population data is non-existent today, and they are invisible in official statistics (Axelsson et al. 2011). In Sweden there are around 20,000 Sami People living in permanent conflict against the Swedish State, due to historical occupations and the exploitation of Sami lands, in mines, industry, energy, infrastructure, promoting Sami's permanent displacement to the extreme north, in the hardest climate conditions.

In 1977, the Sami people were recognized as an Indigenous people with a specific culture and rights. They elected a Sami Parliament and approved the use of Sami languages at school (13 languages), as well as environment program, the right of self-determination, land, and water.

The leader interviewed in the Sami Parliament and in the municipalities in the north clearly identify structural racism in the history of eugenics and land occupation, and they are internationally articulated with the movements in defense of the Indigenous rights.

> "Racism is structural, the State displaces us from our lands, they support mining companies occupying and exploring for minerals in our lands" (Sami man 1)

> "In 1922, the State Institute for Racial Biology was created to study our bodies and genetics, the size of our head, arms, legs. They have Sami's body remains, which must be returned to their family, their village and lands, their descendants deserve respect and justice" (Sami woman 2)

Artisans are organized in cooperatives and promote Sami culture around the country, in scientific environment to empower themselves to register the Sami history and cosmovision from their own perspective.

> "We have cooperatives, artisans, artists, researchers. We are writing our history, about our culture… we are able to talk about ourselves, about who we are". (Sami woman 2)

Other family groups promote Sami's cosmovision by reproducing their ancient practices in small communities where they promote environmental tourism based on Sami practices of agriculture, food, family collective sharing and welfare.

> "Here we produce our vegetables, we care for our reindeer, we make exchanges with the community, we care for the environment, we are entrepreneurs. My wife was a manager in a hotel close to here, she promoted our culture of sustainability and attracted clients, we were developing our community. However, she was substituted by a foreign manager, not a Sami". (focus group 1)

Sami people relate experiences of racism when working with some non-indigenous entrepreneurs. They perceive that their work can be used in a process of cultural appropriation, so, they try to be organized to continue reproducing their activities in organized groups, to protect Sami identity, legacy and history.

However, most of those interviewed had difficulty to talk about individual experiences of daily racism.

Most of them are conscientious about colonialism, eugenics and the concept of race inferiority, but this perception is more oriented towards land rights and caring for reindeer, and against the governmental support to development projects that occupy their land or destroy the environment, affecting their way of life, family members and animals. In this sense, they are conscientious about structural racism perpetuating racism, even in post-modern states and social democratic societies.

When asked about experiences of racism and traumas since childhood, it is difficult for the Sami to retrace memories and express themselves.

This forgetfulness cannot be related to alienation, but speeches show a mix of respect for maintaining their culture and image with pride, preservation of identity and self-esteem, and a sense of moving towards the future assertively, overcoming obstacles.

A Sami woman invited me to visit her house and introduced me to her entire family, invited me to her room, showed her Sami clothes and talked about Sami life, culture, differences compared to non-indigenous Swedish people.

> "Look to my house and garden, and to my neighbor's houses and gardens. Can you see the difference? They are very organized, but I have all the things I need outside, for my family and grandchildren use. They see our house as a mess. You can see you are in a typical Sami house: everything is outside, in the garden, we don't want a perfect garden, we have a useful garden, we are not concerned about how it looks like, it is the Sami life". (Sami woman 2)

I was invited to eat, to have a coffee, and the interview was transformed into a friendly visit.

The same experience in another Sami house in the border with Finland: I was invited to eat with all the family members and neighbors living around. I received a book on Sami food preparation, written and published by one member of the Sami community, I was invited to swim in the lake and to enjoy the environment, to walk around and to know the village, to know their handcraft and the wooden tents built with the Sami architecture.

The collective Sami way of life, values, relationships, exchanges and practices are an essential component of Sami culture, and they fight to preserve the right to continue reproducing their culture, self-identity and collective values.

A sense of self-preservation is clear when a man talked about a very suffering experiences of racism. Only two Sami people were able to talk about these experiences, remembering and identifying them only from their childhood. And it took a long time to talk about it, first they denied having some experience, but they subtly remembered one traumatic episode and were not able to control their emotions.

> "I was a child, at school, other boys called me a devil" ... (Sami adult man 1, crying). "At school they called me those names… I cannot tell you the names, it hurts me until now" (Sami young woman 1)

To understand why this word had hurt him so hardly, the young woman stopped the interview and left the place, but the men answered me:

> "At that time, the worst thing to call a Swede was a "devil", and Sami people were named "devils". "But today, the worst thing to call a Swede is a racist"

To have the perspective of no Indigenous Swede, I tried to interview two women in two different localities where Sami people live, and I asked them about racism in Sweden.

One woman explicitly referred to Sami people as a trouble: "If I am driving and I hurt a reindeer, I have to pay for that, it is an absurd, Sami people have so many privileges" (no Indigenous woman 1).

Another woman, wearing Sami clothes, simply denied racism in Sweden, reaffirming the Lagom culture and denying Sami culture. This process of appropriation of using Sami clothes to pretend to be a Sami looks like a cultural appropriation process by some middle-class women living in a municipality known as a Sami town, where a Sami museum, cooperatives of art and handcrafts, and organized groups of Indigenous people are relevant to the local economy and tourism.

> “There is no racism here, I live in a perfect country” (White Swedish woman 2, wearing Sami clothes, not self-identified as a Sami).

This individualistic and idealized point of view is clearly in contrast and opposition with the collective and realistic speech and customs observed in the interviews with real Indigenous people.

Afro Sweden

From the 1970s immigration from Africa increased due to civil wars (from 596 in 1960 to 103,077 in 2009). Today there are around 250,000 African and African descendants living in Sweden. (Statista, 2022).

Censuses and registers of population in Sweden do not ask about ethnic or race self-identification. The only way to identify the African diaspora is through the question about the country of origin.

> “Children born in Sweden receive the same citizenship as the parents. If the child's parents are citizens of a country outside the EU, the parents must apply for a residence permit for the child.” (Migrationsverket, 2024).

Today’s immigrants are perceived as a problem for Sweden democracy and welfare state. Although Muslims are the most perceived as a trait, Afro-descendants experience a specific kind of racism, based on eugenic approach. The racist construction about the African body, inferior and dangerous moral behavior and inferior cognitive and intellectual capacities was identified by the African-Swedish interviewed:

> “They think they have the right to touch my hair and to make comments about it. Can you imagine if I touch their hair? They say it is only curiosity, but it is my body, my hair, and it is supposed that Swedes consider touching another body as a disrespect. However, my hair is an exception, to be touched, to satisfy their curiosity”. (Young African Swede 2)

> “They ask us to dance for them, please, dance, dance for us, and laugh. They never ask Swedes to do it” (Young Afridan-Swede3)

> “Teachers never gives as an “A”, only “C”, we make a lot of effort, but it doesn’t matter, we will always have a “C” level. (Teens, focus group 2)

> “He asked me not to touch his car. He believed that my black hand is dirty”. (Adult African-Sweden)
> “A White woman refused to be attended by me, she does not like Black people. So, to prevent conflicts, my boss moved me to another position” (African-Sweden man)

> “Employment, even if he has a higher level of education and experience, they put my son-in law in a lower position, not correspondent with his ability.” (African-Sweden men, father, and son)

> “In the clinic, they did not give medical attention to my daughter, the attendant gave me dipyrone, she ignored the emergency and my exasperation. Next day my girl was terrible, much higher fever, I came back calling for a doctor to examine my daughter… she had pneumonia, she could have died without attention and the correct medication. I had to fight for that” (African-Sweden, woman)

> “At school, a new worker, a White woman, told me directly: ´I don’t like you, I don’t like Black people”. I had to talk to the director, but he put me on suspension for a week, ´to relax´. He didn’t put her on suspension to think about her attitude, it was me who had to be out school for one week” (African-Sweden, woman, teacher).

The eugenics approach is predominant in all the speeches. Moreover, during my period of research, I have observed situations of exclusion and discrimination of African students in social and religious events. And an attack against an Afro-Swedish old men, who was thrown onto the train tracks by a white woman. When she was arrested, in her defense she used the argument: "but he is Black".

Violence based in race supremacy violence in general is invisible and denied in multicultural policies, while the narrative criminalizing non-White migrants increases, and interviews with members of the diaspora are clearly showing racism sin the same way they happen in non-Nordic countries.

Black and Indigenous People Alterities are defined in eugenics as inferior cultures, moral and rights. Racism stigmatizes these non-European populations based on the myth of the lazy, ignorant, dirty, corrupt native Indigenous or Afro descendants. Afro-Swedish are more conscious about daily racism, compared to Sami people. It would be due to Afro-Swedish been the first, second or third generation living in a racist environment, while Sami have been historically discriminated against for centuries, and developed a kind of resilience against racism.

Youth Black women, children of the first generation of the African diaspora can identify several experiences of explicit racism in Sweden:

> “In the shopping center, I paid in cash, and the cashier gave me no change, she told me there was no change, but there was, fifty euros. So, how could I prove that I gave more money to her? She took my money, but she is White, it is my word against her word. It is a very frequent situation; it has happened with all of us”. (Focus group of female teens)

> “In the street, a woman was aggressive touching my arm, I asked her for an excuse, that is the normal behavior in Sweden, an excuse. But she called the police and accused me of being violent, of doing what she did against me. I learned I will never be recognized as the victim, it doesn´t matter to ask for police or other support, I will always be the layer, the aggressor, the robber” (African-Swedish young woman, student)

McEachrane (2014) identifies a new racism in Sweden, that incorporates a common-sense of “raciology” – reflection and government – accentuating culture rather than politics.

As Sweden is considered a non-racist society, racism has never been an object of governmental intervention or policies.

However, the results confirm that both, Black and Indigenous people alterities have been perceived and treated as having inferior cultures, morals and intellectual capacities, and multicultural policy is not enough to achieve real equality and rights as assumed in the Swedish exceptionalism and multiculturalism.

COLONIZED COUNTRIES, BRAZIL AND MEXICO, SPECIFIC HISTORIES AND RACIST SOCIETIES

Both, Brazil and Mexico, experienced slavery and the genocide of Indigenous peoples and Africans and their descendants.

Brazil is a colonized country characterized by the predominance of the oligarchic elites of slave-farming landowners and the emergence of an urban merchant and finance elite enriched by human trafficking of Africans and an agricultural monoculture of exportation. (Ribeiro, 1976; Freire and Penna, 2001; Carvalho, 2003; Fernandes, 2008; Codato, 2015)

Sequential coups d'état led to authoritarian regimes and dictatorships with only short years of democracy, interrupted rapidly by another coup d'état. After a military dictatorship from 1964 to 1988, there were three elected presidents, and another coup d'état, lawfare and persecution of the party and candidates removed by force from the power, and a recent restoration. (Missiato, 2011).

In Brazil, Indigenous peoples were around three million of inhabitants, who fought and resisted. In 2022 the self-declared Indigenous population decreased to 1.7 million (IBGE, 2023), 305 ethnic groups speaking 274 different languages (FUNAI, 2022).

Brazil is the country that received the most Afro-descended people, while Mexico ranked in third place in the number of enslaved Africans in the population – 500,000. Brazil was also the last country in Latin America to abolish the enslavement of Africans and their descendants, in 1888 (Ribeiro, 1976; Carvalho, 2003; Fernandes, 2008), while in Mexico the abolition took place more than 70 years earlier, during the independency wars.

The Indigenous in Brazil

In Brazil, Salvador is the city with the largest African diaspora (826,000) (IBGE, 2022). From 2003, Brazil has regulated and implemented anti-racist and inclusive laws and policies such as quotas at universities and public services (Silva Filho, 2008). However,

there are challenges about unbuild racism inside schools, universities, and other public spaces.

Interviews show that, assuming Indigenous and Afro-identity and inclusion in new spaces revels old and new conflicts and harassment in both, public and private spaces.

Interviews with Indigenous students in Brazil reinforce the need to build antiracist environments inside the public spaces where they are starting to participate. The first challenge is the need the non-indigenous recognition of the right the Indigenous people to freely self-declare their identity and to access daily activities at the university in equal conditions.

> "At school, I felt like I was in the rubbish, I suffered so much, it is not a little thing to feel alone. People say: 'Oh, you are an Indigenous intercultural actor, who was the first group there' (at the University). I started to feel welcomed. But those issues were not in the debates. There is a fracture there."
>
> "When we enter the affirmative action policy, it is our duty to talk about where we come from, why am I here, right? When I introduced myself, I felt very scared, because they asked: 'What is she doing here?' In Brazil, people only identify as Indian people living in the Amazon, not in the Northeast. They think we do not exist in the Northeast. And then they spoke between the lines, as if it is not the place for me … as the law is not for me. They decide whether an Indigenous is an Indigenous or not. That marked me deeply. This structural racism is in all of them. That is painful for me."
>
> "You start to feel discriminations and racism when you are outside your group, leaving your Indigenous community. At the University, when I identify myself as Indigenous, people say that I do not look like an Indian. In the city, in the church, frequently they say the same… Why do people think they know more than I know about my origin?" (Young woman studying Psychology)
>
> "There is racism, even in tourism, commerce, right? My mother and I were selling handcrafts. If I introduced myself as an Indigenous person, they say I am only a descendant, not Indigenous. How so many people questioned it. So, I stopped explaining myself. (Young woman)"

Afro Brazilians

Black adolescents who enter the university by quotas start to participate in black movements and assume the Afro-descendant identity, cultural symbols of African culture, changes that create new conflicts with their relatives, who only aspired to social ascension for their children entering university, but they didn't expect identity changes in their children.

Therefore, the new challenge for inclusive policies is how to universalize antiracist policies among the population, particularly the poorest and, at the same time, to promote antiracist reactions when interacting with these new groups in spaces never previously occupied by them.

Those who assume their Afro identity suffer bullying due to expressing themselves, acting, wearing, using hairstyle as a symbol of Afro-descendant, from the family to the

neighbourhoods, schools, and public spaces. Prejudices, fear, aggression at work, health systems, family, and confrontation with the security forces are a norm in Brazil, even for youth included at the university through quotas.

They suffer discrimination in their places of residence and have conflicts with family ascendants, for whom racist culture has not changed, and they suffer humiliation for assuming their Afro-descendant identity. This happen even in communities where Afro-descendant population is the majority.

However, some Afro descendants living in the poorest neighbourhoods have a lack of awareness about the need for an anti-racist political struggle.

During interview with an adult man, a gardener it was possible to observe how he related two silly situations of racism, and one was interpreted as a “joke”, which is very common among Brazilians, to transform suffering, prejudices, xenophobia, misogyny, racism and all kinds of discriminations into jokes or to revert interpretations of realities against the victims, laughing and bullying.

People resist talking about racism in the family. ... It is easier to talk on the street, shops. But school is second hardest place to talk about it, followed by family, where people never discuss racism. Contradictorily, a frequent topic in interviews was interracial dating and racism in family.

> “My father is a Black, my mother is White. I have a dark skin and my brother is White. He was once helping my father at work when someone asked my brother if he was my father's son, and he jokingly replied: 'Me?! A White like me couldn’t be a son of that black guy'. My father didn't like it, they fought and later my brother apologized, but my father didn't forgive him, and until today they don't get along. I think my father is being racist for not forgiving his own son!” (Security Guard. Camaçari-BA)

> “My grandmother is white, she raised me, I live with her, she always makes fun of me for my hair. But I don't care, she's racist, she admits it, I don't care, I let it go, I live in her house”. (Young merchant. Rio)

> “I was dating a white guy, and his mom hated that I was dating him, I wasn't good enough for her son because of my skin color. One day, she accused me of having stolen dishes from her house. The worst pain was that my boyfriend believed her. Well, my relationship ended and later she found out that her eldest daughter who arrived from Europe had stolen her dishes. (Young Black woman, a nurse, Rio).

Affection and jokes are used to justify racist expressions: “Bombril’s hair”, that means “hair made with steel wool”, but in general people perceive it as just kidding.

> “I knew a bandit based on the person's face (a bandit's face)” (White man, a doctor, Camaçari, Bahia).

> “Do you think that blacks are more aggressive than whites?” “Yes, since the world has existed, we have known that Black people are angry because of slavery and so

> on. So, they want to take it out on everything they see ahead, including us White people as if we were responsible for all their suffering. This thing about shifting blame just shows that in a way we are superior to them... look, don't confuse this with racism. I'm not racist!" (White man, Coordinator of Health Service, Camaçari, Bahia)
>
> "The majority of the population that turns to crime are black people, so there had to be no racism, if that is the condition they chose, a way to live. White man, a doctor at the hospital

Denying the skin colour and African ancestry is indispensable to aspiring to and achieving social mobility. All the Black women interviewed had the experience of having been forced by their mothers, since they were small children, to use chemical products to change their hair, to be socially accepted.

> "My teacher told me to use a Black hairstyle for a competition, my friend did it, I felt so beautiful… But when I left home, all the people in the street were laughing of my hair… everyone, I was so humiliated, in public, in my small town… I have never used it anymore". (young woman, University student).
>
> "With a lot of effort, I put my daughter in a private school. I just didn't know she would suffer so much... One day the teacher ordered my 10 years old daughter to clean the floor of the classroom." (Black woman, nurse).

Eugenics orientation is more evident when talking about violence, related to Afro descendants. Security forces, police, communications media, and citizens in general treat African descendants as a threat of aggression and crime.

Police and other private systems of surveillance and punishment, use to arrest Afro descendants in supermarkets and shopping centers, suspecting they have committed some crime. Personnel like guards in commerce, supermarkets, shopping centres, receive trainings to act in accordance with racist guidelines, applying violence, beatings and even assassinations, accusing the victims of robbery and violence.

Imprisonment and police violence are more frequent among Black men, who are most imprisoned people. Social networks and media, TV, movies, videogames, football, reproduce explicit racism daily.

In conclusion, the Racial Democracy hypothesis is not only non-existent, but also an excuse to perpetuate racism in its explicit form, in a continuous process of social and individual alienation.

MEXICO

Mexico colonization started with a 52 years' war against the Spanish Empire, until the defeat of the Aztec empire which were decimated by the war, conflicts between Spanish forced work and slavery, and the destruction of infrastructure, social, political and economic

structures of Indigenous society, as well as epidemics. The 1574 census of tributaries reported around two million taxpayers, corresponding to 8 to 10 million Indigenous people in Mesoamerica). (Livi-Bacci, 2006).

Indigenous people actively participated in the wars for independence and in the Mexican Revolution in 1910, resulting in the agrarian reform, collective land, Indigenous rights, and the constitution that remains in force up until today. However, occupations of Indigenous lands for mining and other development projects revived until today. (del Val, 2010; León-Portilla, 2010; Ávila and Salmerón, 2015)

Indigenous in Mexico

Today the self-declared Indigenous peoples represent 19% of the population, or twenty three million of inhabitants, and 7 million of them speak one of the sixty-eight Indigenous languages (INEGI, 2020).

Racism is present in the relationships with non-Indigenous people, particularly in the city, where they are a minority.

> "They are Indigenous because they speak their own languages. But there is racism. So, in the city they do not say anything anymore, or speak in their language, so, people do not know what they are saying. And when they answer them in Indigenous language, they get angrier."

> "When I studied a master's degree, there was a teacher who was always acting in a derogatory way towards me, because I had come out of a program of Indigenous women, he was saying: 'Oh, you always play the victims role.' He did not support me, even though he was my thesis advisor."

> "I came to occupy a position of decision, however, there was no recognition of my work, because I was Indigenous, young, short, I did not have a partner… I was working in Justice and Dialogue, and people treated me like 'so what is she able to mediate'? What is she know about? I even came to think of resigning because it was very heavy, not recognized."

Afro Mexicans

In Mexico, in 2020, there were more than 2 million people who identified themselves as Afro-descendants, representing 2% of the total population. Afro Mexicans are concentrated in small villages in some states like in the Costa Chica of the State of Guerrero, . In these communities, they are integrated with the communities of Indigenous people, and their culture is valued and enjoyed by most of the populations. Afro Mexicans have been denied as part of the population, and only in 2020, for the first time, did the censuses ask about Afro descendants in Mexico, generating strong racist reactions in a part of the society, who prefer to continue being considered only by their Indigenous and European ancestry.

> “At primary school, White teachers and pupils rejected me. It was a prestigious public school. The teachers believed I could not be among the good ones. They said: how? Why does she get a ten? The teachers were white. ‘No, … you were looking closely and copied the exam. Surely you were copying this, surely.’ … so, they (teachers) separated me. They separated me, I did not understand, I was in the first year.”

Suddenly they moved me to second grade. And they (White students) went to third grade. It did not matter if I studied or not, so I left school, because I did not like what they said to me, for me it was an aggression. Well, I did not want to go to school anymore.”

> “She had to study another master's degree, but they made her doubt about her ability. Because she was Black and, yes, because she was a woman, she felt this. This is still there, even after having done the master's degree … how to take this rejection towards….

Afro Mexicans relate experiences of racism in their childhood.

> “At school, everyone was bullying me because of my skin colour. They said they are better than us, because they are White, and we are dark. I felt unbelievably bad, I returned home to my village. I was ashamed, I no longer wanted to go to school. Because every day my classmates made fun of me. You know that everyone laughs, they all laughed at me.
> The teacher does not say anything to him. She just told him to shut up. Then they kept laughing. The next day, he continued. But we beat him up because they were against me. I just hit the kid, and he sent his mom to school.
> The group insulted me because of him. He did not insult but they yelled things at me. I should leave that school because every day I had that mockery. For how much longer? As soon as class started, they were already there, to throw papers (on me) … and I was on the point of hitting him because I was tired.”

> “I do not want to be at school, I really did not want to go to class for the same reason, because they said ugly things to me. I failed, I did not go, because of the bullying. They stayed there. I did not go, I lost, that is why I failed.”

> “The ugly name, I tried the first and second time. But my heart had left there. I am already tired. I do not get angry because I am Black. I do not think about it. Not anymore. I do not even pay attention to it.

DISCUSSION

INTERGENERATIONAL RACISM IN INTERRACIAL FAMILIES

An Imperial and colonial Europe country like Sweden, based on its culture of egalitarianism and universal welfare, shows patterns of denial, delusion and defensiveness, linked with the history and memory of Nazism, the legacy that leads to multicultural policies. A process of amnesia or alienation promotes an “active forgetting”, a political, social and psychological denial of the imperial past, colonization and the corresponding eugenics and racism.

The great denial of racism leads to a collective self-delusion that race is irrelevant, that racism does not exist. That is why Sweden has no laws or data on Afro descendant or Indigenous people. What you can't see, or measure doesn't exist. Although there are some interracial marriages, it is rare and can generate conflicts inside families and in public spaces. (my friend with a son married with an African woman)

In colonized countries like Brazil the society forges a "White" identity through interracial marriage, however, racism is explicit and violent even inside the family, even between parents and children. A white mother and her mixed son who denies his Black father are an example. Another example is a brown boy with a black brother, the grandmother treats him with a racist attitude.

In Mexico, mestizo children who are Afro descendant suffer the same kind of racism in the public spaces, but it seems to be more protected inside their family.

Interracial marriage reproduces submission and humiliation of Blacks in family members between generations, denial of children with darker skin and curlier hair.

Racism operates in the three countries with violence, in the form of ironies or oral aggression (son denies father, another boy asks his mother not to invite Black people to his birthday party.

HOW RACISM IS REPRODUCED IN SOCIETY AND PUBLIC SPACES.

Racism in Sweden is hidden through the concepts of multiculturalism and migration exceptionalism, although racism is manifested through attitudes of isolation and segregation of Africans and Indigenous since childhood, mainly at school and public spaces. Racism is officially denied, although it exists. There are no affirmative policies, only a multicultural policy based on egalitarian values that don't matter for the Sami and African-Swedish.

In Brazil it is explicit, with violent attitudes and often hidden in the form of jokes that are not perceived as racism, in all areas and spaces, including the family and friends, in all public and private spaces. It is the most difficult context to talk about racism. Affirmative policies include Black and Indigenous people at the university and in the middle class, however, it is not enough, since racism is structural and reproduced even in presence of social mobility.

In Mexico racism hides behind jokes and nicknames, and it also segregates Indigenous and Afro descendant people from childhood, at school and public spaces. Mexico applied integration policies for the Indigenous, but not for Afro-Mexicans, never recognized as part of the population until 2015. Even with integration policies Indigenous

people are discriminated against at school and in other social positions, mainly due to their language, clothes and behaviors.

Colonialism perpetuation reproduces structural racism through land occupation by force in the three countries. National states force Indigenous displacement from their lands to promote mining companies of old colonizer countries.

Eugenics perpetuation is also common in the three countries with the same inferiorization of Indigenous and Afro descendants: criminalization of Afro-descendants and a new legacy to exercise explicit violence against Africans and Afro descendants. Eugenics legitimizations justify land occupation.

Structural racism perpetuates violence and bullying whitening and between generations at school and universities, in all the public spaces and, in Brazil, also among family members, producing psychological exhaustion, self-exclusion and, as a result, an inferior level and quality of education for Indigenous, African, and Afro descendants.

Affirmative policies should develop new strategies against colonialism, structural racism, and eugenics perpetuation.

Multicultural policies should include an antiracism approach, as well as measures to make it visible (what you do not name, does not exist) and to be effective.

Structural racism against Afro descendants is present in multiracial families in Brazil. Special actions are necessary to mitigate not only “racial democracy,” but mainly “whitening aspirations” in the collective imaginary.

Colonization and enslavement of Indigenous peoples and Africans and their descendants in both countries in the last centuries and, as a result, up until today there is social inequalities, discrimination, and racism.

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GENETICS AND ECOLOGY OF *Aedes spp.* IN THE STATE OF MATO GROSSO

https://doi.org/10.56238/sevened2024.037-073

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ABSTRACT

This chapter is a fundamental contribution to the understanding and management of one of the main vectors of diseases in Brazil. It is the result of a collaborative effort of a research group that has explored in depth the complex interaction between the genetics and ecology of Aedes spp., with a special focus on the specific conditions of the state of Mato Grosso – MT, Brazil. The analysis discusses the genetic diversity and ecological adaptations of Aedes spp., based on data collected directly in the territory of Mato Grosso. It presents studies from the last ten years, which reveal how environmental and genetic factors influence the population dynamics and vector capacity of these mosquitoes. First, it deals with the biology of the Aedes spp. mosquito, which makes a bibliographic review of the state of knowledge type in the time period from 2013 to 2023, on the subject in our state. It then discusses climate change and one health, in the face of arboviruses, and details the methods used to map the genetic diversity of Aedes spp. populations in Mato Grosso, aiming to clarify genetic variability and the possible implications for insecticide resistance and the spread of diseases. As future perspectives, the chapter also addresses the implications of the results obtained for future control and prevention strategies, discussing integrated approaches, including genomic studies, that can be adopted to mitigate the impacts of these diseases in the state, expanding knowledge about the vector.

Keywords: Mosquitoes. Arboviruses. Public health.

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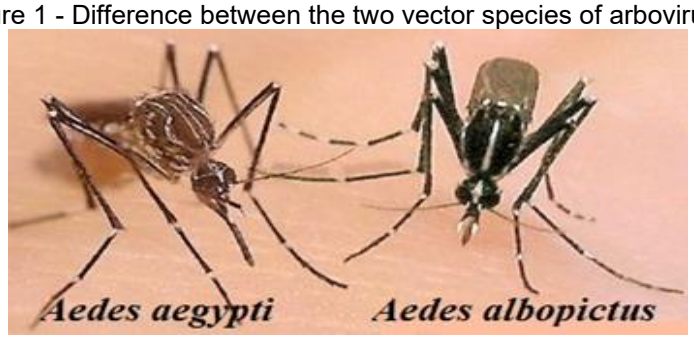
INTRODUCTION

BIOLOGY OF *Aedes* spp.

Aedes (Stegomyia) aegypti (Linnaeus, 1762) and *Aedes (Stegomyia) albopictus* (Skuse, 1894) are the main vectors of highly pathogenic viruses for humans, such as Dengue (DENV), Chikungunya (CHIKV) and Zika (ZIKV) (Gómez, *et al*., 2022; Allan *et al*., 2023), which cause febrile, hemorrhagic and neurological diseases and continue to be a major threat to global public health. The high ecological plasticity, opportunistic dietary patterns and the versatility in the use of urban and natural breeding sites of these vectors have favored their dispersion and adaptation in tropical, subtropical and even temperate zones. Due to the lack of available treatments and vaccines, mosquito population control is the most effective way to prevent arboviruses (Gómez, *et al*., 2022).

Both *A. aegypti* and *A. albopictus* are diurnal mosquitoes and, in their larval stage, live in clean, still water or in any container that accumulates clean water. Their morphological appearance is very similar and with the naked eye it is easy to confuse the two species of mosquitoes, because they have black and white streaked bodies and legs. *A. aegypti* is characterized by the presence of a set of silvery-white scales and a lyre on the thorax (mesonot) and *A. albopictus* has a longitudinal median band of longitudinal silvery-white scales on the back, in addition to being darker than *A. aegypti*. *A. albopictus* has a single straight line in the center of the thorax (Figure 1).

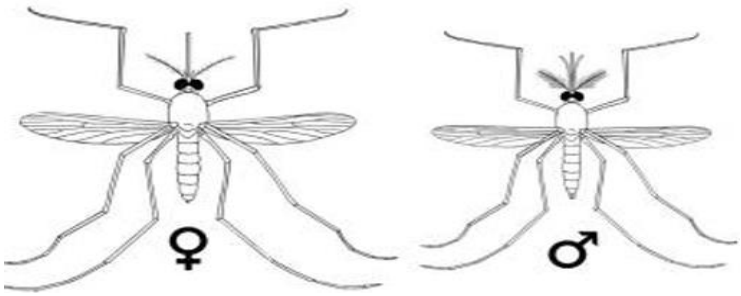
Figure 1 - Difference between the two vector species of arboviruses



Source: Florida Medical Entomology (1999). https://fmel.ifas.ufl.edu/research-areas/invasion-biology-of-*Aedes-albopictus*/.

Gonçalves (2016) showed that the female and the male are differentiated, morphologically (sexual dimorphism), by some characteristics such as the antenna and the abdomen. The female has a hairy antenna and a more robust abdomen, while the male has a feathery antenna and a slender abdomen (Figure 2), as well as longer palps.

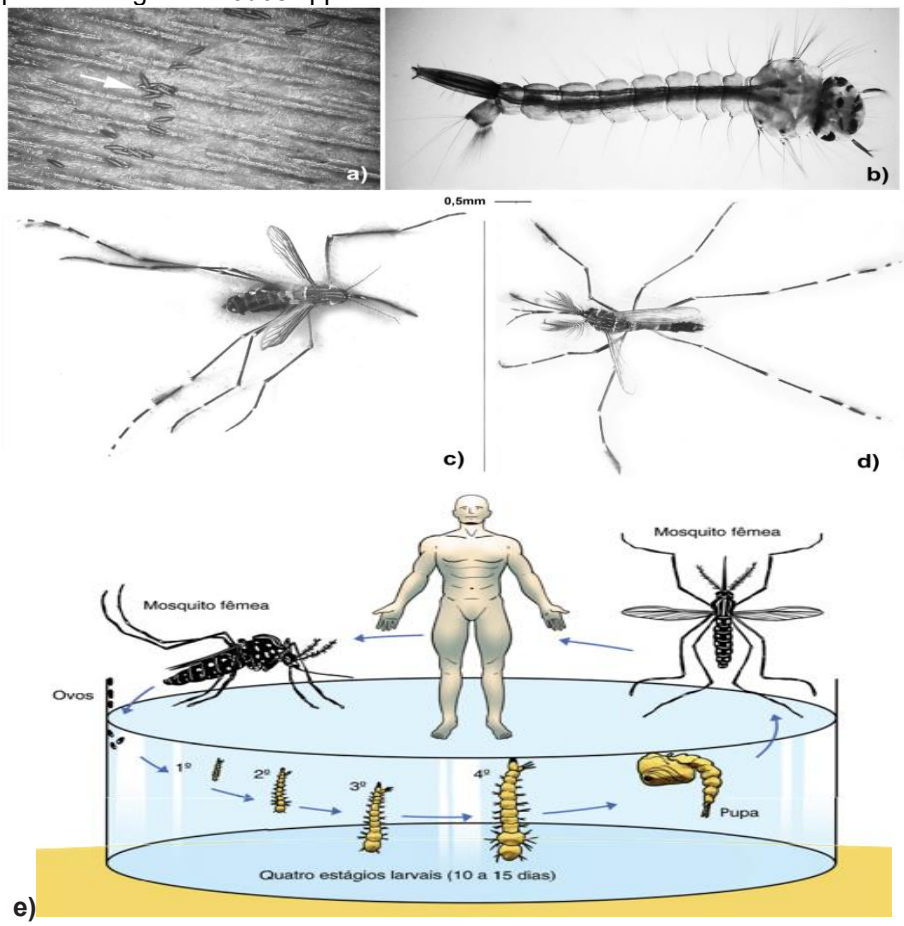
Figure 2 - Sexual dimorphism of the A. *aegypti mosquito*



Source: Lorenz *et al*., (2018).

The female mosquito, after biting a person, lays the eggs on the wall of the container. The eggs evolve through four larval stages and a pupal stage, when they then transform into adult male and female mosquitoes (Figure 3). Within 24 hours of turning into mosquitoes, males and females fly to mate. The female, from then on, needs blood for the eggs to mature (anthropophilia) and the male feeds exclusively on vegetable juices, and the mosquito lives an average of 30 to 35 days.

Figure 3 - Stages of development of *Aedes* spp.: a) eggs, b) larva, c) adult female and d) adult male e) Life cycle of the mosquito of the genus *Aedes* spp.



Note: Construction by the authors.

Oviposition usually takes place in the late afternoon and the pregnant female prefers dark and shaded environments with clean water to lay the eggs.

We found larvae and pupae in various breeding sites such as bottles and in disposable packaging, cans, tires, vases, cisterns, slabs, uncovered water tanks and others. It also requires attention under potted plants where they accumulate water and are considered potential breeding grounds. Other important environments are pools without cleaning and without weekly treatment and clogged gutters.

CLASSIFICATION OF *Aedes* spp.

Ordem - Diptera (Di=dois, pteros=asas)
Family - Culicidae
Subfamily - Culicinae
Tribe - *Aedini*
Genus - *Aedes*
Subgenus - *Stegomyia*
Species – *Aedes aegypti*
Espécie - *Aedes albopictus*
Aedes (*Stegomyia*) *aegypti* (Linnaeus, 1762)
Aedes (*Stegomyia*) *albopictus* (Skuse, 1894)

Aedes *and* Anopheles *species* thrive in the same urban environments, and urgent action is needed to integrate disease surveillance and generate innovative vector control tools for urban populations, to protect the many millions of people at risk (Allan, 2023). The integration of different compatible and effective vector control strategies considers the available technologies and regional characteristics as a viable method to try to reduce mosquito infestation and the incidence of arboviruses transmitted by them (Zara *et al.*, 2016).

It is worth noting the occurrence of populations of *A. aegypti* resistant to organophosphates commonly used as larvicides and insecticides (Montella *et al.*, 2007). This mechanism is known as metabolic resistance and the increased activity of detoxifying enzymes, such as esterases circulating in the vector's body, which contributes to the elimination or inactivation of insecticides (Brasil, 2006).

Insecticide resistance can be thought of as a process of accelerated evolution of a population that responds to intense selective pressure, with the consequent survival of individuals who have alleles that confer resistance. This resistance is pre-adaptive, the result of many mutations (Braga; Valle, 2007). It is very important to understand their mechanisms in order to contribute to the progress of methods capable of overcoming them. When we identify the mechanisms of resistance related to *A. aegypti*, there is a minimization of the evolution of the infection picture and consequent reduction of the impact of resistance to humans (Rosa, 2016).

In general, the resistance they stimulate is due to amplification of the number of genes or increased activity by the action of regulatory mechanisms, which generate an increase in the synthesis of the corresponding product (Rodríguez *et al*., 2002). Consequently, this adaptive trait in a set of selected genes favors the maintenance of the insect capable of reproducing in an environment exposed to insecticides (Belinato & Martins, 2016).

It is suggested that insecticide resistance may be pertinent to the high genetic differentiation of Brazilian populations of *A. aegypti* and this may reflect in important vector differences and populations from different areas of Brazil should be treated as independent epidemiological units (Ayres *et al*., 2003).

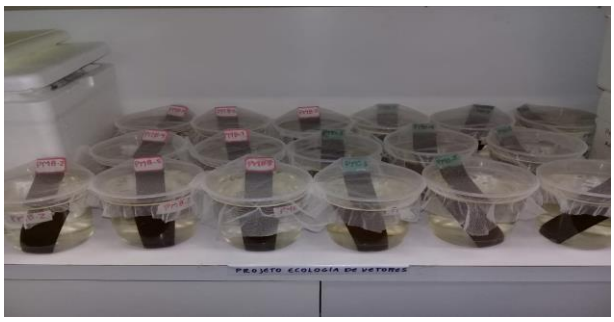
GEOGRAPHICAL DISTRIBUTION

It has a wide geographical distribution, and predominates in tropical and subtropical areas located between the parallels of latitudes 45° North and 40° South (Forattini, 2002). The genus *Aedes* is common to oviposition outside the liquid medium, but close to it or in potentially floodable places. The place for oviposition is one of the main factors responsible for the distribution of mosquitoes in breeding sites and their subsequent dispersal in different geographic areas (Tilak *et al*., 2004). As a result, the geographic displacement of human beings favors and increases the risk of carrying pathogens from other locations, causing the emergence or reemergence of diseases (Lima-Camara, 2016).

In her reproductive cycles, after each oviposition, the female will respond to the attractive stimuli of a host, which gives the mosquito its epidemiological role in the transmission of diseases (Natal, 2002), especially dengue, Zika, Chikungunya and yellow fever, in addition to the vector having a great capacity to adapt to urban environments (Brasil, 2005). This fact instigates research for new methods of vector control, whose larvae explain the degree of adaptability to drastically altered areas resulting from the destruction of natural habitats, and later, invasion into environments occupied by man.

Its control through ovitraps (egg capture, Figure 4a) is a promising strategy that depends on the scope and time of use of the traps in the field, as developed and efficiently employed by Miyazaki *et al*. (2009), Depoli (2016) and Oliveira *et al*. (2020). After collecting the ovitraps, the material is sent to the Entomology Laboratory of the Federal University of Mato Grosso (UFMT) for the development of the biological cycle (Figure 4b).

Figure 4- a) Ovitrap. b) Development of mosquitoes at the Entomology Laboratory of the Federal University of Mato Grosso (UFMT).

a)  b) 

Note: Construction by the authors.

In favorable conditions of humidity and temperature, the development of the mosquito embryo is completed in 48 hours. The resistance to desiccation also allows the eggs to be transported over great distances in dry containers.

Larval density, high fertility and fertility rates, short life cycle, adaptive capacity to environmental changes, and egg resistance to waterlessness are factors that determine the survival, distribution, and density of vectors (Custódio *et al*., 2019). The abrupt transformation of natural environments (Ferreira Filho *et al*., 2017) consequently due to anthropogenic changes in the landscape interferes with its proliferation for its rapid population growth, and seems to play an important role in the dynamics of its abundance (Butakka *et al*., 2022).

STATE OF KNOWLEDGE ABOUT THE GENUS *Aedes* spp. IN THE STATE OF MATO GROSSO

A survey was carried out in the following Brazilian catalogs: 1) Capes Journals; 2) CAPES Catalog of Theses and Dissertations (CTDC), [5]3) Brazilian Digital Library of Theses and Dissertations (BDTD).[6]

In the Capes Periodicals, the descriptor "*Aedes*" and "Mato Grosso" and specific filters for the period were used, seeking to measure the number of productions related to this theme in the time period from 2013 to 2024 (last eleven years) 47 academic publications were located. After reading the titles and abstracts of these, they were filtered

[5] Platform for the search and dissemination of the country's scientific production, founded by the Ministry of Education (MEC), available at https://catalogodeteses.capes.gov.br/catalogo-teses/#!/.
[6] Platform for searching and disseminating research carried out in the country, developed by the Brazilian Institute of Information in Science and Technology, available at https://bdtd.ibict.br/vufind/.

to 23 publications in which we sought to identify studies that addressed *Aedes* spp. in the state of Mato Grosso in themes focused on general biology, genetics, ecology and health education.

Considering the high importance and need for studies on *Aedes* spp. in the state of Mato Grosso, and based on the studies stored in the Capes periodical portal, we found that the number of scientific productions is still small, requiring more studies to boost the theme in the state and encourage the development of research at various levels.

In the CTDC, when we used only the keyword "*Aedes*", in the CTDC, 2,360 records were generated. When we used the keywords "*Aedes*" and "Mato Grosso" only 02 works returned. Thus, it was decided to use only the keyword "*Aedes*" and the filter "educational institution", with the following options: "Federal University of Mato Grosso (UFMT)", "University of the State of Mato Grosso (UNEMAT)" and "University of Cuiabá" (UNIC), Federal Institute of Mato Grosso and University Center of Várzea Grande (UNIVAG).

When applying the time lapse from 2013 to 2023, the number of dissertations and theses selected for reading and analysis of the abstracts were: 10 for UFMT, 05 for UNIC. Subsequently, in the phase corresponding to pre-analysis, among the productions cited in the research universe, these were selected after reading the abstracts because they were studies on *Aedes* sp. in the state of Mato Grosso, with 12 master's dissertations and 03 doctoral theses. When used as options, the other higher education institutions in the state of Mato Grosso did not return any work.

There is a small number of studies that discuss research with a molecular data approach of *Aedes* spp. In this sense, it is relevant to investigate the directions of these productions, thus contributing to a reflection on the difficulties and importance of this theme.

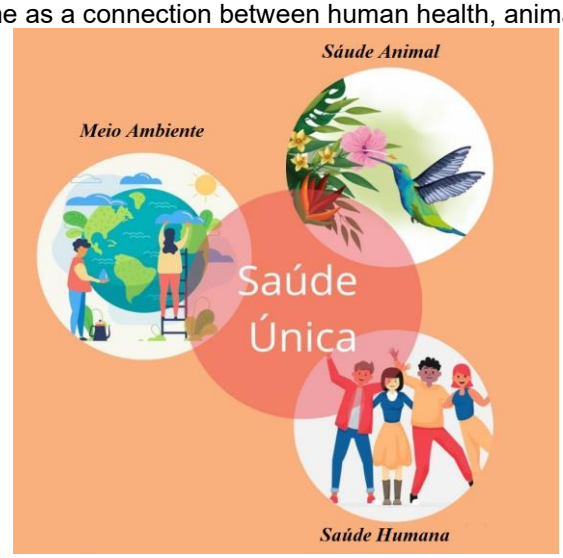
These findings indicate the need for advances and new research. It is understood that the mapping of the theme involved allows the opening of discussions and debates about the large area in Biological Sciences and how the productions have been evidenced in recent years.

CLIMATE CHANGE AND SINGLE HEALTH IN THE FACE OF ARBOVIRUSES

The concept of One Health establishes the connection between human health, animal health and the environment (Figure 5), integrated in a systemic and interdependent way that allows us to exist, coexist and at the same time "evolve" (Lobo *et al.*, 2021). The relationship between man and nature can be understood through One Health with the integration between different knowledge and areas of knowledge in an interdisciplinary and

collaborative way, with a holistic approach to the health-disease process (Cruz-Silva *et al*., 2023).

Figure 5 – One Health Scheme as a connection between human health, animal health and the environment.



Source: Adaptation of the Environmental Education Portal. Gov. São Paulo (2021).

One Health as an interdisciplinary approach to health promotion must be contemplated with an understanding that human, animal and environmental health are inseparable. The One Health approach arises from the need to respond quickly to the problems arising from the high demographic density of the population and urbanization, the invasion of habitats for the intensification of extractivism and the use of resources (Monteiro *et al*., 2024). Environmental Education with a focus on One Health promotes awareness and attitudes aimed at its promotion and quality of life (Cruz-Silva *et al*., 2023).

The Brazilian Constitution of 1988, article 225, establishes the right of everyone to an ecologically balanced environment, an essential good for a healthy quality of life, imposing its defense and preservation on the Government and the community (Constitution of the Federative Republic of Brazil, 1988, update of amendments, 2016). Global climate change is producing direct effects and significant impacts on human health, especially in urban areas. Its effects can lead to exposure to extreme conditions such as natural disasters, hurricanes, droughts, and floods, increased spread of vector-borne diseases such as mosquitoes (Galati *et al*., 2015), and increased disease transmission. This trend will be accentuated with the increase in temperatures on the planet, directly or indirectly to health, since it is the complex relationship between the physical environment of the atmosphere and the social one, with effects on the dispersion of diseases (Nunes & Mendes, 2012).

Climate variability, understood as an intrinsic property of the terrestrial climate system, is responsible for natural oscillations in the weather patterns observed at the local, regional and global levels. There are several climatic factors, such as relative humidity and

temperature that favor the reproduction and survival of vectors of infectious agents, such as the *Aedes aegypti* mosquito (Confalonieri, 2003), essentially high temperatures in cities (Degallier, 2010). In view of the alarming numbers of sick people, it is necessary to better understand the influence of climate change on the prevalence of vector-borne diseases. Obtaining data is necessary for future decision-making by the agencies responsible for the area of prevention and combat against the mosquito, as well as the civil defense itself.

The accelerated expansion of the fossil fuel industry, deforestation and burning of forests have aggravated global warming and resulted in more favorable climatic conditions for the reproduction and survival of pathogens and vectors (Mordecai *et al*., 2017). Climate change may accelerate the cycles of arboviruses and expand their geographical distribution areas. Considered a vector that disseminates the Dengue, Zika and Chikungunya viruses, *A. aegypti* has become a threat to public health especially in urban areas, where dengue transmission is strongly influenced by a range of biological and environmental aspects, specifically the high temperatures and formation of heat islands, associated with the precarious conditions of marginalized populations in these environments. It is essential to know its seasonal and geographical range and its relationship with the urban climate (Mordecai *et al*., 2017). The recent report by the *Intergovernmental Panel on Climate Change* (IPCC), published on February 27, 2022, points to the increased risk of arboviruses, particularly dengue, with longer seasons and a wider geographic distribution in Asia, Europe, Central and South America, and sub-Saharan Africa, potentially putting billions more people at risk by the end of the century (Prophiro, 2022).

The mosquito infestation will always be more intense due to accumulated water, which favors the hatching of mosquito eggs, as well as the lack of basic sanitation, the presence of open ditches are causes of soil contamination and the advance of transmitted diseases. Without infrastructure, the health chaos overloads public health systems and a scenario that prevents, in the short term, the proposition of actions aimed at the eradication of the transmitting vector (Galati *et al*., 2015).

DATA ON DENGUE, ZIKA AND CHIKUNGUNYA IN MATO GROSSO

By observing the Epidemiological Scenario of Urban Arboviruses: Dengue, Chikungunya and Zika in the state of Mato Grosso, we can perceive the importance of surveillance, prevention and control actions, supporting decision-making at the various levels of management (Table 1).

Table 1 - Number of probable cases of Urban Arboviruses from Epidemiological Week 1 to 30/2024, MT, Brazil

Arboviroses urbanas				
No. Notified cases		No. Probable cases	No. Confirmed cases	Sorotipo DENV
Dengue fever	63.783	40.602	34.643	1, 2 and 4
Zika	1.654	1.041	256	...
Chikungunya	18.948	17.315	15.844	...

Source: SINAN – Epidemiological Surveillance SES-MT-2024 * No. Subject to change due to online database feeding.

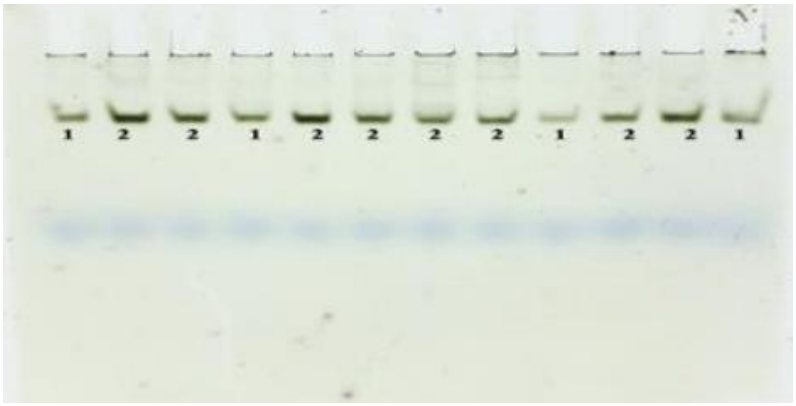
Historically, the peaks of dengue epidemics usually occur between the months of March and April, but this year, changes in temperature and in the rainy season caused by global warming and the serotypes of the disease in circulation drove the increase in cases earlier. Alternatively, the study by Souza *et al*. (2018) in a population in Bahia, indicated that in addition to determinants such as garbage collection, unhealthy housing conditions and the absence of public policies are determinants for the occurrence of cases. Environmental Education is a preponderant factor in the control of zoonosis.

INSECTICIDE RESISTANCE AND ESTERASE ENZYME EXPRESSION

The differential expression between larvae and adults may be relevant for the monitoring of resistance, when it is necessary to compare bioassays and biochemical assays. Esterases of the fourth larval stage of *A. aegypti* populations were identified by Paiva (2006) as the main mechanism that confers resistance to organophosphates, related to gene overexpression. This resistance increased with the increase in the level of the esterases. Research on resistance to these chemical components was also developed by Campos & Andrade (2003).

The analysis of esterase polymorphism occurs by using polyacrylamide gel. Samples are stained with alpha naphtyl acetate and RR-Salt, diluted in acetone and phosphate buffer, then placed in an oven at about 37ºC, with no light for one hour. For the identification and analysis of the bands, weak bands (1) and overexpressed bands (2) are considered normal (Figure 6).

Figure 6- Polyacrylamide gel from *Aedes aegypti* mosquitoes stained with RR-Salt and Alpha esterase. Identification of esterase enzyme bands by band intensity, normal-weak bands (1) and overexpressed-dark bands (2).



Source: Lima *et al*. (2021).

Lima *et al*. (2021) concluded that, despite the significant presence of normal expressed alleles, there is evidence of esterase enzyme polymorphism in natural populations of *A. aegypti* in Chapada dos Guimarães - MT. The analysis also revealed the presence of overexpressed alleles, indicating that this population has insects with potential for metabolic resistance. In addition, it was observed that the seasonal phases directly influence the constitution of the population of these organisms. External environmental factors affect the selection of organisms, promoting the overexpression of the esterase enzyme and making it difficult to control the vector. Esterase facilitates the detoxification of the body, making it resistant to chemical substances such as insecticides used to combat the vector, which represents a concern for the management of these populations.

A genetic sequencing model was performed by Anderson *et al*. (2024), to mitigate insecticide resistance through the formation of alleles in a novel gene expression system. These authors tested gonial homologous cell sequences (bgcn) of *A. aegypti* to express multiplexing in the sgRNA inserted in the kynurenine 3-monooxygenase (kmo) gene. In a study on ecogenotoxicology developed by Rodrigues *et al*. (2005) in the municipality of Campo Verde – MT, it was observed that the average heterozygosity index of the esterase enzyme in two populations of insects of another family, the drosophilids, was higher in the natural ecosystem, which indicated an influence of the agroecosystem on the genetic structure of their communities, possibly narrowing the genetic base. Such data showed that insects can be used as sentinel organisms to assess environmental impacts.

Studies of insecticide resistance have shown that it is due to three main types of mechanisms: (a) reduction of insecticide penetration, due to changes in the insect cuticle; (b) increased metabolism of the insecticide by the action of esterase, monooxygenases or glutathione enzymes – transferases; and (c) by modification of the insecticide target (Bisset

et al., 2006). The literature also records a behavioral resistance mechanism, in which insects avoid contact with places that contain the toxic substance.

The effective success of a monitoring program for this vector requires a detailed study of the larvae resistance mechanisms, as well as the factors that regulate their proliferation, which include adaptation to the diversity of breeding sites.

ENVIRONMENTAL EDUCATION – FOCUSING ON SINGLE HEALTH ISSUES

The multidisciplinary essence of Environmental Education is revealed as the theme is related to the concepts of ecologically balanced environment, common use, quality of life, conservation and preservation of the environment, and sustainability (Cruz-Silva *et al*., 2023). There are numerous possibilities for applying educational practices that are environmentally adjusted to contemporary issues, such as urban densities, pandemics, epidemics, and climate emergencies and their consequences (Monteiro *et al*., 2024).

Environmental Education and Health are closely related, as a socially and ecologically balanced environment is capable of ensuring a healthy quality of life (Machado, 2018). This approach has the ability to stimulate the analysis of existing socio-environmental problems, as well as more ethical practices and attitudes. Environmental Education (EE) fundamentally involves encouraging the moderate use of natural resources, in order to understand the role of society in the environment. The relationship between man and nature must be resumed in a more sustainable way in view of the complexity surrounding this relationship that involves One Health (Monteiro *et al*., 2024).

The development of activities that rescue environmental heritage should constitute a goal for environmental preservation, associated with animal welfare and human health. The One Health approach is a path to scientific improvement, which enables long-term socio-environmental and economic balance and well-being. These indicators prioritize One Health and the factors that affect the health situation of a region, not only the ecological aspect, but also by incorporating the political, cultural, and historical dimensions, among others (Limongi and Oliveira, 2020).

In our reality, in the face of arboviruses in the State of Mato Grosso and in Brazil, contributing to environmental education and working with actions to prevent the vector and transmission of diseases such as dengue, it is essential to have a social mobilization with school communities and the population, seeking to create habits of health surveillance in the public and private sectors. Knowledge can generate new paradigms to discuss the disposal of solid waste that can accumulate water, such as cleaning gutters, water tanks, caring for screens in drains and the correct recycling of materials. Mosquito control and

prevention measures can be intensified, as well as reflections on environmental impacts can be proposed to implement safe measures to eliminate mosquito breeding sites.

PUBLIC HEALTH POLICIES

The absence of good urban planning results in inadequate housing conditions, as well as the lack of public policies in basic sanitation services, access to drinking water and the management and disposal of solid waste, among the determining factors for the permanence of arboviruses and other urban diseases.

Faria *et al*. (2022) carried out an analysis of eight reference government documents in order to investigate, through public policies already implemented in Brazil, how basic sanitation is addressed in guiding instruments for the control of arboviruses in the country.

They found that aspects related to communication and social mobilization, vector control and public management are the most addressed topics in the documents analyzed. However, the components of basic sanitation, the management and drainage of rainwater and sanitary sewage were not addressed in the fight against arboviruses, which may contribute to the low effectiveness of intervention and, therefore, such contradiction needs to be overcome by existing public policies in Brazil.

To combat arboviruses, educational actions to combat *A. aegypti* contribute to improving the knowledge and behavior of communities, sensitizing the population to manage the environments they inhabit. Dias *et al*. (2022) proposed health education as an element implemented jointly and articulated with other vector combat strategies. Positive results were associated with the use of educational strategies such as: reduction of mosquito habitats; elimination of breeding sites; reduction of vector infestation; expansion of knowledge, attitudes and practices around vector control that contributed to making it empowered communities.

However, the health sector, by itself, cannot solve the complexity of the factors that favor the proliferation of the dengue vector, such as the *A. aegypti* mosquito, because dengue control encompasses a global intervention process, whose approach goes beyond the health sector. Educational interventions around diseases transmitted by *A. aegypti* are strategic actions that should be implemented in a participatory and continuous manner, with active methods, which have demonstrated more satisfactory results in health promotion, in contrast to the vertical teaching models that have demonstrated limitations in motivating the population to control vectors.

Faced with this scenario, the State Health Department of the Federal District launched a Plan to combat dengue and other arboviruses (2024-2027), subsidized by the

national regulatory framework, in view of the epidemiological and entomological situation in recent years, especially to adopt intersectoral measures and reduce the population's risk vulnerability. However, this plan identifies the ento-epidemic situation, health education and communication actions within the regions, but it does not yet involve other sectors, such as urban planning for rainwater drainage and sanitary sewage with technological innovations, notably in the outskirts of Brazilian cities.

Investing in environmental education and raising awareness among the population is necessary to influence the political process and increase the recognition that we must better understand the relationships between One Health, social relations and the integrity of ecosystems, help in planning in which prevention should be invested and succeed on an ecologically healthier planet. The association of Environmental Education and Health, together with the approach to these themes, has the ability to "encourage the analysis of existing socio-environmental problems, stimulate more ethical practices and attitudes, and enable the development of activities that rescue environmental heritage and encourage preservation", as pointed out by Machado (2018).

The control of disease vectors in areas that have shown rapid urbanization is necessary not only for health actions, but also the implementation of public policies that integrate the mobilization of society, improvements in housing, sanitation and actions to avoid further deforestation (Machado, 2013). It is important to evaluate urban health and environmental quality as a concept intertwined in the aspects of the spatial, biological, social and economic urban environment (Ribeiro & Vargas, 2015). Thus, it is recommended that managers and representatives of civil society frequently dialogue with all segments of the community to identify which factors are preponderant for vector control. They should represent priorities for an environment free of vector-borne diseases, collective mobilizations, investments in health, safety, leisure, infrastructure, especially basic sanitation (Dias *et al*., 2022).

This intersectoral dialogue between civil society and communities should be a priority in health surveillance, with an emphasis on environmental sanitation and guidance on the correct disposal of garbage, as this can generate a large number of potential breeding sites (Rocha *et al*., 2014). Mol *et al*. (2020) found a relationship between solid waste management and the occurrence of dengue, and pointed out the importance of implementing adequate solid waste management in municipalities as a strategic action to reduce dengue cases. In this sense, "participation, mobilization and social control work as a transversal axis", uniting health education, environmental education and basic sanitation. Faria *et al*. (2023) addressed that, for public policies to reach a level of control of

arboviruses, it is essential "a set of measures and interventions in environmental risks that prevent or minimize the spread of the vector, avoiding or destroying potential breeding sites of *A. aegypti*".

In this sense, good practices in solid waste management can be cited, such as the installation of ecopoints for the correct segregation and packaging of waste. Based on the analysis of the guiding instruments in the context of combating urban arboviruses in Brazil, it is necessary to present clear and specific actions with good health management, which allows decisions between different sectors of the government (intersectoriality) in the implementation of public policies to combat urban arboviruses.

THE GENETICS OF *Aedes* spp.

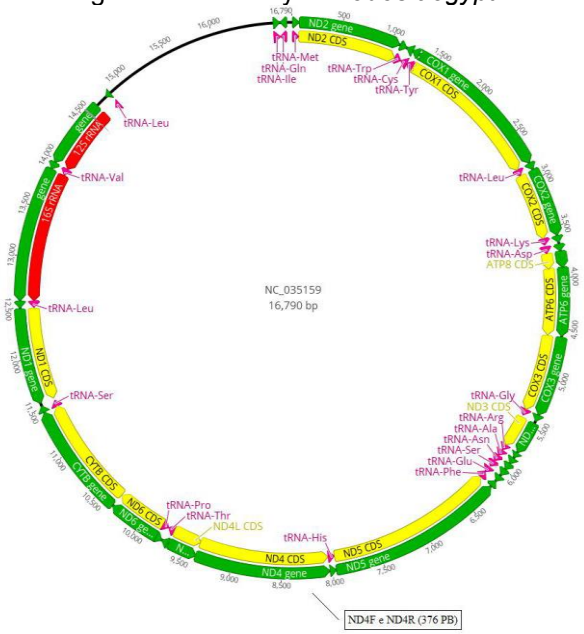
According to Valdivalangan *et al.* (2016), shedding light on genetic deviation in populations of *A. aegypti* is of crucial importance to fully understand its molecular ecology and evolution. It is also important to know the chromosomal structure, diversity, and patterns of population dispersal to understand the genetic mechanisms that have led to this mosquito, which has a relatively small genome (with three chromosomes), adaptive abilities, and resistance to insecticides and environmental changes.

Spadar *et al*. (2024), to support monitoring efforts and strategies for vector control, provided the first global catalog and geographic distribution on mutations and gene duplications in *A. aegypti*. These researchers used whole-genome sequencing samples from this species in 15 countries, including nine in Africa, to investigate genetic diversity in four genes linked to insecticide resistance. The use of genetic sequencing revealed important information on molecular markers involved in insecticide resistance. These researches provide guidance for functional studies and the design of genotyping assays.

The differences and similarities of homologous mtDNA sequences between species have been used extensively to construct evolutionary trees. mtDNA evolves relatively quickly and so this approach has been most useful in tracing recent evolution (Griffiths *et al*., 2016). To study gene regions and their variations, amplifications from pairs of *primers* (primers) are required, which are easily designed when diversified genomic data are available.

Mitochondrial DNA (Figure 7) has been used as an important tool in the study of population structure, and to understand population dynamics and evolutionary processes.

Figure 7 - Illustrative image of the mNAHD4 gene in which it is possible to observe the site and its number of base pairs used for the analysis of the genetic variability of *Aedes aegypti*



Source: https://www.ncbi.nlm.nih.gov

Mitochondrial genetic systems are made up of DNA and the molecular mechanism necessary to replicate and express the genes contained in that DNA. Mitochondrial DNA, abbreviated as mtDNA, was discovered in the 1960s, at first by electron micrographs that showed DNA-like fibers in mitochondria. Later, these fibers were extracted and characterized by physical and chemical procedures. The advent of recombinant DNA techniques has made it possible to analyze mtDNA in great detail. In fact, the complete nucleotide sequences of the mtDNA molecules of many different species have already been determined. Each mitochondria contains multiple copies of DNA, and because each cell usually has many mitochondria, the number of mtDNA molecules per cell can be very large. Animal mtDNA is small and compact... The size of invertebrate mtDNA is approximately equal to that of vertebrates, but their genetic organization is somewhat different (Snustad; Simmons, 2017).

Chu *et al*. (2016) presented the complete sequence of the mitochondrial genome of *Culex tritaeniorhynchus* (Diptera: Culicidae) using the traditional Sanger sequencing method. According to the authors, the sequences of the mitochondrial ND4 and ND5 genes can offer relevant insights into population genetic structure and gene isolation as a function of distance. In addition, the cytochrome c oxidase I (COI) gene, widely used as a marker in the DNA barcode, is highlighted as an essential tool for molecular identification. This method, used for more than two decades in eukaryotes, has contributed significantly to resolving taxonomic conflicts and distinguishing subspecies with recent genetic divergences (Chu *et al*., 2016). According to Hebert *et al*. (2003) and Hajibabaei *et al*. (2007), precursors

in the use of DNA barcode, the results obtained from this region of mtDNA can facilitate the identification of species, providing subsidies for detailed genetic analyses, especially when genomic data already available delimit target sequences with precision.

Contessoto *et al*. (2023) described the genomic architecture of the *Aedes aegypti* mosquito and discovered a different organization from that found in most living beings, through data-based physical simulations to study the three-dimensional construction of the genome. A computer modeling of the mechanical properties of the genome revealed that the chromosomes of *the Aedes aegypti*, due to their atypical presence of the organism This latest discovery provides a possible physical mechanism that links clues to gene regulation and gene structure analysis between different populations.

For the species *A. aegypti* from Mato Grosso, it would be of great value to do a study based on the example of Kurucz *et al*. (2022), which used *A. koreicus* specimens collected over 12 years from five European countries. With this it would be possible to determine genetic variations and point out the difficulties of control in populations with greater adaptive abilities. The absence of consistent genomic data for different populations of this vector may mean ineffective public investments in the control of the four main viruses transmitted by the species in the state.

The genetic basis for vector control was contemplated in the work of Almeida and Romano (2024), who demonstrated that genetically modified mosquitoes, through lethal genes or with the ability to make insects sterile, transform or replace the next generations in the population, through the introduction of an effector gene, which blocks the transmission of the virus in the wild population.

Research with the complete sequencing of the mitochondrial genome of *Aedes* (Behura *et al*., 2011; Souza *et al*., 2023) contributed with sequences and primer designs , which made it possible to analyze genetic variations that can enable the species to increase population and/or resistance to control mechanisms, as well as to discuss the evolution of the genus in tropical regions. The main *primers* currently used in Brazil for the genus *Aedes* and mtDNA and their variations are ND4, ND5, COI. However, each population of the species can have different mutations, in different states of this continental country and in terms of climatic and ecological diversity.

A methodological strategy for teaching in health and environment is to know the biology of an important dengue vector in different populations. In the article published by Mariotto *et al*. (2022) investigated the genetic variability of *A. aegypti* through molecular markers of mitochondrial DNA, COI, ND4, and ND5. The mosquitoes were collected with the aid of ovitraps for capture at points located in four municipalities in the state of Mato

Grosso: Cuiabá (CB), Várzea Grande (VG), Chapada dos Guimarães (CP), and Santo Antônio do Leverger (SA). PCRs (Polymerase Chain Reactions) were tested on 169 samples, with the best quality DNA, using three pairs of *primers* for mitochondrial DNA (mtDNA): Cytochrome Oxidase Subunit I (COI - F and R), Nicotinamide Adenine Dinucleotide Dehydrogenase Subunit 4 (ND4 - F and R) and Nicotinamide Adenine Dehydrogenase Subunit 5 (ND5 - F and R).

An interesting finding of the aforementioned work was the difficulty of amplifying the specimens in the IOC Region. Of the same DNAs that amplified the ND4 and ND5 regions, with more than 95% positive results, less than 20% resulted in useful amplifications for sequencing, when the pairs of primers used were for the IOC region. Most amplifications seemed nonspecific, and after purification they disappeared, clearly showing punctual differences in the COI region with probable mutations, which was not observed for the other two gene regions (ND4 and ND5). The authors suggest that other *primers* need to be established for populations of different Brazilian regions of *A. aegypti*. However, for this, it is necessary that new genomes are available. Attempts at new *primers* with available genomic data, from other Brazilian states and even from other countries, were frustrating, because when tested they did not amplify DNAs from specimens from Mato Grosso.

On the other hand, the study by Naim *et al*. (2020), showed reduced levels of genetic variation in *Aedes* mosquitoes in regions of Malaysia, which suggest they retain less genetic variation when subjected to fewer changes in environmental conditions. The authors also cite studies with similar results and more stable environmental conditions. This could explain, in part, the high variation of the COI gene region for *the A. aegypti* of Mato Grosso, in view of the sudden changes that the state has undergone in recent decades with the advances of agriculture and deforestation. Moore *et al.* (2013), found a wide variation in the ND4 region of *Aedes* among different populations and locations, and suggest that for local haplotypes of the species there may be adaptive abilities, while Fachinelli *et al*. (2023), state that consistent information on the behavior of the vector and human actions is necessary to implement effective actions to control it.

ConformeBilton *et al*. (2017), divergences in the mitochondrial COI sequence may not corroborate what was previously recognized to delimit taxonomic groups of insects, such as subspecies. The authors also cite several previous studies that show incompatibilities between traditional taxonomic boundaries and phylogenies based on mitochondrial DNA. These discrepancies can be attributed to factors such as introgression, differential selection, and changes in nuclear and mitochondrial genomes. Thus, the expansion of available genomic databases significantly increases the probability of more

robust diagnoses, allowing a more accurate assessment of the conservation or genetic variation of populations.

Castro Júnior *et al*. (2024) found high intrapopulation genetic variation and low interpopulation variability in the semi-arid region of Paraíba and suggested that it may indicate constant vector migrations to locations with a high number of individuals. When there are smaller genetic distances, interindividual, within a population of vectors, it is suggestive that there is the action of factors extrinsic to the individuals of the population, including the removal of the breeding habitat, which can contribute to reduce variability. As a consequence, intercrosses between individuals who are very close genetically. This was found for the analyses in the municipality of Chapada dos Guimarães, as opposed to the data for the municipalities of Cuiabá, Cáceres, and Santo Antônio de Leverger (Mariotto *et al*, 2022).

Like mtDNA, nuclear DNA also has significant alterations, especially in populations constantly subjected to pesticides used in fumaces or pyrethroids, common in fumigation. The frequency of nuclear mutations, related to resistance, can result from the pressure exerted artificially and induce the genetic variability of mosquito populations.

Mutations in the Kdr (nDNA) gene, for example, show that this incongruence is consistent across different datasets and taxon sampling, and that it can be explained by any peculiar evolutionary event, such as different levels of saturation in certain lineages or a past history of hybridization across the genus. Even more discrepant is the origin of the species of *A. aegypti* and *A. albopictus* that divide mitochondrial and nuclear data ranges, with no overlap in their confidence interval, and statistically this indicates that the two sets of data reject each other, as well as for the mtDNA data, also the nuclear genes are scarcely known, and different authors insist on the need to expand genomic data for the genus *Aedes*. To delve deeper into nDNA and/or compare with mtDNA, we suggest the recent articles by Parimittr *et al*., (2018); Zadra *et al*. (2021) and Chieli *et al*. (2023).

The genetic-based analysis of vectors such as *A. aegypti* contemplates, in a contextualized way, a formative learning that contributes to a perception of the importance of science in vector research, and leads to a reflection on the constant variability of populations in different environments. Knowledge of the different adaptations and interpopulation gene flow can expand and renew forms of control for this important vector of viruses.

CONCLUSIONS

The Aedes aegypti *and* Aedes albopictus *mosquitoes* are main vectors of highly pathogenic viruses. Its spread is expanding due to social, environmental, and ecological factors. Understanding the biology of the genus *Aedes*, the epidemiology of arboviruses, and developing new intervention strategies are crucial.

Monitoring requires detailed studies of larval resistance and factors that regulate its proliferation, including adaptation to different breeding sites. The control of *A. aegypti* depends on population awareness, elimination of breeding sites and research into control alternatives against insecticide resistance.

Improving vector control in infested areas is essential, especially since *A. aegypti* is associated with dengue, chikungunya, and Zika in Brazil. Poor urbanization increases the risks of reproduction and transmission. Research carried out in Mato Grosso highlights the importance of genomic data and reinforces the need for surveillance and government actions for effective prevention and combat.

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EDUCATION AND SCHOOL FEEDING, THE PNAE AND ITS CONTRIBUTION TO REGIONAL DEVELOPMENT AND FAMILY FARMING IN SCHOOL MEALS IN GOIÂNIA

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ABSTRACT

This article aims to understand how the National School Feeding Program (PNAE) plays a crucial role in promoting regional development, especially by encouraging family farming in the city of Goiânia. This government initiative not only ensures the provision of nutritious and quality meals for public school students, but also boosts the local economy by integrating smallholder farmers into the process of providing food for school meals. The integration of family farming into the PNAE has multiple benefits, such as providing a stable source of income for family farmers, encouraging local production, and promoting the economic sustainability of rural communities. In view of this and through a literature review, with important authors, such as Alvarez (2022), Monteiro (2017), Triches and Schneider (2010), among others, the study explores the inclusion of fresh and varied foods in school meals in order to contribute to a healthier diet for students, combating malnutrition and promoting healthy eating habits from an early age. The results reveal that in Goiânia, the implementation of the PNAE with a focus on family farming has shown significant results. This is because through public procurement policies that prioritize local producers, the program strengthens the regional agricultural sector and encourages more sustainable agricultural practices. The PNAE in Goiânia exemplifies how well-structured public policies can foster regional development and sustainability, while ensuring healthy and quality food for students. It can be a reference for other regions.

Keywords: Education. School Lunches. Family Farming. Regional development.

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INTRODUCTION

EDUCATION AND SCHOOL FEEDING

Brazilian education, as in other countries, develops at different levels and modalities, with significant challenges and notable advances during the trajectory of schools. This division of the Brazilian educational system is basically structured in three levels, early childhood education, elementary education and high school.

Today, Brazil has continued to face significant challenges in its quest for quality education. For this reason, the National Common Curriculum Base (BNCC) was implemented to standardize teaching and improve the quality of basic education (BRASIL, 2018).

However, problems such as regional inequality, school dropout, lack of financial resources and the devaluation of education professionals still persist, as well as the students' own nutrition. This movement of depreciation and devaluation of public basic education, which is responsible for the integral formation of the individual, in all its stages.

As a way of improving these points, it should be noted that, in the 1950s, when malnutrition and nutritional deficiency were common problems in Brazil, public schools provided students with a balanced diet during the school period through the School Lunch Program.

Over time, the program gained more independence and, in 1979, it changed its name to the current one, the National School Feeding Program (PNAE), although it is still known by some as 'School Lunches'. As a result, since the 1988 Constitution, school feeding has been mandatory and is the responsibility of the federal, state and municipal governments.

Among the main changes, the stimulus to national family farming stands out, which since the standardization of the PNAE with Law No. 11,947, of June 16, 2009, there is an incentive to purchase foodstuffs produced by family entrepreneurs.

This article is a bibliographic review with the theoretical basis of the legal bases contained in our country and with renowned authors, including Alvarez (2022), Belik (2009), Costa (2001), Monteiro (2017), Peixinho (2013) and Triches and Schneider (2010), among others.

In this way, understanding the importance of education, school feeding and family farming, makes it possible to understand the importance of education and its reaches, such as the National School Feeding Program (PNAE) and Family Farming.

EDUCATION

Education is listed as the first of the social rights in article 6 of the Brazilian Constitution of 1988, which determines the obligation of guarantees for people to access "education, health, food, work, housing, transportation, leisure, security, social security, protection of maternity and childhood, assistance to the destitute, in the form of this Constitution" (BRASIL, 1988).

From its divisions, early childhood education is the root of basic education, elementary education is its trunk and secondary education is its finish. It is from this holistic view of the "base" that one can have a consequent view of the parties. Basic education becomes, within article 4 of the LDB, a citizen's right to education and a duty of the State to serve him through qualified supply (CURY, 2008).

These initial considerations open spaces to understand the importance of the articulation between Early Childhood Education, Elementary Education and High School as an organized set of sequenced stages of education to be articulated in order to guarantee and ensure the common education of children, adolescents, young people and adults from any condition and region of the country. Linked to this, in all these phases, it is also important to promote student nutrition through school meals as a way to improve learning (SAVIANI, 2008).

Early childhood education (ECE), since its inclusion as the first stage of basic education (EB), in the Law of Guidelines and Bases of National Education (LDB), has undergone many changes in terms of supply and organization. Part of them was driven by changes in Brazilian legislation, among which the Constitutional Amendment (EC) No. 59/2009 and the National Education Plan (PNE) of 2014 stand out. The constitutional amendment made the enrollment of students aged between 4 and 17 compulsory and established that the service from 4 to 5 years old should be universalized by 2016. In a complementary way, the PNE, in addition to the universalization of this age group, established as a goal the care of at least 50% of children aged 0 to 3 years.

Even with the advances in the field of the declaration of the right, expanding access to early childhood education is still a challenge. The Report of the 3rd cycle of monitoring of the goals of the PNE (INEP, 2020), produced from the National Household Sample Survey (PNAD), indicates that, in 2018, only 32.7% of the population aged 0 to 3 years was served. This means that there were, in that year, 3.8 million children served and at least 1.5 million children who should be included in daycare by 2024. The same report presents data showing that the universalization of preschool had not been achieved until 2018. About 330

thousand children between 4 and 5 years of age were still outside the educational system (INEP, 2020).

It is worth remembering that early childhood education must be offered under the principles that govern Brazilian school education, established by the Federal Constitution, among which are "equal conditions for access and permanence", "free public education in official establishments" and the "guarantee of a standard of quality" (BRASIL, 1988).

These principles express the recognition of the equality of all children. In addition, a commitment is made to a type of education that cannot happen without the effective participation of the State (LIBÂNEO, 2023).

This means that, in addition to many children losing the fundamental right to free education, they no longer enjoy school meals, which are also guaranteed by law.

For the materialization of the right to early childhood education to materialize, ensuring increased access and quality conditions to study and food, financial investment by the State is necessary. It is about requesting and providing the necessary inputs to offer the best conditions and resources built historically and culturally, so that children can enjoy their civil, human and social rights, being able to manifest themselves and see these manifestations welcomed, as subjects of rights (LIBÂNEO, 2023).

It is pertinent to highlight that the municipalities have challenges of different proportions with regard to access and conditions of provision of early childhood education. The technical and financial resources to overcome these challenges are not the same for everyone, which highlights the relevance of a federative pact that, in fact, is cooperative.

Ensuring a supply in quality conditions presupposes increasing the spending of municipal networks on education in all municipalities, even in those with the highest values in this indicator. In view of this, it is urgent to increase revenues to enhance the supply of adequate education. In some cases, this expansion of resources must happen with the complementation of the Union and the States (SAVIANI, 2008).

As for elementary education in Brazil, it is a crucial stage of basic education, aimed at children from 6 to 14 years old, as determined by Brazilian legislation. This period is divided into two cycles, the first cycle, from the 1st to the 5th grade, and the second cycle, from the 6th to the 9th grade.

Historically, elementary education in Brazil has undergone several transformations, both in terms of curricular structure and the quality of teaching and universal access. However, it still faces many challenges, especially in poorer regions and rural areas.

In Brazil, more than 80% of primary and secondary school enrollments are in the public network. The expansion of basic education is a reality in the country, especially after

the Fund for the Maintenance and Development of Basic Education and the Valorization of Education Professionals (FUNDEB) and the Constitutional Amendment No. 59 of the Ministry of Education that expanded the mandatory nature of education from 4 to 17 years old (INEP, 2023).

However, there is a significant disparity between the quality of education offered in the most developed and the poorest regions of the country, as well as the food quality of the meals. Many schools, especially in rural and peripheral areas, face problems of poor infrastructure, such as lack of adequate classrooms, absence of basic equipment, deficient libraries, poorly equipped kitchens, and low financial resources. As a result, school dropout is still a relevant problem, especially among the most socially vulnerable students (SAVIANI, 2008).

In recent years, some initiatives have emerged to improve the quality of elementary education in Brazil, such as literacy programs; initiatives aimed at improving literacy in the early grades; the incentive to stay; scholarships and programs that encourage students to stay in school, such as the Bolsa Família program; innovative curricula and the adoption of more flexible and contextualized curricula, which seek to improve student engagement with content.

Likewise, there are already recommendations from the PNAE to improve the quality of school meals, such as the availability of a nutritionist as the technical responsible, evaluation of dietary restrictions among students, the establishment of varied menus and the appreciation of local producers.

Improving the quality of education and food at this stage depends on continuous efforts on several fronts, such as investment in infrastructure, teacher training, the most appropriate curricula and effective public policies that address regional and social inequalities (SAVIANI, 2008).

The trajectory of secondary education in Brazil has also been marked by challenges and transformations over the last decades, reflecting social, political, and economic changes in the country. High school is a stage of Brazilian basic education, aimed at young people between 15 and 17 years old, lasting three school years.

In recent decades, there has been a significant expansion in access to secondary education, with an increase in the schooling rate in this age group. This was driven by public policies for the universalization of basic education and by greater awareness of the importance of education for individual and national development (SAVIANI, 2008).

This phase went through several curricular reforms and adjustments in educational legislation. One of the most recent reforms was the implementation of the National

Common Curriculum Base (BNCC), which establishes guidelines for school curricula at all stages of basic education, including high school.

Despite advances in access, the quality of secondary education is still a concern, as mentioned in the improvements it needs, school dropout remains a significant challenge, especially among young people from more economically vulnerable families. Reasons such as the need for work, lack of interest in the content offered and social problems influence dropout (SAVIANI, 2008).

There is a growing demand for a high school that prepares students not only for the job market but also to enter higher education. The need for a more complete and integrated education has been a recurring topic in educational discussions. Even with initiatives and perspectives with the reform of secondary education, which began in 2017, it is expected that there will be greater integration between theory and practice, with the implementation of training itineraries that include specific areas of knowledge, such as languages, mathematics, natural sciences, human sciences, and technical and professional training.

It is essential to ensure the participation of young people in decisions that affect their educational path, listening to their needs and expectations to make high school more relevant and effective, essential steps to ensure quality and the ability to prepare young people for the challenges of the twenty-first century (FREIRE, 2013).

It is necessary that the educational process be sensitive to the political and social purposes of transforming an excluding society into a new society, inclusive and open to all regardless of the classes and *status quo* of its members, since "teaching is not just a mechanical act, but a critical act, curiosity, action and transformation" (FREIRE, 2008, p. 64).

With regard to public education policies and the duties of the State in order to ensure the rights of society, the Federal Constitution of 1988, in its article 208, item VII, provides for the "assistance to the student, in all stages of basic education, through supplementary programs of didactic and school material, transportation, food and health care" (BRASIL, 1988).

Supplementary education programs are actions that are part of the regular educational system, aiming to meet the specific needs of students to give more quality to basic education and address social and economic issues that can interfere in the learning and dropout process. These actions are initiatives implemented at different educational levels, from kindergarten to high school, and encompass the areas of health, food, culture, among others. As an example of public policies, we can mention the National Textbook

Program (PNLD), the National School Transportation Program (PNATE), the National School Feeding Program (PNAE) and the School Health Program (PSE).

Even before the 1988 Constituent Assembly, the National Textbook Program (PNLD) was established by Presidential Decree No. 91,542, of August 19, 1985, "with the purpose of distributing textbooks to students enrolled in public 1st grade schools" (BRASIL, 1985).

Law No. 10,880, of June 9, 2004, which institutes the National Program to Support School Transportation (PNATE), has the "objective of offering school transportation to students in public basic education, residing in rural areas, through financial assistance, on a supplementary basis, to the States, the Federal District and the Municipalities" (BRASIL, 2004).

The School Health Program (PSE) was instituted by Presidential Decree No. 6,286, of December 5, 2007, with the purpose of "contributing to the integral formation of students in the public basic education network through prevention, promotion and health care actions" (BRASIL, 2007).

Although the National School Feeding Program (PNAE) was standardized from Law No. 11,947, of June 16, 2009, school feeding is a policy that has existed since the 1940s. Such public policies, after being instituted, were regulated and today have their legislation and collegiate bodies responsible for monitoring their execution (PEIXINHO, 2013).

In a complementary way, basic education, which involves the three levels mentioned, should enable conditions for the subject to constitute and reconstitute their own identity, in the midst of bodily, affective-emotional, socio-emotional, cognitive and socio-cultural changes, with a view to respecting and valuing diversity. Thus, it is important to recognize the pillars that support this education, focusing, for example, on school feeding.

SCHOOL FEEDING/PNAE

Feeding is a basic need found in all living beings, whose main objective is to obtain the energy necessary for the maintenance of vital functions and for the physical and mental development of the human being. So for our body to be in perfect balance, it is important to have a proper diet. That is why it is necessary to provide assistance to students who attend schools in Brazil, especially those who do not have access to certain food groups, whether they are children, young people or adults, because food is of paramount importance for the academic development of the student (RECINE, 2014).

School feeding aims to provide nutrition in adequate quantity and quality, in order to meet the physiological needs of students, in addition to promoting the adoption of healthier

eating habits, which contribute to better growth, development, learning and lower incidence of diseases.

To achieve this goal, balanced and varied menus must be prepared, always taking into account the acceptance of students in school meals. This is because this meal at school is intrinsically linked to education, since, according to official data, it is proven that, after a good diet, the human brain has a higher development and learning index (GONÇALVES AND PIRES, 2019).

With this in mind, from 1955 onwards, the National School Feeding Program (PNAE) was implemented in Brazil. This program, which is a Brazilian public policy of universal character inserted in the school environment, is one of the important strategies implemented to ensure both the right to food and the right to education and is linked to the National Fund for the Development of Education (FNDE) of the Ministry of Education. The program serves, universally and free of charge, students enrolled in basic education in public, philanthropic and community schools in all municipalities in the country (BRASIL, 2020).

In 1997, the PNAE was incorporated into the National Fund for the Development of Education (FNDE), an autarchy created to execute public policies linked to education through financial transfer programs. The distribution of financial resources for school feeding occurred with Provisional Measure No. 32 1,784, of December 14, 1988, which provides for the transfer of financial resources from the PNAE to states and municipalities. In its Article 2, it is established that the "transfer of financial resources aiming at the decentralized execution of the PNAE will be carried out automatically by the Executive Secretariat of the FNDE, without the need for an agreement, adjustment, agreement or contract, through deposit in a specific current account" (BRASIL, 1998), which made the financial distribution process more efficient and agile.

The development of the school feeding management policy in Brazil, over the more than 60 years of institutional implementation of the PNAE, has made it possible to strengthen it. Initially conceived as a food supplementation or assistance program, aimed at pre-school students and students of the former first grade, current Elementary School, enrolled in public education establishments, it has undergone several resignifications and restructurings throughout its existence (PEIXINHO, 2013).

The objective of the PNAE is to promote and ensure that basic education students have access to adequate food, which helps them develop, grow, learn and perform well at school, as well as develop healthy eating habits. It is a supplementary financial assistance program in which states, municipalities and federally funded schools are reimbursed in a

fixed amount per student, for each day of instruction, based on the student's age and mode of instruction (BRASIL, 2015).

Due to the importance of healthy eating for the health and development of students, understanding that education and nutrition are interconnected, this policy seeks to ensure that students enrolled in basic education have access to nutritious meals, contributing to their learning and healthy growth.

Established as a State policy, the PNAE is a policy that transcends governments, as the program, in addition to being structured in various instances of society, also stands out in the educational conception, since it encourages good health habits and social awareness (GONÇALVES AND PIRES, 2019).

In the case of the PNAE, State policy is related to the idea that school feeding is a fundamental right of students and should be guaranteed continuously over time, regardless of ideologies.

The PNAE has a service dimension of about 10 billion meals per year and aims to provide food security to public basic education students across the country (ALVAREZ, 2022). This has a direct impact on life in society, since, although Brazil is a major food producer, one of the causes of food insecurity is precisely the lack of access to basic foods, that is, the reason for food insecurity in Brazil is social inequality, which penalizes the poorest who do not have the financial conditions to acquire enough food to meet nutritional needs.

The delivery of foodstuffs by suppliers can be carried out directly to the school units and there can be central supply intermediation warehouses. A great advantage of the centralized way is the possibility of carrying out an effective control of the entire process and ensuring that the quality of the products and menus is applied in all schools in the municipality. In addition, centralization confers greater negotiating power on the city hall vis-à-vis suppliers, which can lead to a reduction in expenses, considering that the volume of purchases is higher (BELIK, 2009).

Currently, about 45.6 million students are served daily by the PNAE, which has changed nutrition standards at school. Over the last few decades, school meals, as preferred by the Ministry of Education, School Feeding, have undergone transformations (TURRIANI; FORTUNATO, 2008).

Changes in the list of products were made, such as the basic components in order to ensure better quality and safe food for students and contribute to learning, with the objective of finding practical and effective solutions that will minimize the school dropout rate and also provide the stimulus to healthy eating.

As it is a supplementary public policy, states and municipalities must make the counterpart investment of their own resources to subsidize the acquisition of foodstuffs to compose school meals, as well as the necessary structure for the execution of the program (COSTA AND VASCONCELOS, 2013).

To calculate the financial transfer to states and municipalities, the number of children and young people enrolled reported in the School Census of the previous year, the two hundred mandatory school days and the type of educational service modality are considered. This is because each type of service modality has a different per capita and has been defined throughout the program through updates in the resolutions that regulate its execution, as well as update the per capita values (COSTA AND VASCONCELOS, 2013).

In addition, the School Feeding Council (CAE), the social control body responsible for supervising the program and advising the executing institution, is the entity that represents social control before public policy and is responsible for monitoring and monitoring the resources and execution of the program. In this way, the policy of social control was consolidated from the process of our 1988 Constitution, through the devices created for the effective participation of society in the implementation, monitoring and inspection of the most diverse public policies. (COSTA AND VASCONCELOS, 2013).

It should be noted that the School Feeding Council (CAE) of each state and municipality, according to Article 43 of Resolution CD/FNDE/MEC no. 006, of May 8, 2020 (BRASIL, 2020), in addition to monitoring and inspecting the execution of the program, is responsible for analyzing the accountability issued by the Executing Entity and issuing a conclusive opinion approving or not approving it. It should be noted that the delay in sending the accountability may result in the non-availability of the resource.

It is also worth noting the obligation of the nutritionist technician to be responsible for the execution and monitoring of the PNAE. The actors involved in the development of the PNAE, mainly nutritionists and cooks, are committed to understanding the entire process of school lunch production, in order to understand that this food program is part of a social policy inserted in a certain political and economic context, suffering, therefore, the influences of the historical moment in which it is situated, which will give meaning to the work of these actors (COSTA *et al*., 2001).

The knowledge and understanding of this totality facilitates a posture of connection with work, allowing the creation of new strategies for more timely and creative interventions in the resolution of daily problems and in which skills and experiences are applied in interactive actions with the school population.

As a result, the state and municipalities are obliged to provide adequate education and nutrition to all Brazilians. However, it is worth noting that the Government is not solely responsible for guaranteeing these rights. According to articles 205 of the Federal Constitution of 1988 and 2 of the LDB, education is also the responsibility of the family, and it is up to society to promote, encourage and collaborate in the realization of this right (BRASIL, 1988; LDB 1996).

In recent years, public policies have sought to improve the quality of education, with initiatives such as the National Common Curriculum Base (BNCC, 2018), which defines essential competencies and skills for each stage of education, in addition to financial investments in food programs for students.

Among the main changes, we can highlight the stimulus to national family farming; the inclusion of food and nutrition education in the teaching and learning process; the participation of the community in social control; recommendations to ensure students' access to a wider variety of foods; and the incentive for the acquisition of natural and minimally processed foods (FARIA, 2020).

In addition, by promoting the purchase of food from family farming, the PNAE also supports the economic inclusion of small farmers, which contributes to the reduction of social disparities in the country and regional development.

In 2009, Law No. 11,947 (BRASIL, 2009) established, in its article 14, that at least 30% of the transfers from the National Fund for the Development of Education (FNDE), within the scope of the National School Feeding Program (PNAE), should be invested in the acquisition of foodstuffs from family farming.

Law No. 14,660 (BRASIL, 2023) clarifies that

> of the total financial resources transferred by the FNDE, within the scope of the PNAE, at least 30% (thirty percent) must be used to purchase foodstuffs directly from family farming and rural family entrepreneurs or their organizations, prioritizing agrarian reform settlements, traditional indigenous communities, quilombola communities and formal and informal groups of women.

In order to facilitate the participation of local family farmers, bidding was waived, and the acquisition of products from these families in the region was subject to simplified procedures by public call, which also enables regional development.

REGIONAL DEVELOPMENT AND FAMILY FARMING

The emergence and recognition of family farming in Brazil are recent and three factors are equally important for a better understanding. The first has to do with the resumption of the role of the trade union movement after the end of the Military Dictatorship;

the second is related to the role of mediators and intellectuals, especially social scientists who debated the topic in the early 1990s; and the third factor is related to the role of the State and public policies, which began to recognize this sector and provide visibility from the creation of the National Program for the Strengthening of Family Agriculture (PRONAF) (BECKER AND ANJOS, 2015).

The period of political transition, from 1992 to 1994, ended up strengthening the struggles of organized rural social movements, especially trade unionism, which led to the creation of the National Program for the Strengthening of Family Agriculture (PRONAF). In 1996, through Presidential Decree No. 1,946, of 07/28/1996 (BRASIL, 1996) and, later, with Law No. 11,326, of 07/24/2006 (BRASIL, 2006), it provided the formation of what is now called family farming (BECKER AND ANJOS, 2015).

In 2009, Law No. 11,947, of 06/12/2009 (BRASIL, 2009), instituted, within the scope of the National School Feeding Program (PNAE), the mandatory use of at least 30% of the resources decentralized by the National Fund for the Development of Education (FNDE) for federal, state and municipal schools, for the acquisition of foodstuffs from family farming.

Peixinho (2013) cites Law No. 11,947/2009 as a major advance in the National School Feeding Program, because, among other aspects, it defines food and nutrition education as a priority axis for achieving the objectives of the PNAE, in addition to strengthening the participation of the community in the social control of the actions developed.

Authors such as Oliveira & Santos (2015) and Caldas & Nonato (2014) address the issue of public procurement as a promoter of sustainable development and local development. In addition to allowing the government to perform its functions, public procurement would have a role in stimulating economic, social and environmental aspects that lead to an improvement in people's quality of life.

For Oliveira & Santos (2015), Law No. 11,947/2009, with regard to the obligation to purchase from family farming, represents one of the greatest advances in terms of establishing criteria that seek social impacts for public purchases.

For those who do not work directly with the theme, it would be expected that, eight years after the enactment of the law, the dynamics of the operation of family farming acquisitions would no longer be a problem for those involved, considering that the rules of operation of the program and its purposes and objectives are widely described in Law No. 11,947/2009 itself and subsequent decrees. Such information is widely disseminated by the agencies linked to the execution of the National School Feeding Program (PNAE) in the

various federative instances and by the Technical Assistance and Rural Extension (ATER) agencies.

In fact, in 2014, of the R$ 2.48 billion transferred by the National Fund for the Development of Education (FNDE) to the municipalities, more than R$ 578 million were invested in acquisitions of family farming, which represents 23.3% of the total. However, in that same year, only 39.5% of the municipalities reached the minimum limit of 30% for the acquisition of family farming. This means that about 60% of the municipalities were still unable to meet the minimum percentage provided for by law. Even though these numbers have been growing between 2011 and 2014, it is evident that the purchase of family farming still has aspects to advance (THIES *et al.,* 2016).

Some analyses that have been developed contribute to the realization that executing the purchase of family farming goes far beyond the knowledge of the law and poses questions that make the development of the program quite complex (TRICHES & SCHNEIDER, 2012). Inserting family farming products in school meals is not a trivial action, both for those who buy and for those who sell.

Family farming plays a key role in regional development, especially in regions that rely heavily on agricultural production. This sector is characterized by the predominance of family labor, small properties and the diversification of agricultural activities. In addition, family farming is closely linked to environmental sustainability, food security and the dynamism of local economies.

Family farming is responsible for a large part of the food production consumed in Brazil and in the world. According to data from the Food and Agriculture Organization of the United Nations (UN), approximately 80% of the food in the world is produced by family farmers. In Brazil, family farming accounts for about 70% of the food that reaches the table of Brazilians, contributing significantly to the country's food and nutritional security (FAO, 2014).

Family farming is marked by the diversification of production, which includes everything from basic food crops to agroecological and organic products. This diversity not only ensures the livelihood of the families involved, but also promotes economic and environmental sustainability. Diversified production contributes to the maintenance of biodiversity, since it avoids monoculture and soil degradation (COSTA, 2018).

In addition, family farming plays a vital role in preserving cultural traditions and strengthening rural communities. Traditional knowledge and agricultural practices passed down from generation to generation are preserved, promoting a sustainable and environmentally friendly way of life.

The National School Feeding Program (PNAE) has been an important instrument to strengthen family farming and, consequently, promote regional development, since, as mentioned, it provides that at least 30% of the resources transferred to states and municipalities for school feeding are used to purchase family farming products. This policy not only ensures a stable market for smallholder farmers, but also promotes food diversity and the appreciation of local products.

In Goiânia, the implementation of the PNAE has shown positive results in promoting regional development. By encouraging the purchase of products from family farming, the program contributes to income generation and the settlement of families in the countryside, reducing the rural exodus and strengthening the local economy. In addition, by providing fresh and quality food to schools, the PNAE improves students' diet, contributing to their physical and cognitive development (COSTA, 2018).

In Goiânia, the implementation of the PNAE has demonstrated tangible positive impacts in promoting regional development and strengthening family farming. According to Silva *et al*., (2017), the inclusion of family farming products in school meals has contributed to the diversification of agricultural production and the increase in the income of local farmers.

Another study carried out by Guimarães *et al*., (2018) highlighted that, in Goiânia, the PNAE has encouraged sustainable agricultural practices, promoting the production of organic and agroecological foods. In addition, the interaction between schools and family farmers has generated an environment of cooperation and mutual learning, where schools benefit from fresh food and farmers improve their cultivation techniques.

Regional development involves improving the economic, social, and environmental conditions of a specific region. Family farming contributes to regional development by generating jobs, promotes social inclusion, and encourages sustainable development. This sector also plays a crucial role in the preservation of natural resources and the maintenance of biodiversity, essential factors for the sustainable development of a region (GUIMARÃES, 2018).

Studies indicate that the implementation of the PNAE has a positive impact on regional development and the sustainability of family farming. According to Silva *et al.,* (2017), the PNAE promotes the diversification of agricultural production, improves the income of family farmers, and encourages sustainable agricultural practices. Another study by Guimarães *et al.,* (2018) shows that the inclusion of family farming products in school meals in Goiânia has contributed to the appreciation of local products and to the dynamization of the rural economy.

Despite the advances, there are still challenges to be overcome. Goiânia, for example, like most municipalities, since 2020, has not been able to apply the 30% in family farming because of some factors. Among these factors, the need to train family farmers to meet the requirements of the PNAE, such as standardization and product quality, stands out. In addition, the logistics of food distribution can be an obstacle in more remote regions (SILVA, 2017).

Logistics is one of the main challenges faced by family farming in the context of the National School Feeding Program (PNAE). This is because efficiency in the distribution of products is crucial to ensure the quality of food supplied to schools and to ensure the economic sustainability of family farmers. Logistical challenges are varied and can be grouped into several main categories, including infrastructure, storage, transportation, coordination, and regulation (GUIMARÃES, 2018).

For example, the efficient transportation of family farm products to schools requires a well-coordinated and punctual system. However, farmers often face difficulties such as a lack of appropriate vehicles, high fuel and maintenance costs, and logistical problems in coordinating deliveries. The fragmentation of production is also an obstacle, i.e. a characteristic of family farming that can generate increases in transport costs due to the need to collect small plots from several producers.

Despite these challenges, there are several solutions and opportunities that can be explored to improve logistics in family farming and in the context of the PNAE, such as public support policies. The government can play an important role by creating incentive policies that facilitate logistics for family farming. This can include subsidies for transportation, tax incentives for infrastructure investments, and programs to support health certification. Overcoming these challenges is essential to ensure that the benefits of the PNAE are fully realized, promoting food security, sustainability, and regional development (GUIMARÃES, 2018).

Cities and regions that have been able to successfully implement the PNAE can also serve as models to be followed. Studying these cases can provide valuable insights into best practices and strategies that can be adapted to other regions, for example, the creation of family farmer cooperatives has proven to be an effective solution to overcome logistical and infrastructure challenges.

With these new practices to encourage family farming in school meals, the National School Feeding Program (PNAE) not only ensures a stable market for farmers, but also contributes significantly to the generation of employment and income in rural areas and,

consequently, helps to reduce the rural exodus and strengthen the local economy, promoting a more balanced and sustainable regional development (FAO, 2014).

Therefore, the inclusion of fresh and quality products in school meals improves children's diets, contributing to their physical and cognitive development. In addition, the food and nutrition education promoted by the PNAE sensitizes students and their families about the importance of healthy eating, creating more conscious and sustainable eating habits.

CONCLUSION

As we have seen, Brazilian education has rights established by the Federal Constitution, among which are the "equal conditions for access and permanence", the "free public education in official establishments" and the "guarantee of a standard of quality" (BRASIL, 1988). Therefore, it is imperative that there is adequate financial investment by the State. This investment must ensure the provision of adequate resources and conditions so that all children can enjoy quality education, including school feeding, which is a crucial part of educational and social development (MEC, 2020).

It is necessary that the educational process be sensitive to the political and social purposes of transforming an excluding society into a new society, inclusive and open to all regardless of classes and *status quo* of its members, since "teaching is not just a mechanical act, but an act of criticism, curiosity, action and transformation" (FREIRE, 2008, p. 64). Supplementary education programs are actions that are part of the regular educational system, aiming to meet the specific needs of students to give more quality to basic education and address social and economic issues that can interfere in the learning and dropout process.

The National School Feeding Program (PNAE) has proven to be an example of public policy of extreme relevance for the strengthening of family farming and regional development, particularly in the city of Goiânia. By integrating food from small local producers into school meals, the PNAE promotes a series of benefits that go beyond the simple nutrition of students. This program is a clear example of how well-structured public policies can act as catalysts for social, economic, and environmental change.

One of the main positive impacts of the PNAE in Goiânia is the contribution to the sustainability of rural communities. By ensuring a stable market for family farming products, the program not only improves farmers' incomes, but also encourages the continuity of traditional and sustainable farming practices. This support is essential in a scenario where many families face economic difficulties and are tempted to abandon the countryside in

search of opportunities in the cities. The maintenance of family farming contributes to the preservation of local culture, biodiversity and food security, essential factors for sustainable development.

The inclusion of fresh and nutritious food in school meals has direct impacts on the health and academic performance of students. Studies show that proper nutrition is essential for cognitive and physical development, positively influencing learning and school attendance. Thus, the PNAE not only fights malnutrition, but also plays a crucial role in promoting healthy eating habits from childhood, contributing to the formation of more conscious and healthy citizens in the future.

The creation of cooperatives and farmers' associations is a strategy that can help overcome these challenges by promoting collaboration among producers and facilitating access to resources and technologies. These initiatives can also serve as platforms for sharing knowledge and good practices, further strengthening family farming and its integration into the PNAE.

Also important is the need to raise awareness about the importance of the PNAE and similar policies for regional development. The successful experiences of Goiânia can serve as a model for other regions of Brazil, encouraging the replication of practices and policies that have proven effective. To this end, it is essential that the government, educational institutions, farmers, and civil society continue to work together, promoting dialogue and cooperation towards a common goal, that is, ensuring healthy, sustainable, and affordable school meals for all students.

Finally, it is essential that public policies such as the PNAE are constantly evaluated and improved, so that they can respond more efficiently and effectively to the changing needs of the population and the country's economic and social challenges. The continuity and strengthening of these policies are essential to ensure not only the right to food, but also the right to quality education, promoting the integral development of students and the progress of local communities.

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DENTAL MANAGEMENT IN THE FACE OF ORAL MANIFESTATIONS IN PATIENTS WHO MAKE CHRONIC USE OF ANTIDEPRESSANTS: A LITERATURE REVIEW

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ABSTRACT

The chronic use of psychotropic drugs of the class: serotonin reuptake inhibitor antidepressants and tricyclics, can generate oral alterations, the most common being xerostomia, halitosis, bruxism and periodontitis. Sertraline and fluoxetine stand out as the drugs most responsible for oral alterations. However, the main sign that triggers a series of oral manifestations is hyposalivation. (KAISER; BATISTA, 2022) (DE OLIVEIRA; FREITAS; MILAGRES, 2024).

Keywords: Antidepressants. Depression. Side effect. Oral cavity.

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INTRODUCTION

The chronic use of psychotropic drugs of the class: serotonin reuptake inhibitor antidepressants and tricyclics, can generate oral alterations, the most common being xerostomia, halitosis, bruxism and periodontitis. Sertraline and fluoxetine stand out as the drugs most responsible for oral alterations. However, the main sign that triggers a series of oral manifestations is hyposalivation. (KAISER; BATISTA, 2022) (DE OLIVEIRA; FREITAS; MILAGRES, 2024). It corresponds to the professional and integral responsibility of the dental surgeon to carry out an anamnesis taking into account the drugs administered by the patient, in this context, antidepressants. Evaluate the time of medication use, advise the patient about possible oral changes, establish conduct to keep the oral cavity free of disease through regular consultations and, if possible, request changes in medication from the psychiatrist. (VIEIRA DE MEDEIROS; COLTRI, 2014). General objective: To contribute with information about the chronic use of antidepressants and its correlation with the oral cavity. Specific purpose: identification of oral manifestations, approach to therapeutic conducts that can be selected to meet the patient's demand and educational guidelines. Methodology: This study uses a literature review of scientific articles, books and relevant materials published in the last 10 years. Its research object is: pubmed, scielo, virtual health library, Google Scholar; as well as publications in magazines, periodicals, blogs managed by professionals in the area and research by health agencies.

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THE IMMUNE SYSTEM OF THE RESPIRATORY TRACT AND ITS RELATIONSHIP WITH PULMONARY TUBERCULOSIS

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ABSTRACT

Tuberculosis is one of the oldest diseases of humanity, caused by bacteria belonging to the Mycobacterium tuberculosis complex. According to the World Health Organization, around 100 million people are infected each year with M. tuberculosis and, in underdeveloped countries, between 30% and 60% of them, adults are infected. A bibliographic review of specific literature was carried out to identify scientific articles in the MEDLINE, PubMed, and Scielo databases, published between 2018 and 2022, using the terms "Mycobacterium tuberculosis (M. tuberculosis), anatopathology, histopathology, and pathophysiological processes". The tuberculosis bacillus is transmitted by inhalation of infectious droplets dispersed in the air by an infected patient by coughing, sneezing, and talking. The importance of histological, anatomical, and immunological knowledge is crucial to guide the health professional towards the best care.

Keywords: Mycobacterium tuberculosis. Anatopathology. Histopathology and pathophysiological processes.

INTRODUCTION

Tuberculosis is a disease that has been present since the beginning of human life. Mycobacterium is thought to have originated about 150 million years ago and likely killed more people than any other pathogenic microbe when exposed to humans. Records of disease in Egyptian mummies, passages in the Hebrew books of the Bible, ancient Chinese writings, and the studies of Hippocrates in ancient Greece describe disease killing the pathogen in great nations.[1]

Tuberculosis, in its early stages, must have mainly infected animals by a species prior to Mycobacterium bovis. The disease can be transmitted when people eat contaminated meat or milk. At the very least, it can be shown that the new mutant strains, contained in tubes with better airborne transport and less harmful, which facilitate the spread of the pathogen, are large parasites of the human race[2].

The disease spread throughout America through contact with European sailors during the Great Voyage. The oldest bacterial evidence of the presence of this pathogen in America dates back to 1100 B.C. In an Indian Inca woman, the environmental conditions in which she was buried preserved clinical symptoms and bacilli in her mummified body. Although M. tuberculosis and M. bovis were already present among pre-Columbian tribes, the long stay with European explorers contributed to the spread of the disease. But later, in the twentieth century, when urbanization affected the Americas, there was an explosion of tuberculosis throughout the country, including Brazil[3].

Transmission of tuberculosis occurs mainly through the air and inhalation of respiratory droplets containing the infectious agent. The important thing is that this disease can manifest itself in different ways, from asymptomatic latent diseases to severe cases of active tuberculosis, which demonstrates the diversity and complexity of this pathology. Tuberculosis is a disease that requires a multifaceted approach and a great understanding of the interaction between Mycobacterium tuberculosis and the host immune system[4].

Understanding the respiratory system is important in the context of pulmonary tuberculosis. This system consists of several layers of defense, each of which plays an important role in protecting against infectious diseases. In addition to the physical and mechanical barriers that prevent pathogenic microorganisms from entering the lungs, the immune system contains the defense mechanisms necessary to fight and prevent diseases, including pulmonary tuberculosis[5].

Common cold pathogens are organisms that cause respiratory illnesses, including viruses and bacteria. They can produce a wide range of symptoms such as chronic cough,

high fever, respiratory problems, sore throat and other respiratory diseases. In addition, these pathogens can cause more serious problems such as pneumonia and bronchitis[6].

To prevent these diseases, it is essential to understand the nature of pathogens and the immune system's reaction to influenza. When detecting the signs of an attack by a pathogen, the immune system activates an inflammatory response, mobilizing protective cells and releasing chemicals to fight off the invading agent. However, on some occasions, the immune response can be overwhelmed, leading to tissue damage and the appearance of more severe symptoms[7].

Neonatal tuberculosis does not have specific characteristics, but is usually accompanied by multiple organ involvement. The newborn may demonstrate a weakened state of health, either in an acute or chronic phase, in addition to presenting fever, lethargy, breathing difficulties or pneumonia that does not respond to treatment, as well as hepatomegaly and splenomegaly, or even an unsatisfactory weight development[8].

All newborns with suspected congenital tuberculosis, as well as infants born to mothers with active tuberculosis, need to undergo tests that include chest X-rays and cultures for acid-fast bacilli, using material from tracheal aspirate, gastric lavage, and urine. Lumbar puncture should be performed to analyze cell, glucose, and protein counts, and to allow cerebrospinal fluid culture. It is also critical to examine and obtain culture of the placenta. Although skin tests have low sensitivity, especially early in infection, they should be performed. Tuberculosis-specific interferon-gamma release assays, which are useful in adults, are not approved for use in neonates due to their low sensitivity. To confirm the diagnosis, a biopsy of the liver, lymph nodes, lungs, or pleura may be necessary. In addition, neonates should be tested for HIV[9,10].

In a detailed analysis of lung tissue, the importance of a deeper understanding of the host immune response to pulmonary tuberculosis becomes apparent. The tissues that make up the airways include the upper airways, such as the nose, pharynx, and larynx, as well as the lower airways, such as the trachea, bronchi, and usually the lungs[11]. Each of these tissues exhibits unique histological features, such as the presence of cilia and mucus-secreting cells, which are responsible for filtering and humidifying trapped air. It is worth noting that the presence of mucus-associated lymphoid tissue (MALT) in the lower respiratory tract plays an important role in the local immune response and is important in the prevention of respiratory infections, including Mycobacterium tuberculosis, the etiologic agent of tuberculosis[11,12].

METHODOLOGY

A bibliographic review of the specific literature was carried out to identify scientific articles in the MEDLINE, PubMed, and Scielo databases, published between 2018 and 2022, using the terms "Mycobacterium tuberculosis (M. tuberculosis), anatopathology, histopathology and pathophysiological processes".

Only articles written in Portuguese or English were included, as well as review articles on epidemiological, diagnostic, and therapeutic aspects. Studies in experimental animals were excluded.

DEVELOPMENT

Tuberculosis is an infectious disease caused by Mycobacterium tuberculosis that mainly affects the lungs, but can manifest clinically in many ways and in different organs. The agent has a transitional form between eubacteria and actinomycetes, including non-motil, non-encapsulated, non-sporulated, and non-colonial bacilli, differing between 0.2 and 0.6 x 1 to 10 microns. They form clusters of long, curved branches called filaments, which are important for the visualization and differentiation of bacilli in microscopic analyses[13].

Its generation time varies from three hours for fast-growing species to 18 hours for slow-growing species, a characteristic due to the high lipid content present in its capsules[14]. The pathogen grows slowly, with its metabolism focused especially on building the capsule that protects it from chemical agents, and can survive for weeks or months on inanimate objects. However, it is easily destroyed by physical agents such as heat, ultraviolet rays from sunlight and ionizing radiation. Its resistance to desiccation, to the action of alcohol, acids and antimicrobials, is established due to the constitution of its wall, organized by mycolic acids and lipids, forming a resistant hydrophobic barrier. On the other hand, the presence of a high lipid content in the membrane provides important biological effects, such as the pathogen's property of inducing the formation of granulomas in infected tissues[14,15].

With aerobic metabolism, the half-life is between 18 and 48 hours, as a facultative intracellular parasite, and favors the destruction of macrophages. If left alone and undifferentiated, the disease becomes difficult to eradicate and treatment leads to the recurrence of chronic diseases[16].

M. tuberculosis, known as the M. tuberculosis complex model, is part of the family M. bovis, M. microti, M. africanum and M. canetti, which are similar in appearance and sex, and share 99% of their genes, as indicated by the presence of the IS6110 fragment in the genome[17].

EPIDEMIOLOGY

According to the World Health Organization (WHO), one-third of the world's population is infected with M tuberculosis. In this context, between 8 and 10 million people will contract this disease in their lifetime, and approximately half of them are contagious18. The number of new cases is estimated at 8.7 million, of which 80% are in 22 underdeveloped countries, including Brazil. In addition to this scenario, there are three million known and undiagnosed diseases each year, which the World Health Organization proposed in 1993 to establish the global situation of tuberculosis as a global emergency, called a "public health emergency"[18,19].

Currently, the leading causes of death in the world among men aged 15 to 44 are road traffic accidents, followed by tuberculosis, violence and suicide. Among women, tuberculosis is the first and causes more deaths than suicide, war and blood loss[18,19,20].

According to the WHO, tuberculosis and acquired immunodeficiency syndrome is a chronic disease (AIDS) and is currently unprecedented disasters in history. The state of immunosuppression caused by AIDS creates favorable conditions for transmission and death. Therefore, the progression from the infectious form to the clinical manifestations of tuberculosis differs between uninfected and HIV-infected individuals[21,22].

In the United States, there are between 40,000 and 50,000 deaths each year, with Brazil being the country with the highest number of deaths. However, statistics analyzed by the Pan American Health Organization show that Peru and Ecuador are the countries with the highest mortality rates on the planet, while the lowest mortality rates are found in the United States, Canada, and Cuba[23].

HISTORY OF DISEASE EVOLUTION AND PATHOPHYSIOLOGY

The source of the disease comes from people with pulmonary tuberculosis. The ability of the bacillus to transmit to another person is a result of the nature of the bacillus in question and the intensity of the contact in terms of proximity, time, duration of exposure and the favourable environmental context that seems to be required for a successful infection, for example, it is said to take between 100 and 200 hours, depending on the intensity and proximity of the contact[24].

It is estimated that, in a community, a source of disease can infect up to 15 people on average in a year. Talking, sneezing, and coughing send particles called Flügge droplets into the air. Heavier substances tend to become volatile in the environment, while lighter substances become radioactive in the air[25]. Only water-fine droplets, up to 5 microns in diameter, containing 1-2 suspended bacilli, reach the bronchioles and alveoli of the lungs,

thus initiating the infection process. The infectious particles are called primary Weels. Most environmental particles are retained by mucus from the upper respiratory tract and removed from the bronchi through the mucus system. Bacilli eliminated in this way are eaten, not digested in gastric juice, and excreted in the feces. The smallest particles reach the alveoli, where the microbe grows. Environmental pathogens are often dispersed in airborne particles and do not play an important role in disease transmission[25,26].

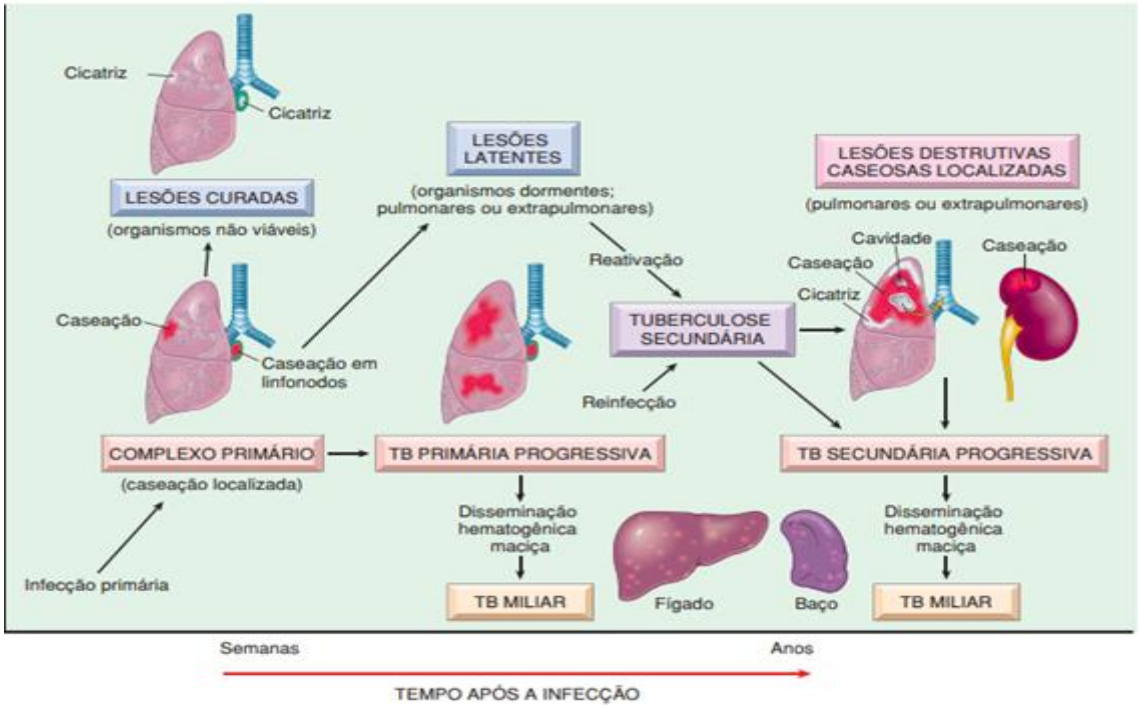
The characteristics of a cough and a person coughing interfere with the transmission of the bacillus between the source of infection and the contact. Patients with better general condition and diet are more likely to cough up and disperse bacilli-producing particles with greater transmission[27]. The discharge is also influenced by the physicochemical properties of the sputum, such as thickness and viscosity. In this context, it can be observed that the duration of treatment can lead to complications. If there is no previous treatment of the patient or any other risk of resistance, it is considered that after 15 days of treatment, if the clinical condition improves, the patient is considered non-infectious. However, due to the nature of the bacilli resistant to the first drugs, it is recommended to show the patient's disease under treatment by means of a negative smear and Paucybacillus control[27,28].

According to the history of tuberculosis, most people know how to generate immune responses against M. tuberculosis, but these responses are not enough to kill the invading pathogen28. In this context, only 10 to 30 percent of people exposed to the bacillus become infected, and only 5 to 10 percent of them develop active tuberculosis. However, many people have a form of immunodeficiency against bacillus-specific antigens, which favors the rapid multiplication of the agent and the development of the disease. Using the model proposed by Rich, the development of the disease is proportional to the number of bacilli, the severity of the strain involved, and the development of hypersensitivity in the host[29].

After inhalation of the bacillus, a series of non-specific mechanical barriers will act against infection. Nasal hairs, angulation of the airways, air turbulence, tracheobronchial secretion, and mainly mucociliary clearance, are the main elements that prevent the bacillus from entering the pulmonary alveoli of the exposed contact[30]. Mycobacterium, by overcoming the physical barriers of the upper respiratory tract and entering the pulmonary alveolar environment, faces macrophages, cells that are part of local innate immunity. The macrophages resident in the tissue, after phagocytosing the bacillus, producing the phagosome, fuse the vesicle formed with the lysosomes, and at this stage the processing of the antigens can occur, and the subsequent presentation of the latter to the helper T lymphocytes, through the major histocompatibility complex of class II. During the phagocytosis process, cytokines and chemokines are produced, which signal the presence

of the pathogen to the immune system, causing the recruitment and migration of neutrophils, monocytes and lymphocytes to the site of infection. However, due to the specific resistance mechanisms of tuberculosis bacilli, the pathogen is not successfully exterminated. Through the inhibition of lysosome-to-phagosome fusion caused by macrophagocytic activity that allows mycobacteria to survive during this period of host immune activation, the phagocytic cell dies and continues to propagate extracellularly[30,31].

Natural History and Spectrum of Tuberculosis – Taken from KUMAR, V.; ABBAS, A.; FAUSTO, N. Robbins and Cotran – Pathology – Pathological Bases of Diseases. 8. ed. Rio de Janeiro: Elsevier, 2010.



Pathological manifestations: Granuloma caseosum and cavitation are the result of sensitization and immune response. Granuloma is primarily a necrosis factor surrounded by epithelioid cells and large multinucleated Langhans-type cells and a ring of lymphocytes. Macrophages are the primary cells infected by the agent. The bacillus enters macrophages by endocytosis through receptors such as mannose. Inside the cell, they multiply into phagosomes and prevent the formation of phagolysosomes by inhibiting calcium signals. In the first stage, the agent increases in alveolar macrophages and in the respiratory tract. 3 weeks after infection, there is a T-Help 1 response (IL-12-dependent for differentiation), due to the introduction of mycobacterial antigens to drain lymph nodes and activate macrophages for their bactericidal activity. Importantly, mature Th1 cells produce IFN-γ, which stimulates the formation of phagolysosomes in macrophages and provides an acidic environment for bacteria. The Th1 response also induces granuloma and caseous necrosis[32].

If the above protective measures cannot eliminate the infectious bacilli, an inflammatory process and the development of non-specific pneumonia will occur. In this new inflammatory environment, the mycobacterium begins to multiply and take advantage of the lack of a specific immune response, which occurs between fifteen and twenty days after death. Thus, after fifteen days, up to 105 bacilli can be found at the primary focus of the infection, and then the infection spreads to other organs lymphatic and/or hematogenously[33].

The pulmonary focus formed in the infectious process, called Ghon's complex, measures 1 to 2 mm, has a soft consistency, and develops over a period of 3 to 4 weeks, during which the development of cellular immunity occurs, with the consequent change in the tuberculin test[34]. Simultaneously with the phagocytic phenomenon, dendritic cells with M. tuberculosis inside migrate to the regional lymph nodes, activating the local CD4 and CD8 lymphocytes, which migrate to the site of infection, guided by the chemokines produced by the infected cells. The accumulation of activated lymphocytes, macrophages, dendritic cells, fibroblasts and endothelial cells, among others, leads to the formation of the granuloma that surrounds the bacillus in a hypoxic and unhealthy environment, limiting its dissemination, and forms a microcontext, where the members of this immune response interact with the aim of eliminating the invading pathogen, providing containment of the infectious focus[34,35].

In protecting against tuberculosis infection, the study of different lymphocyte populations showed the important role of TCD8+ lymphocytes in the primary fight against the bacillus and the prevention of primary infection. Therefore, CD8+ T cells stimulated by endogenous mycobacterial antigens released into the circulation during infection have the ability to destroy mycobacteria-infected cells and can be eliminated, becoming one of the primary care methods. On the other hand, there seems to be very little threat to combat this disease, since antibodies that are not secreted by the animals' plasma can enter infected macrophages[36].

In this period of the first disease, in 95% of cases, the infectious process disappears with the formation of calcification or fibrosis of the Ghon complex, which can be observed on X-rays. On the other hand, if the infectious lens does not occur, in only 5% of cases, it is due to the lack of immunity of the host cell, or to the conditions of the disease, resistance, or strain of the host cell. Infectious bacillus blessing disease, liquefaction of caseum and cancer occurs. This pathophysiology results from the development of tuberculosis from the primary lung complex that develops within the first five years after initial infection and is

termed primary tuberculosis. These can also occur in different diseases and show lymph node, ganglion-pneumonic, bronchioneumonic, cavitary, atelectasis or miliary symptoms[37].

Symptoms of tuberculosis may be seen later, in the first few years after the first infection. In this case, the disease occurs at the end of the period of the first infection, and the person has acquired immunological memory for antigens, and the clinical picture shows that it is longer and the damage is less and the formation of caries and the formation of caries38. A fibrotic process in itself is accompanied by many hypersensitivity reactions. Infection may arise from a new source of external infection by more virulent or resistant strains, or it may arise from the reactivation of a fixed focus of dormant bacilli. Stimulation of the lens occurs with the formation of granulomas, mostly in the upper part of the lung, which progress to necrosis and death. Leakage of fluid into the bronchus can cause bronchogenic proliferation and create a collecting duct at the drainage site. This new release can lead to new treatments for the disease or problems related to a new invasion, through the destruction of the lung parenchyma itself or the invasion of other nearby structures, such as the development of infectious bronchial cancers. A vein known as Rasmussen's aneurysm[38,39].

CLINICAL AND DIAGNOSTIC

Tuberculosis usually presents as a mild or chronic disease, characterized by indolent symptoms that increase in intensity, with periods of remission and recovery. Therefore, it takes a long time to seek medical help, and 66% of patients take three months to contact the healthcare system. Among the various symptoms that appear during the disease, the patient is more likely to report and caregivers are more likely to monitor some signs and symptoms. Therefore, symptoms such as cough, hemoptysis, shortness of breath, chest pain, fatigue, fever, sweating, weight loss, are an important and classic part of the wide range of possible symptoms. However, it is important to remember that there are many non-specific symptoms of the disease, depending on the organ affected by the bacillus[40].

Cough is present in almost all patients, as it stimulates alveolar inflammation and granulomatous involvement of the airways. Initially, a dry cough develops into a productive cough with mucous or purulent sputum, usually in small amounts and sometimes accompanied by hemoptysis. The diagnosis of tuberculosis should be suspected in patients who have a persistent cough for more than three weeks.[41]

Hemoptysis is not a mandatory symptom, but there may be an abnormality of blood mixed with sputum (hemoptosis) or severe hemoptysis, which is rare, associated with a

Rasmussen aneurysm. On the other hand, hemoptysis can occur even in small lesions, and can end up as a sign of disease when parenchymal cavities form[42].

Shortness of breath is an alarming symptom due to some aspects of the pathophysiology of mycobacterial action on the intestinal parenchyma. Damage to lung tissue due to the inflammatory process, including the alveolar environment and surrounding vessels, does not cause a significant change in the area's air/perfusion ratio. The configuration of this characteristic is different in many other stages of disease development. Atelectasis, large cavities, miliary pattern, lesions with excessive inflammatory involvement, development of pneumothorax, pleural effusion and chronic lesions of the disease, due to the nature of the fibrotic ligament was created, and shortness of breath appears as an important manifestation of this[43].

Chest pain associated with pleural effusion. This occurs early in human disease due to the proximity of the alveoli, the primary site of infection, to the pleural surface[44].

Hoarseness, as well as forms of lung disease associated with laryngeal involvement, may not be detected by the patient, are rarely reported and are seen if there are no other signs and symptoms[45].

DISCUSSION

Based on the analysis of the pathophysiology of mycobacterial growth, we found that the growth of intra- and extraphagocytic bacilli is greater during peak periods of adrenal cortisol production, between 11:00 and 12:00 hours. Simultaneously with the slow spread of the pathogen, the death and destruction of infected macrophages also occurs and, in the following hours, the inflammatory content is released into the lung parenchyma, so a local inflammatory process occurs. The host's response appears as a tab. Therefore, fever is characteristic in the afternoon, between 5:00 p.m. and 9:00 p.m., and a lot of sweating at night, after the fever rises, instead of the body increasing body temperature. However, fever can be detected at a not too high temperature, which is explained by the slowness and multiplication of the bacillus and is accompanied by a local inflammatory process of low intensity[45,46].

The chronic inflammatory context established by the insidious Mycobacterium infection can cause a wasting syndrome, proportional to the duration and extent of the disease, which manifests as weight loss, anorexia, weakness, arthralgias, and myalgia. In this scenario, patients who already suffer from pathologies that exhaust the immune system, such as AIDS, alcoholism, malnutrition and drug addiction, end up presenting an intense nutritional deterioration, with the consequent exacerbation of the infectious picture

and worsening of the prognosis[47]. The findings of the physical examination are proportional to the extent of the infectious process, the duration of the disease, and the site affected by the bacillus. Specifically, in the context of lung disease, rales may be found in the region of granulomatous lesions, usually apical and posterior. Wheezing and rhonchi may also occur in case of bronchial involvement. In caseous pneumonia, there may be a decrease in gallbladder murmur and bronchophony when there is pleural effusion, in addition to the classic amphoteric murmur in the tuberculous cavities. Focusing on the bacillus or its components, usually during the first infection, is observed in erythema nodosum, squamous keratoconjunctivitis, polyserositis, and erythema induratum.[47,48]

CONCLUSION

In view of the presence of a body of epidemiological and social evidence pointing to tuberculosis, several other tests are used to confirm the initial diagnostic hypothesis. As it is an infectious disease, diagnostic confirmation is made by identifying the agent at the origin of the lesion. According to this hypothesis, confirmatory tests should be chosen based on the understanding, specificity and relevance of the test in the context in which the patient and healthcare workers find themselves. The tests used in the diagnosis of tuberculosis are: bacteriological, biochemical, cytological, radiological, histopathological, immunological and tests based on molecular biology.

Thus, given the need to disseminate knowledge about the disease and its prevention to the population, in order to guide them on risk factors, tuberculosis contamination, this education and prevention is generated through health prevention actions, and especially vaccination with BCG. It is worth mentioning that health professionals are a group that should be paid attention to, due to the exposure and educational approaches that are effective in the control and spread of the pathology.

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POPULAR KNOWLEDGE AND CULTURES: DIALOGUES BETWEEN EXPERIENCES AND ECOLOGY OF KNOWLEDGE IN THE ZONA DA MATA OF MINAS GERAIS

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ABSTRACT

In this research, the authors discuss some foundations, assumptions, principles and concepts that are important for working with Popular Education. They examine the basic concepts of culture, correlating them with the need to value the knowledge produced by the marginalized sectors of modern society. In this text, the authors show that working with the most diverse forms of cultures demands giving up dogmatic conceptions, precisely because they understand the concept of culture inserted in a spontaneous and free historical and social context, where social actors build their cultural identity independent of the cultural conceptions and concepts imposed by the State and by the economic elites that hold political and economic power that govern modern society. It makes a distinction between the knowledge coming from the popular sectors and those produced by the capitalist State and reproduced by formal education. Finally, the article presents aspects and records of the richness of cultural dialogues of the "Exchange of Knowledge", an event held at UFV.

Keywords: Education. Popular culture. Critical Pedagogy. Knowledge Exchange/UFV.

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INTRODUCTION

This article arises from the context of research and debates, readings and discussions held from the classes of the Master's/Doctoral Program discipline, "Education and Popular Cultures: dialogues and contributions to the different educational contexts". The article aims to (1) analyze the concept of popular cultures, (2) investigate the relationship between culture and popular education and (3) report the richness of popular experiences and movements in the Zona da Mata Mineira. The methodology that supports this study is literature review, experience reports and documentary research.

The methodological proposal of the discipline brought, at least in our understanding, fundamental elements that enabled the collective of the group to acquire a contextualized understanding of the object of study (the practice and reflections on cultures and Popular Education), through dense pre-selected readings focused on questions about popular education and culture, "*conversation* circles", lectures and thematic seminars that contributed greatly to the enrichment of the debates and growth of the group.

The richness of the classes and bibliographic research, as well as the debates and dialogues arising from them, inspire the registration of some reflections that can become starting points for teachers, researchers, students and militants of popular causes, in studies on the countless meanings, forms of expression and manifestations of the various forms of culture of popular roots, which can serve as important anchors for Popular Education projects.

Nowadays, themes, debates and discussions related to education and popular cultures have surfaced at various times such as meetings, seminars, congresses and even in the communities and behind the scenes of the school.

The insistence on the recurrence of these themes in debates involving the major themes of today's society may be linked to the large gap left by formal or traditional education, or even to the increase in the level of information and organization with sectors and/or social movements. The fact is that, in times of "perverse globalization" (as the late Prof. Milton Santos would say) these themes return, in a healthy way, constituting another important channel of expression and organization of the broad popular sectors and social movements.

On the threshold of the twenty-first century, at a time when we are witnessing the offensive of the neoliberal project on the achievements of workers around the world, and especially on the most marginalized sectors of society, it is even more urgent to revisit the concepts and categories involved in education projects and popular cultures. It is extremely necessary to understand the origin and conceptual bases of the knowledge originated from the popular sectors, as well as its connection with the aspects that demarcate the cultures of

the most different peoples that make up the popular sectors. Therefore, *the objective of this theoretical essay is to understand the bases that sustain the projects of Popular Education, as well as to understand the connection between Popular Education and the aspects that determine the culture of the subjects involved in this model of education*.

CULTURE: A "CONCEPT", "NON-CONCEPT" THAT DISSOLVES AND DISSOLVES INTO THE AIR!!

This title is a provocation, due to the gaps that are formed and the void that is established around the meaning of culture. Prof. Carlos Brandão categorically stated that "the day a rigid, dogmatic and definitive concept of human culture is established, on that same day, it will lose all its meaning and then it will no longer make any sense to study it" (BRANDÃO, 2009, p.131).

The categorical statement of the Anthropologist and Professor Carlos Rodrigues Brandão is bold and opens up a series of reflections on the concept of culture. In fact, the considerations and meanings credited to human culture and all its forms of manifestation cannot be formulated following theoretical standards and conceptions, rigid methods that follow certain standards established by sectors of society or social groups. Since cultural manifestations must be observed and analyzed within a dynamic historical and social context, whose patterns and aspects that characterize them are in a constant process of mutation and transformation over the years and that cross several generations. It is necessary, above all, to understand the dialectical movement of societies and the various social groups that compose it.

Thus, it is totally different to analyze a piece of handicraft, a utensil, a work of art exhibited in a museum from the analysis of these same objects in the locality, in the tribes or social groups in which they were produced and under the eyes of those who produced them. It is necessary to argue about the needs, desires, desires and reasons for its production.

In the field of philosophical thought, we can verify the conceptual ambiguity about human culture, according to the analysis of thinkers such as Hegel and Marx, highlighted by Chauí (2006, p. 108), for example:

> It was Hegel and then Marx who emphasized culture as history. For the former, time is the way in which the Absolute Spirit or reason manifests and develops through works and institutions – work, religion, arts, sciences, philosophy, social institutions, political institutions. In each period of its temporality, the Spirit or reason engenders a determined culture, which expresses the stage of spiritual or rational development of humanity in a sequence of civilizations that begin in the East and end in the West – China, India, Egypt, Israel, Greece, Rome, England, France, Germany would be phases of the life of the Spirit or reason. each one expressing itself with its own culture and surpassed by the following ones, in a continuous process. For Marx, Hegelian spiritualism or idealism is, of course, unacceptable. History-culture is not the

> development of the life of the Absolute Spirit, but the way in which, under conditions determined and not chosen by them, men materially produce (through the social division of labor and economic organization) their existence and give meaning to this material production. History-culture does not narrate the temporal movement of the Spirit, but the real struggles of real human beings who produce and reproduce their material conditions of existence, that is, they produce social relations, by which they are distinguished from nature and differentiate themselves from each other in antagonistic social classes. From this point of view, the movement of history-culture is carried out by the struggle of social classes to overcome forms of economic exploitation, social oppression and political domination.

We can verify, through the excerpt in Chauí's text (2006) that in Hegel human culture resides in the evolution of the spirit and reason, while in Marx, in the evolution of human action over nature. In short, in Hegel, culture is linked to "being in the world", in Marx it is linked to "being and acting in the world and on it". Here we see two totally antagonistic formulations about the meaning of human culture.

CULTURE IN DIFFERENT CONTEXTS

The very contribution of Hegel and Marx, highlighted in the text by Chauí (2006) demonstrates that dealing with the concept of human culture requires a keen look at various aspects and factors imbricated in the process of the realization of man as a cultural being par excellence. Thus, working on the analyses related to cultural investigations requires an astute look at the various dimensions, the various approaches and the most diversified categories that permeate the process of production of human culture in its most different nuances. To begin this discussion, we draw on Eagleton's formulation of human culture:

> Culture is not only what we live on. It is also, to a large extent, what we live for. Affection, relationship, memory, kinship, place, community, emotional satisfaction, intellectual pleasure, a sense of ultimate meaning, for most of us, than inhuman bills of rights or treaties of commerce. However, the culture can also get uncomfortably close too close. This very intimacy can become morbid and obsessive unless it is placed in an enlightened political context, a context that can temper these surroundings with more abstract but also somewhat more generous affiliations. (EAGLETON, 2005, p.184)

Terry Eagleton (2005) highlighted some fundamental aspects that should be observed in research on cultural issues. Thus, the characteristic aspects of the subjectivity of human thought and that make up the terrain of the "sensitive" have an extremely relevant connotation in the treatment of studies and research on culture.

In the same sense, Fonseca (2011) also highlights some fundamental aspects in such investigations:

> As a spontaneous process located within a certain historical-social context, culture is framed within a network of social experiences that mark and determine the context in which it arises. Thus, culture in a given context is different from other cultures within other contexts different from this one and even from each other. In this interpretative

> direction, we can then accept that the concept of culture is relative, depending on the type of spontaneity of the process that originated it, the historical-social context in which it is inserted, and also the point of view of those who examine it. We will never be able to observe a culture of a certain people or social group, from the same angle and with the same eyes as those who built it within a spontaneous process and in a certain historical-social context, in which we do not participate. [...] Thus, it may be useful to make use of a "notion" and not a "concept" of culture, a notion that can guide us in our elaborations and that is not tied to rigid and predefined conceptual norms and standards. Perhaps it is valid to start from the notion that culture is something originating from a spontaneous and free process, inserted in a historical-social context and that expresses values, beliefs, faith, religiosities, ways of life, conceptions of life, of the world and of nature. It is something non-static, on the contrary, it moves as the elements and aspects determined by the constant evolution of the sociocultural context that originated it move, in accordance with the transformations of the conceptions and positions towards the world and its elements, of those who built it. (FONSECA, 2011, p.3-4, passim)

In this sense, we can believe that from this notion built within a conception of contextual transformations, of movements arising from the very life experience of the subjects who live within a historical and social context, these same subjects act to transform the collective as well as to self-transform.

From this perspective, researchers and scholars of aspects related to human culture must exempt themselves from the very common tendency to draw hasty particular conclusions on the subject, since the cultural process comes from the relationship between man and nature, from his intervention in the world of things and in the world of men, where there are relations with material production, mediated by human (or social) relations. In this sense, we can affirm that human culture is the result of a process of evolution of historical experiences of man's relations with nature, within a context permeated by social relations.

Mistaken cultural observations, based on immediacy of interpretations, can lead to unforgivable errors, annihilating even the cultural formations of a people or a certain social group. Such mistakes can cause gross errors that become the basis of supposed absurd theories. Richard Geertz presents an excellent contribution from this perspective;

> [...] The obstructive sin of interpretive approaches to anything—literature, dreams, symptoms, cultures—is that they tend to resist, or are allowed to resist, conceptual articulation and thus escape systematic modes of evaluation. Either you grasp an interpretation or you don't, you see its fundamental point or you don't, you accept it or you don't. Imprisoned in the immediacy of its own detail, it is presented as self-validating or, what is worse, as validated by the supposedly developed sensibilities of the person presenting it; Any attempt to see what she is in terms other than her own is seen as a travesty – as ethnocentric, the anthropologist's harshest term for moral abuse. Of course, this does not serve a field of study that, although timidly (although I am not shy about the subject, at all), asserts itself as a science. There is no reason why the cultural conceptual framework should be any less formidable and thus less susceptible to explicit canons of approval than, say, a biological observation or a physical experiment – no reason except that the terms in which such formulations can be presented are, if not entirely nonexistent, very close to it. We are reduced to insinuating theories because we lack the power to express them. (GEERTZ, 2005, p.17)

Geertz's (2005) statement is too serious to go unnoticed. Unfortunately, we can see in a large number of studies on culture, the lack of commitment to research methods and criteria, the overvaluation of the individual values of researchers to the detriment of the most relevant categories that make up the spectrum of the research object.

Geertz's (2005) formulation allows us to reflect that, although in a large number of studies on human culture we have to take into account the aspects related to the subjective of human thought, to the component parts of the "sensitive", inherent to the particularities of the human being, the researcher can never let himself be involved, let himself be weakened by the aspects related to human sensitivity, it can never be swallowed up by the torrent of emotions emanating from the subjects and/or social groups which may be central objects of research on the various dimensions and approaches of their own culture. Otherwise, there is a serious risk of carrying out a work guided merely by abstract data and observations that will inevitably lead to totally distorted results about the cultural formation under study.

THE CULTURES THAT EMANATE FROM THE OPPRESSED AND MARGINALIZED PEOPLE

So far we have made analytical digressions and a revisit to the concepts and philosophical foundations about cultural formations in a generalized way. However, the new times put on the agenda the small, almost murmuring discourse that emanates from the most suffering and marginalized sectors of the population. Until recently, the history of culture was told by grand narratives coming from the ruling elites. Thus, the history of the culture of the broad sectors of marginalized populations occupied between the lines of official historiography, dictated by the elites.

To illustrate this evidence, it is important to resort to an excerpt from the work of Carlos Rodrigues Brandão, when he refers to the narratives that deal with black culture in Brazil;

> Regardless of the position occupied in the work systems of the countryside and the city, the black is explained according to the way he is recognized by the white: as a minority category, whose presence needs to be explained. By defining himself, he manages to bring together the attributes of an exploited and trustworthy worker with those of a naturally devalued ethnic category. Identifying himself as a worker and black, he divides himself between positive and negative qualities. On the one hand, indisputably, there are no manual workers, specialized or not, better qualified and more productive in Goiás than blacks. On the other hand, being black is an impoverished variant of an idealized way of being people, the way of being and living of the whites of the city. We know that the time of captivity does not frequent the discourse of blacks with the same intensity of detail with which it is present in that of whites. The white man speaks of a black slave: pure and haughty as a race; an individual and collective subject, docile and servile as a worker. For the Negro, the qualities of the race are omitted. Even the origin of slaves, the basis of a characterization of being black underlying the idea of being African, is almost always vague and undefined. (BRANDÃO, 2009, p.62)

Brandão's (2009) quote is part of a research he carried out with blacks from the interior of Goiás. It serves perfectly to illustrate the way in which the history of the oppressed is manipulated by the narratives of official historiography directed by legitimate representatives of white and Western macho culture. Thus, the roots of popular culture have been hidden, in a camouflaged way, by narratives of Western hues.

To reflect on this nonsense, we highlight a textual excerpt from Martins (1980, p.16):

> The people are the ones who know about the people. This is feared by those who make the social sciences a capitalist enterprise, mediated by fat funding, based on the reproduction and reaffirmation, in scientific practice itself, of the essential brutalities of this society that materialize in the figures of the oppressor and the oppressed, the exploiter and the exploited. They are those researchers who are always willing to render a service to the oppressors of the people, becoming themselves instruments of oppression. They are the ones who always have elaborate justifications for refusing to commit to popular struggles, but who do not need the slightest justification to put themselves at the service of those they oppress.

In fact, popular culture constantly lives under the veiled threat of tyranny and the power that emanates from capital and/or its representatives. In this way, this culture is always appropriated by the mechanisms of capital control, which puts it at the service of surplus value. Thus, the free expressions that emanate from the marginalized sectors of the populations are subjected to mechanisms of capital control. It is capital functioning as a manager of the production of popular culture. In the vast majority of cases, this control takes place through the State apparatus itself, and its various representative institutions. Marilena Chauí (2006) discusses the process of appropriation of the Brazilian State over the cultural production of the popular sectors:

> If we examine the way in which the State operates in Brazil, we can say that, in the treatment of culture, its tendency is anti-democratic. Not because the State is occupied by this or that ruling group, but because of the very way in which the State aims at culture. Traditionally, it seeks to capture all the creation of culture under the pretext of expanding the public cultural field, transforming social creation into official culture, to make it operate as a doctrine and radiate it to the whole of society. Thus, the State presents itself as *a producer of culture*[3], conferring on it national generality by removing the antagonistic social classes from the place where culture is effectively realized. There is also another modality of state action, more recent, in which the State proposes the "modern treatment of culture" and considers it archaic to present itself as an official producer of culture. By modernity, the rulers understand the criteria and logic of the cultural industry, whose standards the State seeks to repeat, through the governmental institutions of culture. In this way, it starts to operate within the culture with market standards. (CHAUÍ, 2006, p. 134)

This tendency of the so-called "modern state" to take over popular demonstrations comes in the sense that the state apparatus distorts the very idea of democracy and popular participation. By appropriating the various forms of expression of the people, he tries to pass

[3] Emphasis in the original

on the idea of "openness to the ideas of the people", of "equal opportunities, spaces for citizenship and cultural creation". From the moment it appropriates popular cultural productions, including the injection of resources from the people themselves, it also creates all the effective conditions for the control of these creations, institutionalizing them and placing them under the reins of the capital and consumer market.

In the same vein, Peter Burke (2003, p.33) states that "most studies on knowledge are concerned with the knowledge of the elites, while studies of popular culture have relatively little to say about its cognitive element, popular or everyday knowledge". In fact, the knowledge considered valid is that which serves to legitimize the logic of the so-called "progress", arduously defended by the elites, in each period of the history of humanity. In this way, the knowledge and culture produced by the majority of populations are considered invalid, useless, disposable, contrary to the ideas of progress consecrated over time by the dominants.

Therefore, serious studies about popular culture should be encouraged by all educators committed to Popular Education. From this perspective, the history of popular culture in Brazil was told, until recently, by the intellectualized elites who had the role of telling the history of the country, of the occupation and delimitation of the borders of its territory, that is, the official history of the nation was reinvented by the intellectual elites representing the ideas of civilization of Western society.

WHAT ARE THE LINKS BETWEEN EDUCATION AND POPULAR CULTURE?

The term "popular" often used for those who work with marginalized sectors of society, and especially with poor communities, is difficult to define. For the proper understanding of this term, it is necessary to locate it in the context of the State and outside it. That is why Popular Education takes place in formal and non-formal spaces. A large number of scholars tend to disregard popular knowledge and knowledge, claiming their proximity to common sense and, therefore, are not useful for science.

Now, in the context of class society, we must never despise popular knowledge, because it is knowledge that comes from the majority, that is, from the proletariat. Ignoring the share of knowledge and knowledge produced by the exploited class is the same as saying that science and its practice can only have value when it is based on the knowledge of the elites who hold political and economic power. This is the logic of capital, to validate only the knowledge, desires and desires of the owners of the means of production, that is, the capitalists. For capital, popular knowledge and culture are worthless. And, the school as a

model for the reproduction of this logic, also does not see validity in the knowledge and knowledge coming from the popular sectors.

The traditional school, as a reproducer of the ideology of the capitalist State, exempts itself from its social role and begins to assume the bureaucratic role of control and management of the State in the educational space, as stated by Freitas (2003, p.17);

> [...] For those who look at the effectiveness of the school from the perspective of equity, what remains to be done is to study and disseminate which factors intrinsic to the school (pedagogical and school resources, size of the school, management style, teacher training, etc.) affect the increase in the quality of learning (student proficiency), despite the influences of the socioeconomic level on which, they say, nothing can be done. This is the neoliberal dream: regardless of socioeconomic level (or, as they say, discounting the effects of socioeconomic level) all students should learn at a high level of mastery.

In modern society, the school still lends itself to the role of "conscience former". How many times do we see the pedagogical discourse filled with the word "awareness". In fact, the term "consciousness" comes from the meeting of the terms "consciousness" added to the term "action", which means that consciousness is formed in the practical action of the subject in the world and before the world. The liberating consciousness, then, comes in the sense of reinforcing the "being" in the world and not the "being" in the world of capital as recommended by formal education. It turns out that the pedagogical discourse that perpetuates the logic of the interests of capital has already appropriated the word "consciousness". And, it is in the sense of resuming the meaning of "being" in the world that the term "critical consciousness" was placed by Paulo Freire.

There is a lot of knowledge coming from the popular sectors, from the needy communities of the periphery, from the countryside, from indigenous and African philosophy, among others, which are silenced around a supposed "scientific truth". Here we will not focus on the validity or not of this supposed truth, but rather on understanding the knowledge and narratives of these social actors that a significant portion of science wants to silence. They act as if such discourses did not exist and, consequently, the subjects who produce these discourses are also silenced. It is the denial of the ontology of popular knowledge.

To begin this discussion, we will make use of the studies of (XAVIER; FLÔR, 2015, p.310);

> We live in a country that, due to its own history, has a huge diversity of beliefs, cultures and forms of expression, which makes each community unique, with its own characteristics. We believe that these specificities need to be considered in the local educational practice, which should, therefore, value and rescue the knowledge coming from society and that students bring with them, the result of their experience.

Completing their thought, the authors show that:

> Popular knowledge is pointed out as knowledge "on the margins of formal institutions" (LOPES, 1999, p. 152). In school, the dominant culture is transmitted as something natural, without being questioned, and primitive knowledge is hardly valued, since it is not validated by the Academy. [...]. It is not a matter of overvaluing popular knowledge, but rather recognizing the knowledge that exists in the daily practices of a portion of the population that is often not seen as having knowledge. It tries to deconstruct the paradigm of a single form of education, based only on scientific knowledge, and explore new possibilities. (Idem, p.310)

The textual passages of the authors above show the riches of our country, of continental dimensions built on a mosaic of different beliefs, knowledge and cultures, whose particularities and empirical knowledge need to be valued and strongly taken into account in our studies.

Therefore, Popular Education must seek its political orientation with the elements posed by the culture, experiences and ways of life of the marginalized sectors of society and not with the models presented by the capitalist State. Therefore, the task of Popular Education in the space of the formal school must have as its method the struggle of resistance to pernicious discourse and practice in favor of a school that perpetuates the current model of production. In informal spaces, Popular Education should aim for projects that promote the condition of "being" in the world of the subjects that make up the marginalized sectors. In both cases, Popular Education should never lose sight of the need to transform the school and society, aiming at the construction of another paradigm of education and society that excel in the liberation of the subjects in all senses. Thus, critical consciousness serves as an important instrument that will allow us to distinguish the meanings of the term "popular", on the one hand defended by the capitalist State and on the other hand, from those defended by those who strive for the full liberation of the subjects that make up the marginalized sectors of society.

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defended by those who strive for the full liberation of the subjects that make up the marginalized sectors of society.

THE RELEVANCE OF POPULAR KNOWLEDGE

Here in the Zona da Mata Mineira, popular culture is manifested emphatically, through the cultural manifestations of the Ternos de Congo, Folias de Reis, Manifestations of Candomblé and Umbanda, Movements of Quilombola Communities, of those affected by Mining and Dams, Manifestations of artisans, among others. It is worth mentioning the "Knowledge Exchange", an event that opens the "Farmer's Week", held in July within the scope of the Federal University of Viçosa (UFV). It is of great relevance to highlight this diversity of cultural movements that has been added to the "Exchange of Knowledge", a rich mosaic composed of the most diversified cultures that participate in this very rich experience in exchanging and debating experiences and knowledge related to the land and the marginalized people of the Zona da Mata Mineira region, such as movements of small farmers, family farmers' movement, Agricultural Family Schools, artisans' movements, indigenous movement, women's movement, black movement, movement of those affected by dams, movements of those affected by mining, student movement, ecological and agroecological movements, among many others.

In his studies on Popular Education, Fonseca (2015) observes that in the face of the denial of popular knowledge and knowledge by science, we can affirm that popular culture ***does not have*** any ontological ***and/or*** epistemological ***dimension 2[in the face of so-called universal scientific knowledge]***. From the moment that science denies the validity of popular knowledge, it affirms that it also does not recognize its ***ontological dimension***. It denies the very ***essence***, ideas and ***thought*** of the subjects who produce such ***knowledge***. Thus, in the face of its positivist methods, science ends up denying the ***real existence*** of these subjects who inhabit the margins of society regulated by the set of values [cultural, ethical and moral] regulating the capitalist state and by bourgeois formality. In the same sense, it also denies the "***episteme***", or the set of values that could build any theory about ***popular knowledge***.

So, in this interpretative direction, if it denies the ***real existence*** of these subjects in the plan of the methodology of the construction of valid universal knowledge, it also ***refuses*** to validate any theoretical or empirical bodies of knowledge coming from the popular sectors. Therein lies the question that insists on remaining: is it really important to fight for the recognition of science to the knowledge and knowledge produced by the oppressed and marginal sectors, or will this recognition not lead the cultural values of the marginalized

sectors to the framework arising from the positivist methods of doing science? Wouldn't such recognition format spontaneous, autonomous and popular knowledge to the straitjacket derived from the rigid, Cartesian and positivist methods of doing science? Wouldn't this validity of knowledge before science take away the autonomy, freedom of expression, the opportunity of these subjects to write their own history, minimizing their potential to transform the reality in which they live? These are relevant questions for the studies of popular movements, as is the case of cultural expressions originating from communities of Afro-descendants.

So spaces such as the "Exchange of Knowledge" are fundamental for the struggle for the autonomy and organization of the popular sectors and placed on the margins of an exclusionary society par excellence.

It is important to note that in the two days of the event there are important meetings and cultural activities such as congada groups, folias de reis, celebrations of indigenous philosophy, capoeira circles, installation of studies of the work of Paulo Freire, the black movement, settlements and the Homeless Movement and the Landless Movement, among other various forms of cultural and popular manifestations. We can say that these are very rich moments of effervescence of a true exchange of knowledge and popular knowledge. In Figure 01 we see the official plaque of the event and a tribute to Paulo Freire, our great educator from Pernambuco. There are also spaces for activities and facilities for children to follow and accumulate knowledge and knowledge passed from past generations to the youngest.

Figure 03: Exchange plaque and tribute to Paulo Freire



Source: Authors' collection (2019)[4]

The next figure, later on, is the record of members of the Purí indigenous community in the states of Espírito Santo and Rio de Janeiro. In the image on the right we can

[4] All figures, images, photos and illustrations present in this text were kindly made available to the author for publication, as well as the images of the people in the photos.

contemplate a Shamanic ceremony of the Purí people. The Purís communities are indigenous communities that are remnants of the indigenous genocide and inhabit regions of the states of Espírito Santo (ES) and Rio de Janeiro (RJ). In the image on the right we can contemplate a Shamanic ceremony of the Purí people.

Figure 02: Poster of activities of the Purí indigenous community (left) and Shamanic Ceremony of the Purí people (right).



Source: Authors' Archive (2019)

The indigenous community of the Purí people participates and assists in the organization of the "Exchange of Knowledge". There are even members and leaders of the community who are studying for the Degree in Rural Education at UFV.

Figure 03: Popular singers/educators and suit of Congo de Airões (MG)



Source: authors' collection (2019)

In the figure above, we can see (left), presentation of regional songs typical of the peasant communities. In the first photo, the first on the left (accordion) is the retired professor from UFV, Edgar Coelho: Founder of the Paulo Freire Chair at UFV and the person on the right (viola) is the educator and popular songbook Sebastião Farinhada: one of the main creators, organizers and participants of the Exchange of Knowledge, present at the event since its first editions. In the photo on the right we see a presentation of a Congo Suit, with "Mestre Boi" (in the background) as captain, from the quilombola community of Airões (MG), also always present at the event.

Figure 04: Capoeira workshop for children in the "Troquinha de Saberes" (left) and Anti-racist Banner (right)



Source: authors' collection (2019)

In Figure 04, we can see, in the photo on the left, a presentation of capoeira, an activity dedicated to the children participating in the event called "Troquinha de Saberes". In the photo on the right we see a banner with the inscriptions of an anti-racist agenda, placed on the agenda, especially after the brutal and cowardly murder of George Floyd (USA) and which had a gigantic worldwide repercussion. This range has always been current and has in this times, in particular, a great symbology for the set of exploited and marginalized peoples of this society of unequals.

As already mentioned, the event is composed of a diversity of social and popular movements that have joined it, under the banner of agroecology. It is relevant to emphasize that the agroecological flags were powerful to the point of establishing a connection with other agendas of struggles that bring together a rich mosaic of social movements of the most diverse colors and nuances. The "Exchange of knowledge" that began with *a nucleus of a few dozen people* grew, gaining new body and thickened with a diverse range of social movements and, in this way, becoming a trench of resistance and struggles of the various sectors of popular movements, bringing together within itself several banners of struggles of these movements.

The following figures show some highlights of the 2019 edition of the "Knowledge Exchange".

Figure 05: Women's movement and indigenous handicrafts and pieces



Source: author's collection (2019)

Figure 06: Icons thinkers and fighters of black culture



Source: author's collection (2019)

In the figure above, we highlight illustrations (drawings) of personalities from the movement and black culture: Zumbi dos Palmares (left), Professor Milton Santos (center) and Carolina de Jesus (right). These illustrations were made by members of the collectives of social movements.

PARTIAL CONSIDERATIONS!

Dealing with education and popular cultures means always leaving a text open. The complexity and the enormous range of aspects and themes correlated with the subject, most of the time, leave several reflections that lead to multiple interpretations, in addition to a series of questions (also open) on which the theme instigates the study. Thus, when we try to produce any text on this relevant subject, we must always cover ourselves with special care and attention, otherwise, we run the serious risk of, as formal education does, reproducing the capitalist discourse on the subject.

Dealing with the analysis of this theme requires from the researcher a keen look, a look that instigates the subjects of the communities of the excluded to take steps towards understanding the suffering reality that surrounds them, to perceive the roots and the true responsible for the situation of marginalization in all senses, through which these subjects

pass. It requires educators to be careful to constantly work on the line of rupture/continuity between the formality that permeates the school and the perspective of the construction of an emancipatory model, of liberation, always pointing in the direction of rupture.

On the other hand, Brazil is a very rich cultural mosaic composed of different shades of cultural expression, with cultural contributions that demarcate the origins and essence of the identity constitution of our population. This cultural mosaic provides us with elements, factors and ethnic-cultural aspects that make it possible to build and reconstruct the diverse cultural formations of our people. It also allows us to analyze the degree of exploitation to which our population was subjected during the process of "colonization" of our territory.

This text sought to point out some conceptual aspects in the field of Popular Education and Culture, as well as signaling the formation of subjects who can intervene, concretely, in their reality through the continuous construction of their critical consciousness. Finally, working towards a truly popular education means giving up the archaic, bourgeois and outdated principles that permeate formal education and moving towards the construction of other principles that can guide the action of subjects from the marginalized sectors of society, guaranteeing them the conditions for the formation of their critical consciousness, which will point them to the path of liberation. in the fullest sense of the word, in the face of the oppression of a system that appropriates the values of popular culture, placing them in favor of the flourishing of capitalist surplus value.

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TECHNICAL ASSISTANCE AND RURAL EXTENSION IN THE BRAZIL WITHOUT POVERTY PROGRAM. A REPORT ON THE EXPERIENCE OF THE MUNICIPALITY OF CAXIAS/MA

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ABSTRACT

The present study intends to contribute to the production of knowledge about PATER in the PBSM from the report of the experience of the Municipality of Caxias/MA. The first chapter analyzes the process of expansion of Rural Extension in Brazil, the main institutional changes that have occurred over the last four decades, the process of social mobilization that enabled the formulation of a new proposal for Rural Extension, as well as the conceptual bases that support the new PNATER for family farmers from the implementation of PBSM and PFAPR. The second chapter addresses the socioeconomic characteristics of the benefited families, the guidelines and objectives of the implementation and execution of the PATER, the structures of coordination, execution and social participation and the activities carried out in the proposed period. In the third chapter, the results of the Program are evaluated, according to the view of the technicians of the executing entity and the benefited families in the Municipality of Caxias/MA. The PATER, associated with a set of public policies, connected by it, has the power to lead families to the reduction of significant dimensions of poverty by overcoming indicators of deprivation, as evidenced. When outlining the visible limits of this public policy to lead the families involved to overcome the conditions that generate extreme poverty, it is necessary to consider its achievements in just two and a half years of execution and its potential for qualification in the face of the demand for continuity and deepening.

Keywords: Technical Assistance. Rural Extension. Productive Inclusion. Development. Municipality of Caxias/MA.

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INTRODUCTION

The first decade of the twenty-first century witnessed significant advances in the reduction of poverty and extreme poverty in Brazil, according to data from the National Household Sample Survey (PNAD) of the Brazilian Institute of Geography and Statistics (IBGE, 2017). However, persistent inequality, especially in rural areas, keeps the country among the most unequal in the world, with millions of people still immersed in poverty. This reality highlights the need for social policies that transcend mere welfare, demanding deeper structural reforms to combat the roots of poverty.

Faced with this scenario, the Federal Government launched in 2011 the Brazil Without Extreme Poverty Plan (PBSM), with the objective of consolidating advances in the fight against poverty and extreme poverty. The Program for the Promotion of Rural Productive Activities (PFAPR), aimed at family farmers in situations of extreme poverty, and the Technical Assistance and Rural Extension Program (PATER) emerged as crucial instruments of the PBSM. PATER, in particular, proposes to offer technical assistance and non-reimbursable financial resources to promote food security, productive inclusion, and the strengthening of the autonomy and citizenship of beneficiaries.

Understanding the conception, potential and limits of this public policy is fundamental, considering the historical context of poverty in Brazil and the complexity of the Brazilian social protection system. Poverty is not configured as a fortuitous event, but rather as an intrinsic element in the country's history, demanding approaches that go beyond welfare. The PATER, inserted in this context, raises questions about its effectiveness in overcoming extreme rural poverty, or whether its action is limited to mitigating this condition.

The present study used elements generated by the execution of the PATER in the TCC/MA. The study was deepened in the city of Caxias/MA. In addition to the researcher's experience in the region, this municipality was chosen because it has the highest proportion of families in extreme poverty in the rural area of the TCC/MA. The evaluation of the legacy of the Program was carried out by consulting and analyzing secondary data and various information collected and made available by the executing entity and primary data collected through a form addressed to 39 beneficiary families and the executing team of PATER. From the analysis of secondary data, information from the executing entity and primary data collected through questionnaires and interviews with beneficiaries and rural extension workers, we seek to answer the following question: the PATER, as a complementary public policy to the Bolsa Família Program (PBF), has the potential to lead families to overcome extreme rural poverty, or is it limited to an important one, but insufficient, mitigation policy?

The investigation, conducted under an interpretative approach of public policy analysis, aims to understand the perception of rural extension workers and beneficiary families about the program, as well as the results achieved. Through the analysis of the information collected and its confrontation with the theoretical framework, it seeks to contribute to the production of knowledge about PATER and its implications for inclusive rural development. The results of this study may support future actions and public policies aimed at overcoming extreme poverty in rural areas, in addition to fostering the debate on the role of rural extension in this process.

METHODOLOGY

Primary data were used, collected through a form addressed to 39 beneficiary families and the PATER execution team, and secondary data, generated and made available by GRAPAS, as well as various information collected from workshops, evaluation seminars, reports and published documents. Such data are systematized, analyzed and compared with the theoretical framework and with other reflections carried out with a focus on actions to confront the issue of rural poverty.

RESULTS AND DISCUSSIONS

THE COACHES' PERCEPTION OF THE PATER

The first issue addressed refers to the motivation and knowledge that the team and the executing entity had at the beginning and end of the PATER. As can be seen in *Table 1*, their motivation changed positively, from 76.2% to 92.5%. When assessing the knowledge of the reality of families in situations of extreme poverty and the relationship of the executing entity itself, it is perceived that initially there was a low relationship between the executing entity and the families and that the level of knowledge of the professionals about this reality was low. If initially only 22.4% of the professionals had high knowledge of this reality, in the end this knowledge reached 98.5% of the professionals. This fact is possibly related to the training developed by the MDA and the MDS, in partnership with GRAPAS.

Table 1 - Motivation and knowledge of the reality by the professionals involved, at the beginning and end of the PATER

Escala	Motivação Profissional (%)		Relação inicial da executora com as famílias	Conhecimento da realidade (%)	
	Início execução	Final Execução	(%)	Início execução	Final Execução
Baixa	3,0	4,5	59,1	61,2	0,0
Regular	20,9	3,0	21,2	16,4	1,5
Alta	76,2	92,5	19,7	22,4	98,5

Source: From the author (2017).

When analyzing the perception manifested by the executing team about the scope of PATER regarding food production, 98.5% of the professionals showed that the results achieved in terms of food security of the families involved were high, as can be seen in *Table 2*. In terms of income generation, the scope of the Program was more restricted[3] for 44.8% of the professionals, the impact of the projects developed on income was considered low or regular, while for 55.2% of the professionals it was considered high. This reading is understood as natural, given the limited resources of the Program as a power to structure agricultural or non-agricultural productive activities that can immediately impact the income generation of families that often present situations of isolation or scarcity of land. It must be considered in the time frame of two and a half years analyzed, that the operational dynamics of PATER allowed the implementation of productive projects to occur only from the beginning of the second year.

Practically all the technicians indicated that there was a positive impact of PATER on the citizenship of the families involved. A question was also asked about the level of empowerment of[4] these families with their communities, leaders, institutional and representative spaces and the ATER agents themselves. As shown in *Table 9*, for 56.7% of the respondents, the empowerment of families was initially considered low. In turn, the empowerment that was initially considered high for only 13.4% of the respondents increased to 83.6% at the end of the two and a half years of implementation of the Program[5].

[3] This is an indirect perception, that is, as food production has improved, the money previously spent on the purchase of these goods has been used to buy other things.
[4] In Freire's perspective, empowerment, based on a critical perception of social reality, is fundamental, but such learning needs to be related to the broader transformation of society. From this perspective, empowerment can be conceived as emerging from a process of social action in which individuals take possession of their own lives through interaction with other individuals, generating critical thinking in relation to reality, favoring the construction of personal and social capacity and enabling the transformation of social power relations (BAQUERO, 2012).
[5] In a reading of rural extension, as an educational process of a continuous non-formal nature, it would be interesting to quantify how much the methodological and pedagogical contribution enunciated by the executing entity and its professionals through its mission, was decisive for this perception to materialize.

Table 2 - Perception of the local executing team about the scope of PATER in terms of income generation, food security, citizenship and empowerment of families

Escala	Alcance do PATER (%)			Empoderamento das famílias (%)	
	Geração de Renda	Segurança alimentar	Cidadania	Início Execução	Final Execução
Baixa	7,5	0,0	0,0	56,7	3,0
Regular	37,3	1,5	3,0	29,9	13,4
Alta	55,2	98,5	97,0	13,4	83,6

Source: From the author (2017).

The data in *Table 3* allow us to assess the perception of the executors about the capacity of the productive projects elaborated to strengthen the reproduction strategies of the families involved and their probable impact on gender relations. In this perspective, for 82.8% of the respondents, the productive projects presented themselves with a high capacity to strengthen the social and economic reproduction strategies of the families involved, and 75.8% consider that the projects prepared and executed by the families will have continuity, reproducing themselves over time. This perception dialogues with the concern expressed by Rahnema (2003), who, when studying the production of poverty and misery generated by the economic system itself in comparison to the poverty of simple life societies, which organize themselves to meet their needs, ponders that many programs designed to account for this reality constitute a mere exercise of power and mitigation, often contributing to steal instruments patiently forged to meet their needs, such as the ability to self-defend and organize, which allowed them to resist adversity.

Table 3 - Perception of the local executing team about the profile of the productive project, its ability to continue and the importance of having been prepared on behalf of women

Escala	**Capacidade do Projeto**		**Projeto em nome da mulher qualificou**	
	Fortalecer estratégias (%)	**Continuar (%)**	**Relações de gênero (%)**	**Execução (%)**
Baixa	3,1	4,5	6,0	1,5
Regular	14,1	19,7	3,0	9,1
Alta	82,8	75,8	90,9	89,4

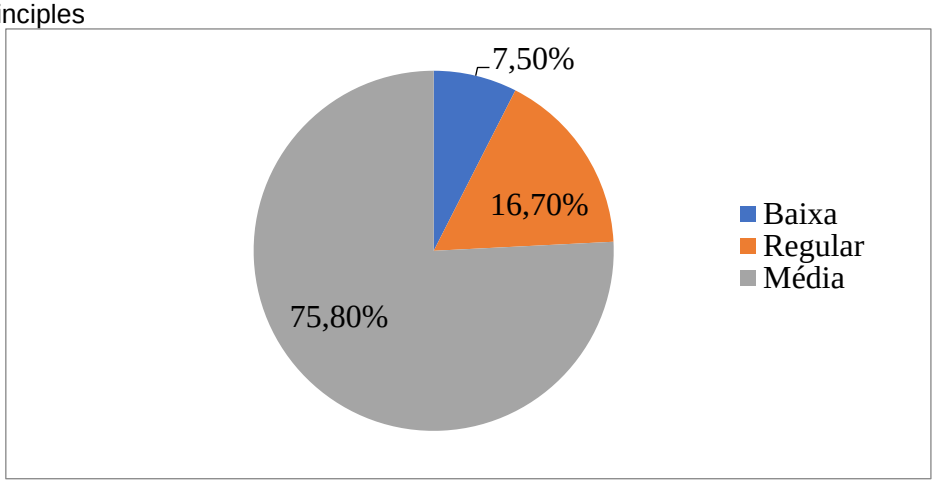
Source: From the author (2017).

However, given the purpose and limits of the present study, the effective politicization of individuals and groups in terms of citizenship proposed by Souza (2009), "who can overcome the precarious habitus", will be taken only through this indirect reading and, therefore, partial at some risk of overestimating advances at this level, highlighting that such reach has the potential to generate over time, effective and deeper changes in socially constructed reality.

Regarding the importance of the elaboration of the project and the release of resources having been carried out mostly in the name of the woman, holder of the BF, the data in *Table 3* indicate that for 90.9% of the respondents there is a high perception that this guideline strengthens women in gender relations in the rural environment[6], while for 89.4%, Such referral qualified the execution of the productive project. This reading of the female empowerment in the gender relationship established within the UPF with the purpose of enabling the implementation of the productive project and in the community through participation in events and management of the resources received is in accordance with what Rego and Pinsani (2013) identified when analyzing the impacts of a decade of income transfer programs that have women as their centrality; that is, that there was a reduction in women's submission, an increase in autonomy and more freedom and independence linked to the possibilities of choice, given by the management of financial resources.

When asked at what level the profiles of the projects elaborated indicate the incorporation of the principles of agroecology, understood as a science that guides the adoption of ecologically-based practices, 75.8% of the respondents considered this perception to be high, as observed in *Graph 1*. This finding dialogues with initial data from the diagnosis elaborated, in which the main autonomy strategies adopted by families in situations of extreme rural poverty in Caxias/MA are presented, in terms of maintaining the biodiversity of plant and animal species under their domain.

Graph 1 - Perception of the local executing team about the profile of the productive projects when considering agroecology principles



Source: From the author (2017).

[6] This genre is understood here in the perspective proposed by authors such as Louro (1997) and Braga (2007). For these authors, biological difference is only the starting point for the social construction of what it is to be a man or a woman. Sex is attributed to the biological as a gender is a social and historical construction. The notion of gender points to the dimension of the social relations of the feminine and the masculine. Gender is the first field within which, or through which, power is articulated, so differences are socially constructed and are involved with power relations.

In general terms, an optimistic reading of the results of the PATER is perceived, given by the professionals involved in its execution. This dedication associated with daily monitoring allowed these professionals to perceive advances that will not necessarily be the same as those perceived by the families involved. Such perceptions inform us that the motivation of the professionals involved was increasing, that there was also a great deal of institutional learning about the phenomenon of poverty given the strategy of targeting this public policy. The data indicate that the axis of this inclusion route that advanced the most was food security, with significant achievements in terms of income generation for more than half of the families involved and that most of the productive projects developed strengthened their survival strategies with a high capacity for continuity and sustainability. In addition, the citizenship of the families involved was stimulated and, by prioritizing the ownership of the projects, it strengthened women in gender relations in the rural environment.

PERCEPTION OF THE PATER GIVEN BY THE EVALUATION OF THE EXECUTING ENTITY

From the point of view of the evaluation carried out at the end of PATER, it is relevant to highlight the contributions offered through the participation of support professionals from the four administrative offices and the 17 municipalities present at the seminar held on December 2 and 3, 2015 in Caxias/MA. Such contributions, which took place in an institutional environment of favorable support, pointed to difficulties and learning that occurred during two and a half years of execution. Both the executing entity and its professionals at this time were at a new level, of greater complexity, which imposed the need to value the trajectory built with the families involved, in the perspective of contributing to the continuity and qualification of the public policy itself.

In this context, it is considered appropriate to present the learning recorded in this event from two tables. Taking into account the descriptive nature of this evaluation, it was limited to the synthesis of only ten lines per table, which in a way minimizes the richness of the work developed. This excerpt was elaborated from the set of slides presented by the technicians of the four administrative-operational offices of the executing entity, which were made available.

Chart 1 - Main operational difficulties identified by the municipal team in the execution of the PATER of Caxias/MA

Operational difficulty identified by municipal teams
Initial resistance from local managers.
Social isolation – difficulty in accessing properties.

Initial fear of families in losing BF.
Lack of initial motivation from families.
Lack of experience in developing similar projects.
Bureaucracy – slowness of the SIG@LIVRE and SIATER systems and excessive collection of signatures from families.
Lack of documentation of land ownership.
Properties with very small areas or unfavorable to the development of productive projects.
Payment of the resources of the production project on behalf of the holder of the DAP.
Excessive number of families per municipality with many activities to be developed/ATER

Source: Adapted from GRAPAS (2015, p. 40).

In this sense, *Chart 1* presents the main difficulties, indicating limits that result from the normativity of the policy itself, such as the excessive bureaucracy and control systems used that impact the operational routine of ATER, absorbing precious time of these professionals[7]. This issue was associated with a tight operational schedule that operated two programs simultaneously, with a number of families considered high for the reality of some municipalities which, associated with the geographical dispersion of these families, generated in many places an environment of work overload, especially where the team was small. This reality must be considered from a perspective of qualification and expansion of this partnership proposed by PBSM.

This set of difficulties, which were narrated with appropriation by those who experienced the execution of PATER, is not always adequately understood by those who are outside this level of involvement. Thus, quickly, based on the understanding extracted during the debate, reference is made to some notes, starting with the resistance of local managers, perceived at the beginning of the execution of the activities, resulting from the lack of knowledge of the Program and its purpose, which generated some discomfort with a potential shadowing of responsibilities of the structures responsible for mediating public policies aimed at this public. According to GRAPAS (2015) this issue was understood and overcome as the work progressed, given the understanding that the ATER action proposed in an innovative way by this articulation of two ministries proved to be increasingly correct and necessary in the perspective of socio-productive inclusion proposed by the Program.

The fear of losing the BF, given the intentionality of the development of productive projects with the objective of qualifying food production and income generation, also identified by other researchers who evaluated public income transfer policies, is easily understood, especially in those situations of high social vulnerability in which such resources are often the only source of family resources.

[7] Data obtained from the report and the presentation of the final evaluation seminar, held on December 2 and 3, 2015, in Caxias/MA.

The heavy bureaucracy of the Program can also be easily understood when one realizes the existence of two computerized control systems that do not dialogue with each other and that require a high workload of professional time for double posting of data. The reference to excessive collection of signatures says more than the time needed to collect it in all actions performed for posting in the system. It also concerns a fragile initial relationship, an action that in many cases seemed to humiliate those who were illiterate or had precarious literacy, and the expansion of the set of activities provided for in PATER.

The last difficulty encountered, which seems to require some additional clarification, refers to those cases in which the entire articulation of the productive project was developed based on the mediation of the woman and the resource came out in the name of the husband or partner due to the control exercised by the MDS, which cross-referenced the couple's data with the Pronaf Declaration of Aptitude (DAP). This situation, which generated significant wear and tear, resulted from notes of some documentary non-conformity of the owners of the production unit, "but which was gradually adjusted following the release of the portions of the production project, leaving this sequel referred to that deserves adjustment in an expansion of PATER" (Interview with the Coordinator, 2017).

Chart 2 - Main lessons learned by the municipal team in the execution of PATER in Caxias/MA

Learning pointed out by the municipal teams
Knowledge of the challenging reality of this "new" Ater audience
Construction of a new perception of rural poverty and its structural causes
Adaptation of technical knowledge to the reality and expectations of families
It improved the integration between extension workers and knowledge about social protection rights and policies.
Intersectoriality and social integration – articulation between various local sectors (health, education, social assistance)
Prejudices were resolved – the public surprised us and many local managers.
Focusing the policy on the titular name BF stimulated the protagonism of women and young people
In the socialization of families – the right to speak, to be heard, to know experiences.
Improvements were made in production, food security and income with very little resources
Recognition and appreciation of ATER's work by families hitherto invisible

Source: Adapted from GRAPAS (2015, p. 41).

In turn, *Chart 2* presents the descriptive synthesis of the learning collected by the professionals and the executing entity[8]. In this narrative, the trajectory of the professionals associated with the development of PATER can be perceived, ranging from little initial knowledge of reality, qualification to understand it, interaction with families and local entities to build possible answers, recognition of the policy itself for the advances achieved and of the professionals of Ater for the families involved. Such a synthesis, not without reason,

[8] Data obtained from the report and the presentation of the final evaluation seminar, held on December 2 and 3, 2015, in Caxias/MA.

reaffirms in many aspects the perception of the professionals presented in the previous sub-item of this chapter regarding the knowledge of reality, adaptation of social technologies, integration between members of the multidisciplinary team, overcoming prejudices, focusing the project on behalf of the BF holder, expansion of citizenship through the visibility and socialization of families and, Scope of the program in terms of production, qualification of food security and income.

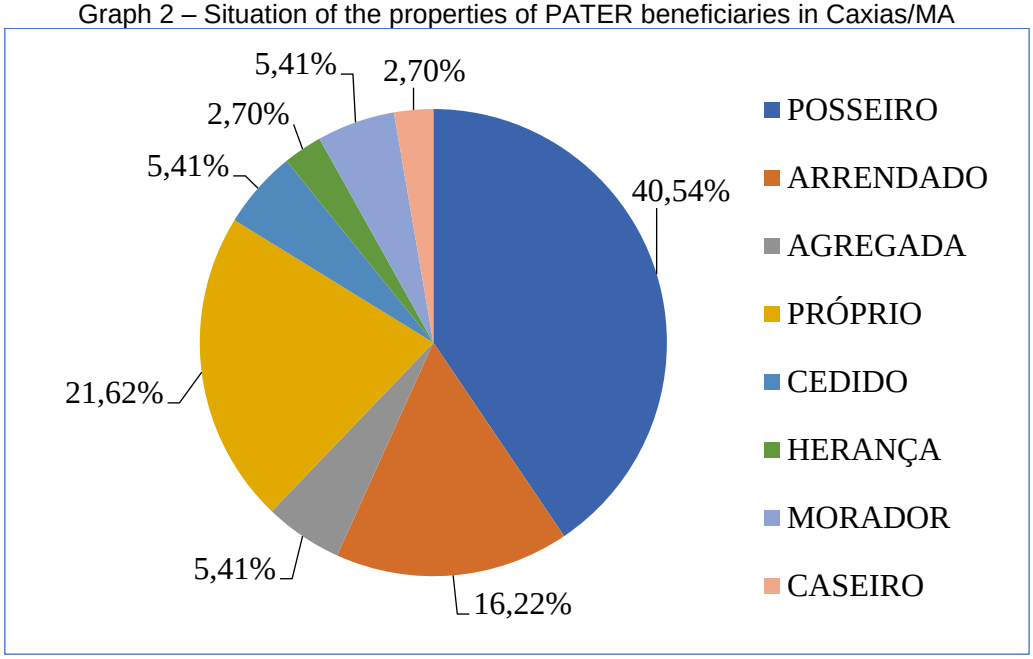
Still as a significant element that can be obtained from this summary table, two aspects should be highlighted. The first refers to the training process structured from the initial training developed by the MDA/MDS, which provided key elements for understanding the phenomenon of poverty. The second refers to the qualification of ATER's relations and the integrated action with the different sectors of the municipality, deepening the understanding of other social policies and developing network action. This movement, stimulated by the operational need to carry out PATER's actions, indicated a new level for ATER that is now understood in its planned and continued work, as a strategic participant in the network that operates local social policy, associating protective action with actions to promote opportunities in rural areas, with a view to overcoming poverty in its multiple dimensions.

PERCEPTION OF FAMILIES BENEFITING FROM PATER

To assess to what extent the improvements identified through the narrative and evaluation conducted by the executors meant an effective movement to overcome the condition of extreme rural poverty, the sequence of this research is organized, seeking, from a case study, to listen directly to the voice of the social subjects who actively participated in PATER. Next, the data collected from the sample of 39 families of interviewees are presented, as well as their analysis, comparing with the theoretical contribution considered.

Regarding the families' perception of the impact of PATER, the primary data (from the field research) made available by GRAPAS (2015) were analyzed, considering a sample of 39 families interviewed, comparing them with the debate pertinent to the object of this research. Preliminarily, it is important to highlight that, of the total number of interviewees, 50.94% are men and 49.06% women; 3.70% are white, 5.19% are black, and 91.11% are brown or mulatto; 91.31% of the interviewees did not finish high school and 25.36% did not complete primary school; 10.14% are illiterate, 7.97% say they have completed high school and only 0.72% have incomplete higher education. Furthermore, as the data in *Graph 2* illustrate, 75.65% of the family farmers assisted by PATER do not own the land, 40.54% are in the condition of squatters and 5% in the situation of ceded properties.

Graph 2 – Situation of the properties of PATER beneficiaries in Caxias/MA

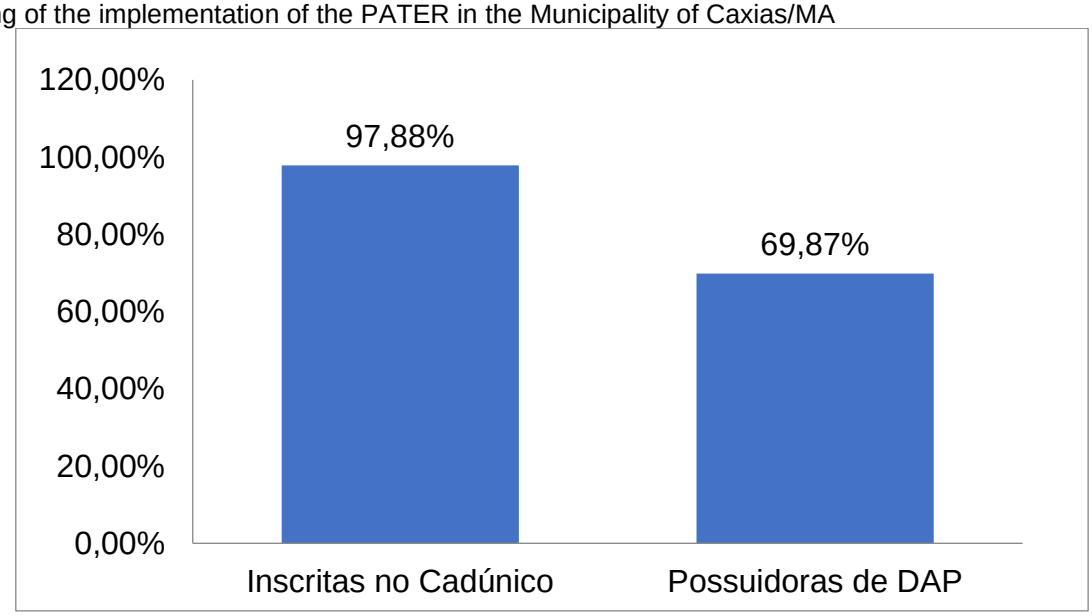


Source: **prepared by the authors based on data from the GRAPAS field research** (2015).

One of the first significant data identified from SIATER refers to the initial condition of families regarding enrollment in CadÙnico and the condition of having the Declaration of Aptitude for Pronaf (DAP). As can be seen in *Graph 3*, 97.88% of the families were enrolled in CadÚnico and 69.87% had DAP. As the prerequisites for access to PATER were to have *a per capita family income* of less than seventy reais, to be accredited in CadÙnico and to prove their condition as family farmers given by the possession of DAP, families with greater vulnerability in rural areas would not have been included in the Program, were it not for the active search strategy that brought 300 new families to CadÙnico and to the Program. This process, in addition to including families that were really on the margins of the community itself, also indicated the need for updating and registration qualification. From this

perspective, the indication of the need to qualify social control over the database for access to income transfer policies can be considered as an indirect legacy of PATER.

Graph 3 - Conditions of families regarding enrollment in the CadÙnico and possession of DAP at the beginning of the implementation of the PATER in the Municipality of Caxias/MA



Source: **prepared by the authors based on data from the GRAPAS field research** (2015).

The second issue highlighted in the evaluation conducted refers to the participation of family members in the productive projects elaborated, which shows that the dynamic involvement of the UPF was sought. Table *4* shows that the projects were prepared in the name of which members of the UPFs, showing once again that the strategy of prioritizing the release of resources in the name of the head of the BF, who is usually the woman, allowed her to have a hegemonic participation in the projects. As can be seen, 48.72% were prepared in the name of the family, 17.95% in the name of the woman, 7.69% in the name of the couple and 7.69% in the name of the woman and children, and only 17.95% of the productive projects were prepared in the name of the man and children.

Table 4 - Identification of family members in whose name the PATER production project was prepared

Membros da família	Participantes do projeto	
	(Nº)	(%)
Homem + Mulher + Filho(a)s	19	48,72
Mulher	7	17,95
Homem + Mulher	3	7,69
Mulher + Filho(a)s	3	7,69
Homem	6	15,38
Homem + Filho(a)s	1	2,56
Total	**39**	**100,00**

Source: **prepared by the authors based on data from the GRAPAS field research** (2015).

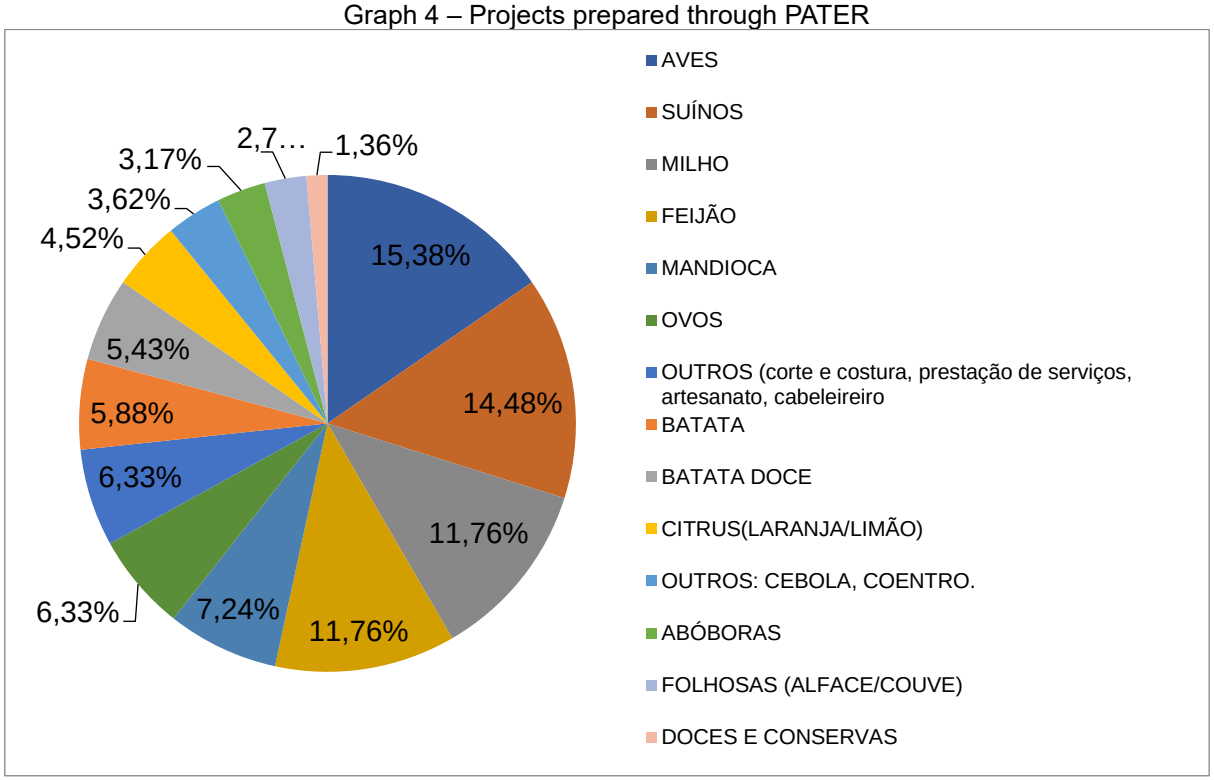
This finding is in line with the perception manifested by the executing professionals that the orientation of the program strengthens women in gender relations in the rural environment, where the patriarchal culture imposes imbalances recognized by sociology. In these terms, Favero (2011) considers that income transfer policies alter the trajectory of family members, in terms of infrastructure and the very way of organizing the house and the life of family farmers. It highlights the fact that this policy highlights the protagonism of women, making them more participative, through the expansion of their network of relationships that give them greater visibility in the public and private spheres.

It must be considered that there was also the release of resources from productive projects for a significant number of men, in the condition of widowers, singles, custodians of children who, in this condition, were holders of the BF. In some circumstances, due to the lack of an identity card, an individual certificate or joint ownership of the wife or partner in the DAP, the MDS security and data crossing system also released resources from the productive projects in the name of the man. In the latter case, the greatest difficulties and noise occurred, given the initial signal that the resources of the productive projects would be released in the name of the woman. This situation of frustration of expectation, whenever legally possible before the control body, was corrected by the MDS when the second installment of the production project was released.

The diversity of the projects prepared is great, and in many cases, even considering the restriction of the value, they are composed of two and even three activities per UPF. In *Graph 4*, which presents the profile of the productive projects developed with the families of Caxias/MA, it is possible to perceive this diversity that reaches 14 different agricultural and non-agricultural activities in this region alone, with emphasis on poultry, pig farming, corn and beans that represent more than 53.38% of the set of projects. These data reinforce the perception that the mastery of processes of multiplication of plant species and the

reproduction of small animals are common strategies of resistance of these families, whether as a source of food or income generation from the commercialization of small surpluses. Here we reaffirm again the perception that the mastery of processes of multiplication of plant species and the reproduction of small animals are common strategies of resistance of these families, whether as a source of food or income generation from the commercialization of small surpluses.

Graph 4 – Projects prepared through PATER



Source: **prepared by the authors based on data from the GRAPAS field research** (2015).

The reflection carried out by Wagner (2010, p. 88) helps to understand the complex and dynamic relationship of families with the surrounding environment that results from the interactions/interventions between man and nature. For this author, "the types of agriculture that are established, as well as the productive systems that are implemented, take on different forms in time and space and are the result of their own history". Thus, to know the objectives established by these families, it is necessary to know, to establish relationships with the past.

> The possibilities, as well as the restrictions and challenges of the cultivation and breeding systems developed in a given region, are not only related to physical and climatic conditions, but mainly to the logic of reproduction implemented by the family nucleus. The understanding of the family as the center of organization of the productive system acquires significant importance to the extent that the relations between the agrarian dynamics and the process of local and regional development are strengthened. Therefore, production and the consequent generation of income are associated with cultural characteristics of a certain group and the environmental conditions of the space where it lives, works and reproduces. Realizing that the

> culture and history of social groups are related to an appreciation of local and traditional knowledge is essential for understanding the form of organization of the productive system implemented (WAGNER, 2010, P. 88-89).

Regarding the question about how many families started to develop some non-agricultural activity, from the involvement with PATER, a relative number answered affirmatively. As the data in Graph 4 illustrate, non-agricultural activities with potential for income generation, such as cutting and sewing, provision of services, handicrafts, hairdressing and agroindustry, represent 7.24% of the projects prepared.

This dimension is in line with the warning made by Schneider (2003), that rural pluriactivity needs, in order to express itself, a dynamic environment that allows the combination of agricultural and non-agricultural activities, and that in environments without this potentiality, the expressions of non-agricultural activities will be insignificant. By dynamic environment we mean expressive economic centers, with enterprises that guarantee a regular supply of work spaces, which allows in their surroundings to constitute a corollary of direct and complementary activities and services, exactly the condition absent in most small rural municipalities. What Silva (2010) called the hard core of extreme poverty, particularly referring to the grotesques of northeastern Brazil.

Gazolla and Schneider (2007) consider that production for self-consumption allows families to acquire greater autonomy in the face of the surrounding socioeconomic context, reducing dependence on products that suffer price fluctuations, thus ensuring, through the production obtained by the farmer himself and his family, the main dimensions of food security [9]. It is in this context that, as illustrated by the data in *Table 5*, of the 39 families that make up the sample cut of this evaluation, 27, that is, 69.23%, declared that they produced food for domestic consumption and 12, that is, 30.77%, carried out some type of commercialization. Such information reflects the limits and potentialities faced by the productive projects developed, often restricted to the possibilities of the surrounding market, the scarcity of land area and available labor and the mobility of families that, in their dynamics, often seek corporate relations of access to land and more satisfactory production at the end of the harvests.

[9]According to Article 3 of the Organic Law on Food and Nutrition Security (LOSAN), Food and Nutrition Security (FNS) comprises the realization of everyone's right to regular and permanent access to quality food, in sufficient quantity, without compromising access to other essential needs, based on health-promoting food practices that respect cultural diversity and are environmental, culturally, economically and socially sustainable (BRASIL, 2006, p.1).

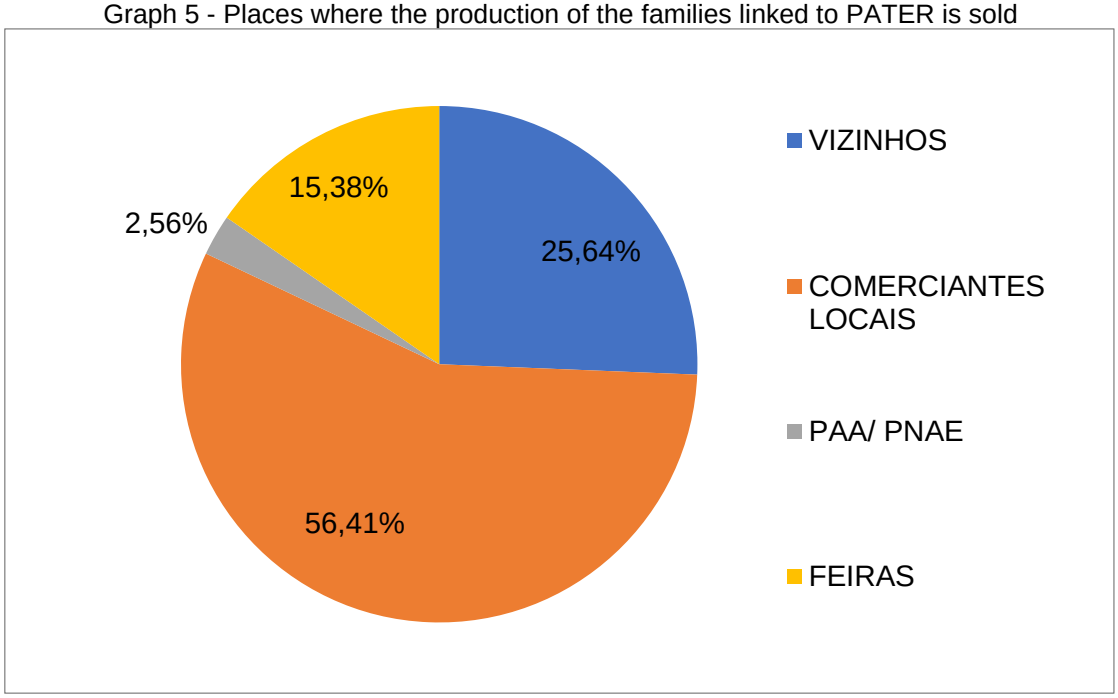
Table 5 – Destination of the production of PATER beneficiaries

Destino da produção	Participantes do projeto			
	(Nº)		(%)	
Consumo doméstico	27		69,23	
Comercialização	12		30,77	
Total	**39**		**100,00**	

Source: prepared by the authors based on data from the GRAPAS field research (2015).

The data in *Graph 5* identify the places where the production of the families linked to the PATER is sold. The main marketing channel for 56.41% of the families is local traders, followed by neighbors, where 25.64% of the families report selling parts of their production. Sales at fairs were carried out by 15.38% of the families and for PAA or PNAE, by 2.56% of the families in the sample. More than a quarter of these families declared that they trade with more than one source. This statistic highlights the difficulties of organization and articulation of logistics of these families who, as a rule, are located at the tip of the communities farthest from the municipalities; the need to strengthen associative and cooperative networks and to connect with access to institutional markets.

Graph 5 - Places where the production of the families linked to PATER is sold



Source: prepared by the authors based on data from the GRAPAS field research (2015).

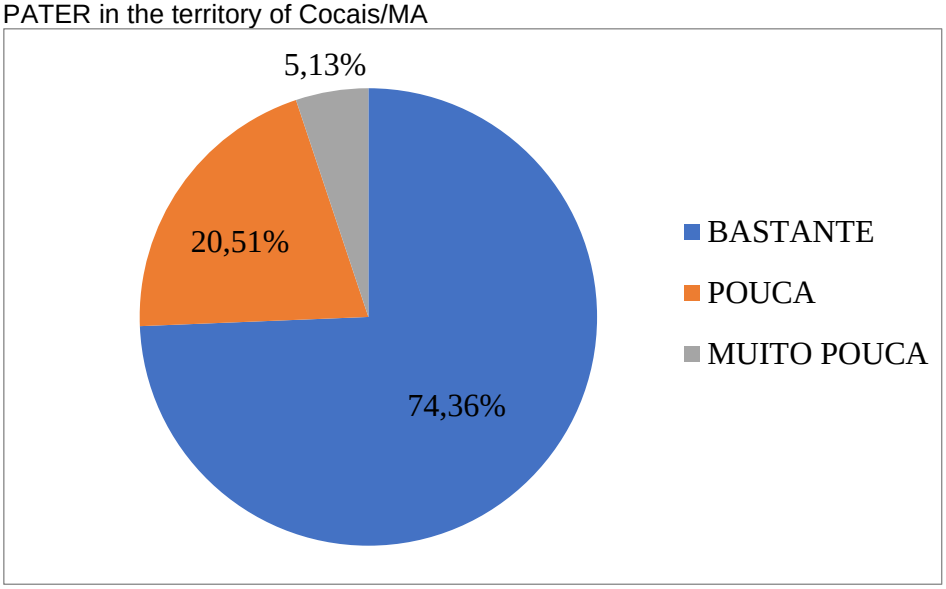
Another relevant aspect of PATER concerns the performance of ATER professionals, in the face of the reality of social vulnerability encountered. For Schröder and Camboim (2015), it has advanced beyond the productive aspects, assuming mediation roles with a view to including these families in other social policies, establishing strategic partnerships

with local agents beyond those that make up the 'productive universe'. The authors highlight that this perceived dimension was greater when associated with the composition of multidisciplinary teams and work methodologies not centered exclusively on productivist approaches.

> The performance of rural extension tended to feed a generalized process of information circulation and consequently to broaden the horizon of possibilities for the family, which, recurrently, was unaware of the existence of various government actions from which they could benefit to overcome their condition of poverty. (SCHRÖDER; CAMBOIM, 2015, p. 13).

In this sense, the data in *Graph 6* illustrate the dimension of improvements that occurred in the quality of life of PATER participants. As can be seen, 74.36% of the families indicated that the improvements were quite a lot; 20.51% that were few and 5.13% that were very few.

Graph 6 – Dimension of the improvements that occurred according to the indication of the families participating in PATER in the territory of Cocais/MA



Source: From the author (2017).

Interpreting the reading that families make of their reality is not an easy task. Are the percentages achieved significant, are they many or are they few for the operational cut considered to be two and a half years? The realism of families that are in a situation of greater vulnerability often does not allow an analytical cut of the specific actions developed by a given program, in view of the greater dimension of needs experienced. Bearing this consideration in mind, the answer to the question about the improvements that occurred in the quality of life of the PATER participants can be considered very significant, high for the time frame considered, since more than two thirds of the families considered the improvements that occurred in the period as "quite a lot".

Following the previous question, the families indicated in which areas the perceived improvements occurred. The data in *Table 6* show that for 87.17% of the families there were improvements in food, for 74.35% there was an improvement in income, for 33.33% in health and for 28.20% in education. For 15.38% there would also have been a noticeable improvement in family relationships and for 28.20% in relationships with other people. It is inferred that the improvement in health identified is related to the set of training events and exchange of experiences, promoted by the entity with the municipal government, resulting from the appropriation and adoption by these families of fundamentals of nutrition, prevention and basic sanitation. Regarding the improvement in educational performance, it is important to realize that these families had already been complying with the attendance conditionalities established for school-age children and young people. Possibly, PATER encouraged these families to pay greater attention to this requirement, which would explain this improvement in more than a quarter of the families.

Table 6 - Improvements and expansion of the participation indicated by the families throughout the PATER, compared to two and a half years ago

Melhorias	Nº UPF	% UPF	Participação	NºUPF	% UPF
Na alimentação	34	87,17	Grupo	7	17,94
Na renda	29	74,35	Associação	2	5,12
Na saúde	13	33,33	Sindicato	11	28,20
Na educação	11	28,20	Comunidade	4	10,25
No relacionamento com outras pessoas	11	28,20	Igreja	4	10,25
No relacionamento familiar	6	15,38			

Source: From the author (2017).

When questioned about the participation of any family member in organizations, compared to two and a half years before, a significant increase in participation in groups was indicated (17.94%), and 20.50% of the families interviewed indicated an increase in the participation of the community and the church. The data in *Table 6* also show that 28.20% indicated an increase in participation in union structures. The movement of expansion of participation verified in this period reaffirms in a certain way the strength and limits of these structures indicated in the initial diagnosis carried out with these families, explaining the low presence in representation and cooperative structures, possibly due to the monthly/annual cost of access.

Helfand and Pereira (2012), when working on the determinants of rural poverty and its implications for public policies in Brazil, highlight transaction costs and market participation as one of the obstacles to the success of small producers, considering that

these costs tend to be higher due to the size of their operations, their geographical dispersion and the limited availability of guarantees, among others, when compared to larger establishments. They indicate that such costs increase the "probability of observing low-productivity subsistence agriculture" and that collective action, whether through cooperatives, associations or local organizations, constitute strategies to achieve greater scale, reduce costs, and increase bargaining power.

The evaluation of the degree of satisfaction of the families in participating in the project indicated that 53.85% declared themselves very satisfied, 43.59% declared themselves satisfied and 2.56% declared themselves somewhat satisfied, as can be seen in *Table 7*. Similar answers were given by families about their self-confidence, where 56.41% indicated that it increased a lot, 41.03% that it increased a little and 2.56% that remained the same.

Table 7 - Degree of satisfaction in participating in PATER and level of self-confidence of the families at the end of the execution

Grau de satisfação	Nº UPF	% UPF	Nível de autoconfiança	NºUPF	% UPF
Muito satisfeita	21	53,85	Aumentou bastante	22	56,41
Satisfeita	17	43,59	Aumentou um pouco	16	41,03
Pouco satisfeita	1	2,56	Ficou igual	1	2,56
Nada satisfeita	0	0	Diminuiu	0	0
Total	**39**	**100**	**Total**	**39**	**100**

Source: From the author (2017).

When considering the data in *Table 6*, which indicate that there was an increase in sociability through the improvement of the internal relationship of 15.38% of the families and in the relationship with other people for 28.20% of the families, in addition to improvements in income and food security, with the satisfaction data presented in *Table 7*, in which the aggregate data indicate that 97.44% of the families are satisfied, the dimension of the work developed over only two and a half years is perceived. Based on these indicators, it can be perfectly concluded that this Public Policy has produced concrete results in the material, social and cultural conditions of these families, focusing on the perspective of citizenship, a task that is considered difficult, as it comes up against the perverse legacy of persistent and naturalized poverty, in an unequal society. These indicators of expansion of autonomy and protagonism signal the importance of this journey, of the deepening of the organization and resistance practices of these families in the search for the advancement of public policies that approach, resolutely, the structural causes that generate social exclusion.

FINAL CONSIDERATIONS

PATER has had a significant impact on food security, with notable improvements in household feeding. More than half of the families involved reported an increase in income, mainly through the production of small animals, corn, and beans. About 31% of families sell part of their production, strengthening economic and social ties in the community. Most of the productive projects developed demonstrated a high capacity for continuity and sustainability.

Ownership of productive projects has often been attributed to women, strengthening their position in gender relations and increasing their participation in social networks. The citizenship of families was expanded, with 97.44% expressing satisfaction with the program. Most families indicated improvements in health, family and social relationships, and overall quality of life.

Despite the advances, integration with other municipal public policies was limited, indicating the need for greater engagement of local government. The lack of continuity of the program after the first phase represents a challenge, with the risk of reversing the gains obtained. The absence of new public calls since the 2016 coup d'état compromises the maintenance of ATER services.

The continuity of PATER is crucial to sustain the progress achieved. The lack of funding and new public calls affects the ability of extension workers to continue serving families, many of whom may return to a condition of vulnerability. Integration with land regularization, agrarian reform, land credit, and PRONAF B policies, as well as with ministries of health, housing, education, and agriculture, is essential to promote the sustainability of projects.

It is necessary to expand social participation, involving the community in the management and control of policies. Actions that encourage municipal public authorities to assume a more purposeful engagement in the search for strategies to overcome local blockades are essential.

Encouraging more proactive municipal actions to overcome local lockdowns and facilitate policy integration is crucial. Inter-institutional articulation, connecting PATER with other government initiatives, is fundamental for the continued success of the program.

The Brazilian social, political and economic conjuncture, marked by neoliberal retractions and influences, represents a challenge for the continuity of policies to combat poverty. Poverty management is often welfare-based, and the lack of economic dynamism limits the applicability of standard solutions. The dependence on the actions of the other

spheres of government is evident, and the fiscal crisis of the regional municipalities limits local action.

PATER has demonstrated effectiveness in reducing extreme rural poverty in Caxias/MA, improving food security, generating income and expanding citizenship. However, the continuity and deepening of the program are essential to sustain the advances achieved. Integration with municipal policies and the expansion of social participation are crucial to the continued success of PATER. The research suggests the importance of understanding the causes of the mutual distance between families and social movements in the countryside, as well as the perspective of young people who live in this reality in the face of the perceived limits to their strategy of social reproduction.

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NETWORKED DEMOCRACY: THE ROLE OF ALGORITHMS IN FREEDOM OF EXPRESSION AND POLITICAL PLURALISM

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ABSTRACT

In recent decades, social media algorithms have redefined the digital environment, profoundly influencing freedom of expression and political pluralism. In light of this, this research investigates how these algorithms, by segmenting content according to user behavior, promote the creation of "echo chambers" and "digital bubbles" that reinforce polarization and limit access to divergent perspectives. The methodology adopted was the bibliographic and documentary review, with analysis of academic and legal sources on the impact of algorithms and computational propaganda on the formation of public opinion. The results indicate that, by prioritizing engagement over informational diversity, algorithms favor polarized environments, hindering democratic dialogue and encouraging the dissemination of extremist content. It is concluded that public policies and regulations that promote the transparency of algorithms and encourage informational diversity are essential to preserve the integrity of the digital public sphere.

Keywords: Freedom of Expression. Political Pluralism. Algorithms. Democracy. Social Networks.

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INTRODUCTION

In recent decades, the rapid evolution of digital technologies and the proliferation of social networks have transformed the way information is consumed, shared, and influenced on a global scale. Platforms such as Facebook, Twitter, and Instagram have emerged as new public spaces, playing a central role in reconfiguring the democratic environment by offering a direct, instantaneous, and accessible channel for the expression of ideas and opinions (Silva, 2021). These spaces, which were previously occupied by traditional media, have come to have a direct influence on political and social dynamics, creating a digital public sphere where any individual with access to the internet can participate in public discussions and debate relevant issues.

However, the apparent democratic character of social networks hides complex algorithmic mechanisms that personalize the content displayed to each user, shaping and limiting the information that each individual sees. This personalization, determined by users' preferences and interaction history, generates what Eli Pariser (2012) defines as "digital bubbles" or "filter bubbles," which isolate people in "echo chambers" where only views similar to their own are reiterated. This phenomenon limits contact with divergent perspectives and restricts exposure to a plurality of information, enhancing the creation of politically polarized environments.

The question of how these algorithms impact freedom of expression and political pluralism has become a central topic of academic and social debate, as the logic of maximizing engagement favors content that reinforces users' previous beliefs and values, making it more difficult to access information that may challenge their worldviews (Farias, 2021). In a context where algorithmic logic prioritizes engagement over informational diversity, digital platforms become facilitators of the dissemination of extremist discourse and disinformation, since these contents usually generate intense emotional responses, attracting more interactions and, consequently, more time users stay on the platforms.

The impact of this scenario on the informational autonomy of individuals is substantial, because, as Sunstein (2017) points out, the formation of digital bubbles and echo chambers impairs the ability of citizens to access a diverse range of opinions, which is fundamental for a healthy democracy. Thus, these platforms, by promoting a segmentation of content based on algorithms, end up limiting the informational pluralism necessary for public debate, restricting the full exercise of freedom of expression and favoring an environment prone to ideological polarization.

In addition, these algorithms raise important questions about the responsibility of digital platforms. Algorithmic moderation and the creation of custom filters often end up

promoting a form of "private censorship", where technology companies have the power to influence what information is amplified or suppressed (Doneda, 2021). This control can subtly and indirectly shape public discourse, challenging the ideal of the internet as a free and open space.

In view of this, the question-problem that guides this study is: How do social media algorithms influence freedom of expression and political pluralism by creating digital bubbles and echo chambers that reinforce polarization? In addition, it seeks to understand how computational propaganda and the use of bots can manipulate public opinion, distorting the democratic process.

In addition, this study aims to analyze the impact of social media algorithms on freedom of expression and political pluralism, investigating the mechanisms by which these algorithms contribute to the creation of digital bubbles and echo chambers, as well as examining the role of computational propaganda in the manipulation of public opinion. It also seeks to assess the limitations of current regulations and propose possible approaches for a more plural and democratic digital environment.

METHODOLOGY

The methodology used in the study was a bibliographic and documentary review. This approach involved the analysis of academic literature and legal sources with the aim of understanding the impact of algorithms on the political behavior of social media users, as well as the effects of "echo chambers" and "digital bubbles" on the formation of public opinion.

Relevant databases, such as Scopus, Web of Science, and Google Scholar, were accessed to identify scientific articles, books, and other publications related to the topic. The focus has been on studies that discuss the role of algorithms, computational propaganda, and digital polarization. Additionally, the documentary review included sources that analyze current regulations and digital governance practices, allowing a critical perspective on the limitations of existing regulations and the proposition of solutions for a more democratic and plural digital environment. This methodological approach ensured a comprehensive and reasoned vision to explore the complex relationships between freedom of expression, political pluralism and algorithms on digital platforms.

RESULTS AND DISCUSSIONS

FREEDOM OF EXPRESSION IN THE AGE OF DIGITAL PLATFORMS

The technological advances achieved in recent decades have opened up numerous new perspectives and opportunities (Benkler, 2018). According to Schwab (2021), founder of the World Economic Forum, society is about to experience a Fourth Industrial Revolution, driven by a technological transformation that will radically change the way we live, work, and relate. The Third Industrial Revolution, which began in the mid-twentieth century and continues to this day, was characterized by the development of the electronics industry, large computers, and the transition from analog to digital technology.

In the Fourth Industrial Revolution, the integration of digital technologies into various aspects of daily life is expected to blur the boundaries between the physical, digital, and biological worlds. This revolution differs from previous ones in terms of scale, scope, and complexity: (i) the exponential speed of new discoveries and advances is historically unprecedented; (ii) the technological revolution causes a disruptive impact on practically all industries and countries; and (iii) the depth and scope of these changes have the potential to completely transform production, management, and governance systems (Schwab, 2021).

Digital platforms and social networks represent this environment in constant and profound transformation in an exemplary way (Abboud, 2021). In the nineteenth century, the public space for discussions was established in cafes and squares, where people gathered to debate politics and culture. In the post-war period, this sphere shifted to journalistic organizations, which controlled newspapers, radio, and television channels. Participation in the public debate was conditioned to financial investments and the dispute for scarce means (such as television channels and radio frequencies), being restricted to a few actors with access to this structure (Doneda, 2021).

With the end of the twentieth century and the beginning of the twenty-first, the emergence of the internet fragmented this power. For Abboud (2021), society has moved from a model centered on prints and organizations to a decentralized format, supported by computer networks and digital platforms. With the internet, anyone has gained the possibility of producing and publishing their own or third-party content on a global scale, and relevant political, social, and cultural discussions have also (and perhaps even mainly) taken place in this environment.

Pro-democracy movements, such as the Arab Spring[3], have demonstrated the power of the internet to form a global democratic community and enable mobilizations on a global scale against authoritarian and illiberal governments (Pamplona, 2015). From 2016, however, after the events that negatively marked the American elections and the Brexit referendum in the United Kingdom, unrestricted optimism regarding digital platforms gave way to growing concerns about the protection of the democratic process and fundamental rights. Issues such as: (i) mass disinformation campaigns, often involving elected leaders, candidates, or even foreign governments; (ii) micro-targeting of electoral advertisements, with the potential to influence the results of elections; and (iii) anti-democratic attacks, dissemination of hate speech, and proliferation of illicit content (Silva, 2021).

In addition, it was found that the idea of decentralization of the virtual public space did not take into account the private power exercised by a few companies over the public debate, especially through content moderation based on private terms of use. This increase in private control over the circulation of information and opinions, including the possibility of banning accounts or removing posts by elected political agents, has largely challenged the view of the internet as a free and open space (Dutra, 2018). The application of private terms of use on a global scale contrasted with the territorial restrictions of national court decisions. Limited in their jurisdiction, judges and courts have begun to order the blocking and suspension of accounts and/or content worldwide, thus threatening the exercise of freedom of expression (Doneda, 2021).

In the context of the so-called Fake News Inquiry, conducted by the Federal Supreme Court, there are reports about the organization of digital militias that carry out coordinated attacks against opponents and critics of the Federal Government, in addition to disseminating disinformation. At the Federal Court of Auditors, the allocation of federal public funds to websites that promote fake news is investigated (Pires, 2020).

In the Superior Electoral Court, there was an investigation into the winning slate of the 2018 elections, which allegedly benefited from hiring companies to send mass messages through WhatsApp, aiming to attack opponents and promote certain candidates[4]. A report by the CPMI on Fake News identified more than 2 million ads paid for with public

[3] The Arab Spring was a series of popular protests and uprisings that began in 2010 and spread to several countries in the Middle East and North Africa, including Tunisia, Egypt, Libya, Syria and Yemen. Motivated by dissatisfaction with authoritarian regimes, corruption, lack of freedom, and socioeconomic inequalities, the movements sought greater democracy and social justice. The internet, especially social media, has played an important role in enabling activists to organize demonstrations, share information, and mobilize international support, highlighting the potential of digital platforms to drive social and political change on a global scale (Pamplona, 2015).

[4] Cf.: Understand why Facebook's action threatens Bolsonaro in the Judiciary. O Globo, 11 jul.2020. Available at: https://oglobo.globo.com/brasil/entenda-por-que-acao-do-facebookameaca-bolsonaro-no-judiciario-1-24527697. Accessed on 07 Nov. 2024.

funds on websites, apps and YouTube channels, broadcasting content considered inappropriate, including anti-democratic attacks and fake news[5].

At the same time, social networks and digital platforms impose limitations on the speech of their users based on their own terms and conditions, raising concerns about censorship by these technology companies, which operate for their own economic interests. The recent practice of removing publications and blocking or deleting accounts of public figures and elected officials has brought this topic to the center of public debate. For example, former President Jair Bolsonaro proposed a provisional measure, followed by a bill, that sought to prevent social networks from moderating content without a prior court decision, under the pretext of regulating the Civil Rights Framework for the Internet[6].

As noted, the cases multiply and raise essential questions about the exercise of freedom of expression and the strengthening of democracy in the Digital Age. On a daily basis, platforms such as Facebook, Twitter, and Instagram face the challenge of balancing this fundamental right with other important social values, such as combating illicit content, disinformation, hate speech, and attacks on democracy (Farias, 2021).

These platforms also deal with censorship orders imposed by national governments, while their algorithms seek to maximize users' time, aiming to increase ad profits. According to Ferrari (2018), this results in the amplification of harmful discourses. In this context, there are those who accuse platforms of failing to contain abusive speech and, at the same time, of removing excessive content, acting as arbiters of truth and promoting a form of private censorship (Lessa, 2021).

To face these challenges, big tech companies have been the target of several regulatory proposals and initiatives around the world. In Brazil, there is a growing issuance of court orders that require platforms to (i) reinstate user content removed based on their Terms of Use; or (ii) remove publications or block accounts — including globally — for disseminating fake news or promoting anti-democratic attacks, even without a clear definition of these concepts. This global backlash against tech companies is called techlash, a term that combines technology and backlash, and represents growing resistance to big tech companies and public support for policies that seek to limit their power and influence (Atkinson, et al, 2019).

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[5] Cf.: CPMI of Fake News identifies 2 million Secom ads in channels of 'inappropriate content' in just 38 days. O Globo, 02 Jun. 2020. Available at: https://blogs.oglobo.globo.com/sonar-a-escuta-das-redes/post/cpmi-das-fake-news- identify-2-million-ads-secom-em-canais-de-conteudo-inadequado-em-so-38-dias.html. Accessed on 07 Nov. 2024.

[6] Cf.: Bolsonaro edits MP that limits the removal of content from social networks. G1, 06 Sep. 2021. Available at: https://g1.globo.com/politica/noticia/2021/09/06/bolsonaro-edita-mp-quelimita-remocao-de-conteudos-nas-redes- sociais.ghtml. Accessed on 07 Nov. 2024

It is undeniable, therefore, that information technology is going through a delicate moment both in Brazil and in the world, in which it seeks to promote freedom of expression and protect democracy, without compromising legitimate business models or compromising the fundamental principles of the internet, such as openness, decentralization and global reach. To achieve this balance, it is necessary to clearly define the roles of both the state and digital platforms, in an arrangement that ensures the harmony of interests without granting excessive power to either party in the regulation of discourse (Przeworski, 2020).

The relevance and urgency of this debate have been highlighted in several democracies. An example of this is the vote of Justice Edson Fachin, in the context of the Fake News Inquiry[7], in which he highlighted that "the limits to freedom of expression are constantly being shaped and, I think, will still demand reflection from the Legislative and Judiciary Branches and, especially, from this Court, with regard to what is currently called 'fake news'". In the United States, in the judgment of Packingham v. North Carolina, the Supreme Court noted that social networks have become, for many, "the main source of access to current discussions, opportunities for employment, to speak and listen in the modern public space, and, more generally, to explore the fertile fields of knowledge and human thought[8]."

In a vote in the case of Joseph R. Biden, Jr., President of the United States v. Knight First Amendment Institute at Columbia University, Justice Clarence Thomas pointed out that "applying old doctrines to new digital platforms is rarely a trivial task." He recognized that while these digital platforms are a powerful medium for promoting speech on an unprecedented scale, they also exert equally unprecedented private control over it. Thomas warned that "soon, we will have no alternative but to confront how our legal doctrines apply to such highly concentrated and privately controlled information infrastructures as digital platforms."[9]

In Italy, in the case of CasaPound v. Facebook, the Court of Rome ruled that Facebook has an effective power of control over political participation. Thus, in addition to the contractual commitments provided for in the Terms of Use, the platform would be

[7] Available at: https://portal.stf.jus.br/noticias/verNoticiaDetalhe.asp?idConteudo=445278&ori=1. Accessed on Nov. 05. 2024.

[8] No original: “Social media allows users to gain access to information and communicate with one another on any subject that might come to mind. With one broad stroke, North Carolina bars access to what for many are the principal sources for knowing current events, checking ads for employment, speaking and listening in the modern public square, and otherwise exploring the vast realms of human thought and knowledge. (…) A fundamental principle of the First Amendment is that all persons have access to places where they can speak and listen, and then, after reflection, speak and listen once more”. (Packingham v. North Carolina, 582 U.S. (2017).

[9] No original: “We will soon have no choice but to address how our legal doctrines apply to highly concentrated, privately owned information infrastructure such as digital platforms” (Joseph R. Biden, Jr., President of the United States, et Al v. Knight First Amendment Institute at Columbia University, et al, 593 U.S. (2021).

subject to obligations arising from constitutional principles, representing a form of horizontal application of fundamental rights[10].

As noted, there is a global perception that the theory of freedom of expression traditionally defended by democracies is not sufficient to deal with the new challenges imposed by the digital revolution. In Brazil, the situation is similar. The Constitution guarantees the fundamental right to freedom of expression, prohibiting only anonymity, and adopts a clear approach to a posteriori reparation (such as the right of reply and compensation for moral and/or material damages), avoiding any form of prior censorship. However, while these provisions are relevant, they, together with the national jurisprudence developed to date, are not able to fully address the emerging challenges that freedom of expression faces in the digital environment.

A REFLECTION ON THE IMPACT OF THE ALGORITHMIZATION OF SOCIAL NETWORKS ON THE DEMOCRATIC PROCESS

According to Youyou (2015), algorithms that analyze likes on social networks can predict aspects such as substance consumption, political positions, and health status. Probably, the algorithm knows people's political leanings, categorizing them into far-left, left, center, right, or far-right. Its intelligence is developed through the analysis of data collected from users of the social network, such as likes, shares, messages and search history, among others.

When a user consumes certain content, likes or shares certain news, it becomes easy to build a political profile that goes beyond simple left or right classifications. This profile includes their views on a variety of topics, such as global warming, immigration, and equality. This information can then be used to display targeted content created by advertisers, campaign managers, and extremist political groups (Doneda, 2021).

In this sense, Pariser (2012) explains:

> The algorithms select what will be displayed to each user based on their personal profile. In this way, each user accesses a specific set of information that is aligned with their political positions. The information shown on social networks tends to reinforce the personal convictions of each individual. Thus, virtual environments similar to digital bubbles are created, which encourage the dissemination of false and hyperpartisan content to attract clicks. This process results in an increasingly politically segregated society, where consensus becomes unlikely due to growing distrust of political figures, the media, and citizens who stand on opposite sides of the political spectrum (Pariser, 2012, p.101-102).

[10] Cf.: Facebook v. CasaPound. Global Freedom of Expression – Columbia University. Available at: https://globalfreedomofexpression.columbia.edu/cases/casapound-v-facebook/. Accessed on 07 Nov. 2024

With this, the algorithm predicts which publications the user is likely to click on, using the personal data previously collected. Social networks, then, display content that users want to see, which, most of the time, is information that confirms their already formed opinions. This isolates users from divergent perspectives, separating them into digital bubbles that function as "echo chambers", where personalized content reinforces their convictions and different positions are absent (Silveira, 2010).

For Araújo (2015), a significant part of society seeks to see their beliefs confirmed, wishing to be right in their opinions. Social media algorithms facilitate this desire by offering content that reinforces users' convictions. When faced with information that they identify as "propaganda" from the "other side", users tend to disconnect, dissatisfied. To keep the attention of these users, social networks end up favoring confirmation bias. According to psychologist Plous (2013), this bias refers to the human tendency to prefer information that confirms and strengthens one's convictions and values.

On the other hand, studies indicate that another portion of the population shows interest in knowing perspectives different from their own (Baquero, 2018). Many people are open to considering ideas that don't align with their initial convictions and may change their minds based on new information. They recognize that they may be wrong and have a desire to find the truth. In addition, there are those who, although they prefer opinions compatible with their own, are willing to listen to ideas that challenge their views and reject the idea of living in an "echo chamber". Research published in the Yale Law & Economics Research Paper reveals that scientific curiosity acts as a counterweight to processing politically biased information (Kahan et al., 2016).

However, the ability of digital platforms' algorithms to analyze the data collected and then filter the content presented to each user based on their beliefs is constantly evolving. All users end up trapped in their digital bubbles, regardless of whether they want it or not. Thus, in the age of algorithms, an issue related to individual freedom also arises (Gurumurthy, 2018).

Freedom of choice presupposes the existence of multiple options and the ability to choose between them, which does not occur in social networks. For freedom to be genuine, it is necessary for society to have the possibility of expanding its horizons and accessing the truth of the facts. The most evident way to limit this autonomy is through censorship and authoritarianism (Pariser, 2011). However, when society is divided into communities of homogeneous thought, individual freedom is threatened, as people are confined to bubbles created by the filters of algorithms, which often go beyond the digital environment and impact the real world. For a democracy to be solid, it is essential to have

shared public spaces, both online and offline, that offer a diversity of ideas, rather than echo chambers (Sunstein, 2017).

Every human mind has filters that select which information will be the object of attention. Filtering is an inherent characteristic of the human being; No one is able to see, hear, and read everything. Each individual performs constant filtering to better direct their attention, either deliberately or unconsciously (Kozikoski, 2015). In leisure time, for example, people choose to focus on their families rather than on distant problems, such as the conflicts in the Middle East. When they are driving, they focus on the traffic and not on the cell phone. In this context, Wu (2012) alludes to:

> In a system that values individual freedom, people have the autonomy to filter out unwanted content. On a daily basis, they choose which information to access based on personal preferences. Those who like sports opt for ESPN; conservatives may prefer Gazeta do Povo, while progressives access Carta Capital. The greater the diversity of options, the greater the range of possible choices (Wu, 2012, p.14).

Through newspapers, magazines, and television channels, people have access to content that they would not otherwise choose in advance. Thus, they are exposed to information that they might not have selected if they had full control to include or exclude it, which does not occur on social networks, where the algorithm accurately anticipates their preferences. Information obtained in an unexpected way can arouse interest, influence behaviors or even transform opinions (Carvalho, 2011).

Digital bubbles and echo chambers confine users to "parallel realities," feeding them personalized content. A confusion arises, then, between the reality displayed on the platforms and the concrete truth. So when people from different bubbles meet, they ask, "Don't they see what's going on?" No, that is the central issue. Each one perceives a completely different version of reality within their own bubble (Ferrari, 2011). In this sense, it is important to highlight the criticism made by Castanho (2009):

> It is true that digital platforms represent an advance for today's society, connecting people, offering entertainment, information, and various other utilities. Few want to see ads for irrelevant products or information on topics that don't interest them. However, despite the wonders provided by social networks, society has been naïve about their negative effects: they raise serious questions about freedom, free will, and democracy (Castanho, 2009, p. 135).

According to Castanho (2009), for democracy and freedom of expression to function fully, more than just restrictions on government censorship and respect for individual choices are necessary. While these are the primary legal and political concerns of many nations, an effective democratic system must meet additional requirements beyond the simple absence of censorship, which is its greatest threat.

First, according to the author, it is essential for a democratic society that its citizens are exposed to information that would not normally arouse their interest. Unexpected and unplanned encounters are indispensable for democracy, as they help avoid fragmentation, polarization, and extremism—likely consequences in a world where individuals interact only with their fellow human beings.

A full democratic system must be structured in such a way that people often encounter – including in the virtual environment – opinions and topics that, if they could choose, they might not select. In addition, it is necessary for citizens to share a wide range of common experiences. Without shared experiences, a heterogeneous society will face more difficulties in solving its social problems. Collective experiences, such as a major sporting event, make it possible to create social bonds. A communication system that drastically reduces the number of these shared experiences generates a number of problems, especially by increasing social fragmentation (Sunstein, 2017).

These imperatives are especially relevant in a vast and diverse country like Brazil, which already faces the occasional risk of social fragmentation. A system that not only makes it difficult to meet opposing opinions, but also weakens the social bond generated by shared experiences, results in a society where people with different political positions are seen as enemies. As Nietzsche (1969, p. 24) states: "as soon as you feel that you are against me, you will cease to understand my position and, consequently, my arguments!".

According to Peters (2013), a professor at the Graduate School of Public and International Affairs at the University of Pittsburgh, governance is defined as the ability to "direct the economy and society towards collective goals". The echo chambers created by social networks can thus lead to disastrous policies or a drastically reduced capacity to formulate effective policies, as individuals cloistered in their "parallel realities" rarely have a sensible view of the problems of the collectivity.

When citizens see themselves as enemies, a diverse society encounters many more obstacles to solving social problems, since it lacks the willingness to understand others. However, social media often encourages feelings of anger against the "other side." Research conducted by Fan et al. (2014), from Beihang University, indicates that anger is the emotion that spreads faster and reaches the largest number of people on social networks, compared to other emotions. As a result, those who share angry messages inevitably end up exerting greater influence. In other words, anger keeps users connected to social networks, and is therefore encouraged and propagated by the algorithms of digital platforms.

Even when conservatives and progressives agree on certain points, the tendency is for them to like and trust each other less and less (Mason, 2018). When like-minded individuals encourage anger among themselves, the consequences can be severe, leading to exacerbated extremism and even violence. Political extremism is intensified by the division of citizens into groups with similar ideals. The global political landscape is increasingly polarized, and thus there is an alarming increase in partisanship—a form of partisan bigotry that breeds aversion toward people who support opposing parties.

This partisan division affects several areas of society. In the labor market, candidates are favored based on their political convictions, even if they are not the most qualified (Iyengar; Westwood, 2014). In the choice of romantic partners, preference for a particular political party becomes more important than physical or personality characteristics (Alford et al., 2011). Marriages between people who support opposing parties are rare; a survey in the United States revealed that only 9% of marriages consisted of Democrat-Republican pairs (Rosenfeld, 2016).

Since 1980, an increasing number of people have come to manifest more negative emotions than positive ones when thinking about the opposing party's candidate. Until approximately the year 2000, reports indicated only a slight antipathy towards the candidate of another party. However, from 2004 onwards, the negative feelings became more pronounced. In this context, the first two decades of the twenty-first century mark an era of intense polarization, in which mild antipathy has morphed into a deeper form of animosity (Iyengar; 2018).

It is imprudent to say that social networks and the internet, in general, are directly responsible for the evident increase in partisanship. However, it is undeniable that the consumption of information that confirms and reinforces individual beliefs and values, facilitated by social networks, is a significant factor that contributes to the problem. The bubble filter - intellectual isolation created when the algorithm displays only the information the user wants to see - can induce people to believe fake news, making it difficult or impossible to correct it (Rouse, 2018).

It is evident that any system that allows freedom of choice will result in a certain degree of polarization of opinion. Even before the internet, people were making conscious choices when selecting newspapers, radio stations, and television programs. In any period, there is a portion of society that prefers to have its opinions validated rather than challenged. With the rise of social networks, however, this power of personalization has increased significantly, with algorithms that filter information according to users' demographic characteristics and preexisting political convictions (Przeworski, 2020).

In addition, algorithms actively recommend content, pages, and groups of an extremist nature to users who might otherwise never have contact with them. An internal Facebook survey conducted in 2016 found that the platform is not only home to a large number of extremist groups but also promotes them to its users. The results revealed that 64% of all memberships to extremist groups occur due to recommendation tools, mainly through the "Suggestions for You" and "Discover" features (Horwitz, 2020).

Similarly, YouTube's recommendation system directs viewers to extremist content. A study conducted on the platform in 2019, analyzing more than two million recommendations and 72 million comments, showed that users often transition from moderated videos to videos with extremist content. Through simulation experiments, the researchers looked at a comprehensive picture of user radicalization on YouTube (Ribeiro et al., 2020).

In a study conducted by the investigative journalism website Bellingcat, 39 out of 75 fascists surveyed attributed their conversion to the "red pill" movement to social media. This movement is a misogynistic ideology based on the extreme right. The term "red pill" comes from the movie The Matrix, in which the protagonist has the choice between a red pill, which reveals reality, and a blue pill, which keeps him in ignorance and safety. Thus, more than 50% of respondents credit social media with discovering and adhering to extremism (Evans, 2018).

The findings provide overwhelming evidence that there has been, and continues to be, radicalization of users, with strong evidence that the recommendation system facilitates the discovery of extremist channels. Content of this nature thrives on social media, since algorithms prioritize engagement, and one of the ways to attract users is to fabricate outrageous news about politicians they have an aversion to. Thus, recommendation systems become part of the problem (Abboud, 2021).

For Carvalho (2011), polarization is part of the business model of the platforms, as it is highly effective in keeping users connected. In other words, displaying inflammatory content, including those that promote hatred, violence, hostility, and discrimination, is an effective strategy to keep people online for longer. Therefore, this content is driven by algorithms, whose ultimate goal is to capture the attention of users.

The promotion and propagation of this type of content is fundamental to the surveillance-based business model of digital platforms. Internal Facebook documents reveal that the company is aware that hate speech, polarizing political speech, and misinformation on Facebook, Instagram, WhatsApp, and Messenger "are affecting society around the world." The company also acknowledges that its "core product mechanics, such

as virality, recommendations, and optimization for engagement, are significant parts of why these types of speech thrive on the platform" (Gurumurthy, 2018).

In addition to these issues, governments and other actors turn social media into weapons of mass manipulation, causing real damage to the offline world. They create fake news and the algorithm disseminates it to the public most likely to believe it. For this, Big Data concepts are used, in addition to political bots and automated profiles on social networks, which are designed to look and act like real people, with the aim of manipulating public opinion (Ratkiewicz et al., 2019).

The article "BIG DATA: the secret behind Trump's election" (Alves, 2017) presents an analysis of the use of Big Data and data-based psychology, highlighting psychometrics — the measurement of psychological characteristics — as the basis of the new electoral strategy. Every action of users, both online and offline, leaves digital traces (such as purchases, searches, interactions, and likes). The central point is how this data is used. In the current context, Big Data plays an important role in political strategies, as smartphones become a kind of psychological questionnaire constantly filled out, whether consciously or unconsciously.

The methodology, in addition to building psychological profiles, allows for the search and manipulation of strategic population segments, such as undecided voters, in order to change their voting intentions. During Trump's campaign, this strategy proved effective in targeting specific voters with content designed to influence their behavior, which highlights the impact of Big Data on contemporary politics and the possibility of manipulation in democratic processes.

Bots, on the other hand, can be used to amplify the dissemination of partisan or false information, increase the number of likes, shares, or comments about an idea or public figure. In this way, they act not only to deceive users, but also to manipulate the algorithms, which can be influenced to promote certain topics or profiles as more popular (Gurumurthy, 2018).

The presence of armies of automated accounts in the political discussion on social networks can generate three main problems: (i) the distribution of influence among suspicious accounts that operate with malicious intentions; (ii) the increase in polarization in the political discussion; and (iii) the amplification of the spread of disinformation and unverified information (Bessi, 2016). Bail et al. (2018) found evidence that exposure to Twitter bots with opposing views increased political polarization among participants in an experimental study.

Nesse ínterim, Arnaudo (2017) argumenta:

> Bots are widely used to manipulate public opinion across national borders, in different contexts and languages. They deceive both the algorithms of the platforms and users, promoting the distribution of manipulated information that favors certain candidates and campaigns. In addition, bots create illusory notions of candidates' popularity or specific convictions, through automated inflation of numbers. The practice of manufacturing consensus — which seeks to increase the credibility of candidates and campaigns with artificially high numbers — has Brazil as one of its pioneers (Arnaudo, 2017, p.40).

In summary, it can be seen that the business model of social networks is structured to keep users' attention focused on the screens, ensuring that the ads paid by their customers reach the target audience with maximum effectiveness. To do this, algorithms promote personalized posts that generate greater engagement, regardless of their veracity. In this way, the platforms become spaces that function as echo chambers, intensifying polarization and extremism. In addition, the relentless search for engagement allows for the manipulation of public opinion through the use of bots in computational propaganda campaigns. The business model focused on engagement on social networks often favors divisive and extremist content, since this is the content that the algorithm tends to prioritize.

CONCLUSION

Social networks and their algorithms, by redefining the informational experience of users, not only promote access and connection, but also profoundly shape the contemporary democratic environment. The analysis of the impacts of algorithms on freedom of expression and political pluralism reveals a scenario where the segmentation of content and the creation of digital bubbles weaken democratic dialogue, limiting contact with diverse perspectives. This phenomenon of "echo chambers", widely discussed in the literature, threatens informational pluralism by creating isolated communities, in which only already consolidated opinions and ideas find space, making public debate more fragmented and polarized.

In the context of digital platforms, the informational autonomy of users is gradually replaced by invisible choices, operated by algorithms whose decisions favor engagement over diversity. This personalization model becomes a challenge to the construction of an inclusive democracy, because, by prioritizing interaction and time of use, platforms end up encouraging the proliferation of extremist content and disinformation, which are more effective in capturing and maintaining the attention of users. In this sense, the very commercial dynamics of social networks become an involuntary ally of radicalization and ideological fragmentation.

Another central aspect discussed is the rise of computational propaganda mechanisms and the use of bots, which manipulate public opinion and reduce the authenticity of political discourse. These tools allow certain groups to reinforce their agendas and influence electoral processes, often in a disguised way and with polarizing objectives. The research reveals that the use of bots and digital propaganda strategies not only distorts public perception of political issues, but also amplifies the sense of popular support for extremist positions, creating a false perception of consensus and intensifying radicalization.

The responsibility of platforms in content moderation is therefore a crucial issue. In the midst of this complexity, the role of technology companies as "content curators" stands out, with enough power to decide which discourses will be visible and which will be suppressed. By exercising this influence without transparency or adequate regulation, these companies assume a position of control over the digital public space, establishing a system of private censorship that deviates from the ideal of a free and plural internet.

However, regulating this environment requires a delicate balance. Regulatory proposals that seek to mitigate the spread of extremist and false content face the challenge of respecting freedom of expression while promoting safety and pluralism in public debate. International experience suggests that it is possible to find models that protect democratic values, but regulations need to evolve to keep up with the rapid pace of technological innovations and the unforeseen impacts that these changes entail.

Thus, this study reinforces the urgency of public policies that promote the transparency of algorithms and encourage the diversity of content, aiming to build a healthier digital environment that is less susceptible to informational manipulation. This approach could include, for example, requirements for platforms to make public the criteria for personalizing content and offer users greater control over their informational experiences, reducing the effect of digital bubbles and echo chambers that are currently established.

In addition, a regulatory framework that holds technology companies accountable for curating content and proposing clear guidelines for moderating polarizing and false content is essential. This framework needs to ensure that moderation is done in a transparent and fair manner, so as not to compromise freedom of expression, but also to prevent the digital space from becoming a polarizing ideological battleground. Only in this way will it be possible to move towards a more inclusive digital democracy, where different points of view coexist and can contribute to the construction of a more robust public dialogue.

Finally, it is essential that future research continues to investigate the effects of the interaction between algorithms, user behavior, and power structures on social networks, because only with a deep and broad understanding will it be possible to develop effective solutions to the challenges of the digital age. The creation of digital governance that preserves democratic integrity and respects the autonomy of individuals is an essential objective for the future of connected societies and an imperative for the strengthening of democracies on a global scale.

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RISK BEHAVIORS RELATED TO SEXUAL PRACTICES IN ADOLESCENTS FROM PUBLIC SCHOOLS IN THE CITY OF RECIFE

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ABSTRACT

Introduction: The population of adolescents in the world is estimated at 1.3 billion, representing 16% of the world's population. Adolescents have specific health needs related to their rapid physical, sexual, social, and emotional development and the specific roles they play in societies. Objectives to identify risk behavior in the sexual practices of adolescent students and correlate them with sociodemographic and behavioral variables. Method: This is a descriptive, cross-sectional and quantitative study. The sample consisted of 643 adolescents aged 12 to 18 years. Results: It was evident that (30.6%) of the adolescents had already had sexual intercourse, the first sexual intercourse occurred mainly in the age groups of 12 to 14 years (47.2%). In the subgroup that had sexual intercourse, (26.4%) had sexual intercourse with four or more partners. The percentage of condom use by adolescents and/or their partners in their last sexual intercourse was significant (69.0%), however, 30.0% of adolescents did not use condoms in their last sexual intercourse. Conclusions: There was an early onset of sexual activity, with a high frequency of partners, with exposure of adolescents to pregnancy and sexually transmitted diseases.

Keywords: Adolescent. Sexuality. Risky behavior.

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INTRODUCTION

The adolescent population in the world is estimated at 1.3 billion, representing 16% of the world's population (UNICEF, 2022). In Brazil, the current decade has been marked by a process called "demographic bonus", characterized by the high percentage of adolescents in the population: of the 210.1 million people, **53,759,457** are under 18 years of age (IBGE, 2019).

Adolescence, which according to the Brazilian Ministry of Health covers the period of life of the individual between 10 and 19 years of age (BRASIL, 2010). Adolescents have specific health needs related to their rapid physical, sexual, social, and emotional development and the specific roles they play in societies (PAHO, 2018). It is characterized by the need to confront, to experience limits, or even to transgress them, constituting a space for conquest, affirmation and relationships, which must be experienced individually or in a group (BRASIL, 2018). The desire to experience new experiences coexists with the feeling of invulnerability and the desire to test limits, and adolescents often take risky attitudes. During this time, increased androgen production leads to increased sexual behavior and this can contribute to the early onset of sexual activity.

The exploration and experimentation of sexuality processes in adolescence can have permanent positive or negative consequences. However, as they explore, experiment, and learn, they still need scaffolding and support, including environments that reinforce opportunities to thrive. A toxic environment makes it challenging for adolescents to develop healthily. Ultimately, the transformations in the body, brain, and behavior that occur during adolescence interact with each other and with the environment to shape the pathways to adulthood (National Academies Press (USA), 2019). Health risk behaviors contribute to the main causes of morbidity and mortality among adolescents and young people.

The concept of risk must be understood as broadly as possible, going beyond biomedical criteria and reaching social and behavioral variables. Researchers from different areas of study have been seeking to diagnose the causes of risk behaviors and identify the moment when they begin in adolescence (SANTROCK, 2014)

Risk behaviors that start early are more likely to become real problems. If these behaviors go beyond experimentation, that is, are maintained over time, the possibility of transforming them into future problems increases even more (STEINBERG, 2008).

An estimated 1.7 million adolescents (10-19 years) were living with HIV in 2021, with about 90% in the African Region (Joint United Nations 2021). One in 20 adolescents worldwide contracts a curable sexually transmitted infection each year, and each day, more than 6,500 adolescents and young people aged 10 to 24 are infected with HIV (WHO, 2023).

Adolescents account for 11% of new HIV infections (5). In 2020, there were 150 000 new cases of HIV infections among adolescents, more than three quarters were among adolescent girls (6). In Brazil, between 2011 and 2021, more than 52 thousand young people aged 15 to 24 with HIV developed acquired immunodeficiency syndrome (AIDS) (Brasil, 2023).

Given these issues, it is observed that the initiation of sexual intercourse at younger ages continues to be a public health concern because it is related to a wide range of negative health outcomes in adolescence, which can last into young adulthood (BOISVERT I, BOISLARD MA, POULIN F, 2017)

Therefore, knowing risk behaviors and vulnerabilities and dealing with them appropriately, promoting and protecting health, will positively impact quality of life, learning conditions and, consequently, the construction of citizenship. The health of human beings is extremely influenced by their lifestyle, so investigating risky sexual behavior in adolescents can contribute to the identification of risk groups, to the monitoring of the health levels of this population and to support the development of health promotion policies and programs. In this sense, the objectives of this study were to identify risk behavior in the sexual practices of adolescent students and to correlate them with sociodemographic and behavioral variables.

METHODS

This is a descriptive, cross-sectional study in which secondary data was used (Beserra, 2015) in which it was carried out with students from state schools in the city of Recife - PE. The sample was composed of 643 adolescents, aged between 12 and 18 years, enrolled in Elementary and High School in State schools in the Santo Amaro neighborhood. The Santo Amaro neighborhood is part of the 1st Political-Administrative Region of Recife, downtown, formed by a total of 11 neighborhoods (FIALHO et al., 2015). For a long time, the neighborhood of Santo Amaro was considered the most violent in the city. The implementation of the "Pact for Life" program has significantly reduced the crime rate in this neighborhood, but drug trafficking is still very present, increasing the feeling of insecurity of residents and visitors to the place (FIALHO et al., 2015).

In the primary survey, the estimated population size of 4,905 students enrolled in the six schools was considered, with a margin of error of 5.0%, reliability of 95.0% that the margin of error will not be exceeded, an expected proportion of 50.0% for each response category, a value that maximizes the sample size (ALTMAN, 1991). Such calculations resulted in a sample size of 357 students. Considering that the sampling was carried out by

clusters (Schools), the sample size was increased by 50%, and the value obtained was increased by 20.0% for possible losses, resulting in a sample size of 643 students.

The data was collected in January 2023. In the primary research, a self-administered questionnaire (already validated in Brazil) containing sociodemographic and behavioral questions was used: the *Global School-Based Student Health* Survey (WHO, 2012). After collection, the data were digitized in electronic spreadsheets and analyzed using the SPSS version 21 program.

The variables selected for analysis were classified as: a) sociodemographic (age, sex, education, marital status, race/color, whether they work, region of residence, mother's education, who they live with, religion); b) sexual behavior (age at sexual onset, number of partners, use of condoms).

The existence of an association between two categorical variables was evaluated using the Chi-square statistical test or Fisher's exact test, adopting a margin of error of 5%, and the degree of association between the variables was evaluated by the prevalence ratio and the respective confidence interval (95.0% CI).

This report is an integral part of a main research and was approved by the Research Ethics Committee of HUOC/PROCAPE, according to Resolution 466/12 of the National Health Council, under opinion No. 705,598.

RESULTS

Sample characterization: The analysis of the collected data revealed that 56.5% of the adolescents were aged between 15 and 18 years old – the others (43.5%) were between 12 and 14 years old; most were female (64.2%), single (93.6%), did not work (87.9%), and considered themselves non-white (82.3%), with a predominance of brown/mulatto/brown (70.6%). Regarding education, a little more than half of the adolescents (54.1%) were in high school; (52.3%) of the mothers of the adolescents surveyed had between 8 and 11 years of schooling. Regarding housing, almost all (95.5%) of the adolescents lived in the urban region, accompanied by their mother (89.7%), and a little more than half (56.8%) lived with their father. Regarding religiosity, there was a predominance of evangelicals (40.4%) and (56.6%) of the adolescents considered themselves practicing their religion.

Table 1 - Sociodemographic characterization of the study population. Recife - PE.

VARIABLE	N	%
Sample size [A]	643	100,0
Age		
12 to 14 years	280	43,5
15 to 18 years old	363	56,5
Sex		
Male	230	35,8
Female	413	64,2
Marital status		
Single	602	93,6
Married/common-law partnership	41	6,3
What race/color do you consider yourself to?		
White	114	17,7
Therefore	31	4,8
Brown/mulatto/brown	454	70,6
Indigenous/Yellow/Other	44	6,8
What race/color do you consider yourself to?		
White	114	17,7
Non-white	529	82,3
Schooling		
Elementary school	295	45,9
Middle school	348	54,1
Works?		
Yes	78	12,1
No	565	87,9
Does he live with his father?		
Yes	365	56,8
No	278	43,2
Do you live with your mother?		
Yes	577	89,7
No	66	10,3
Region in which you live		
Urban	614	95,5
Rural	29	4,5
Mother's schooling time		
< 8 years	186	28,9
8 to 11 years	336	52,3
> 12 years	121	18,8
Religion		
There is none	146	22,7
Catholic	190	29,5
Evangelical	260	40,4
Spiritist	20	3,1
Other	27	4,2

Do you consider yourself practicing your religion?		
Yes	364	56,6
No	279	43,4

(a) Amount used to calculate the percentages for all questions in this table.

CHARACTERIZATION OF ADOLESCENTS ACCORDING TO THEIR SEXUAL BEHAVIOR

The sexual behavior of the adolescents was mapped through the questions listed in Table 2. The analysis of the results showed that approximately one third (30.6%) of the adolescents had already had sexual intercourse. In this subgroup, the first sexual intercourse occurred mainly in the age group of 12 to 14 years (47.2%). Considering the entire life span of the adolescents, almost half (40.1%) of them had sexual relations with only one person, while about a fifth (26.4%) of the adolescents had 4 or more sexual partners. The majority (69.5%) of the adolescents stated that they or their partner used condoms in the last sexual act.

Table 2 – Absolute and relative distribution of the study population, according to questions related to sexual behavior. Recife - PE.

VARIABLE	**n**	**%**
Have you ever had sex?		
Yes	197	30,6
No	446	69,4
TOTAL	**643**	**100,0**
How old were you when you had your first sexual intercourse?		
Under 12 years old	20	10,2
12 to 14 years	93	47,2
15 or more	84	42,6
TOTAL	**197**	**100,0**
In your entire life, how many people have you had sex with?		
One	79	40,1
Two	36	18,3
Three	30	15,2
4 or more	52	26,4
TOTAL	**197**	**100,0**
The last time you had sex, did you or your partner use a condom?		
Yes	137	69,5
No	60	30,5
TOTAL	**197**	**100,0**

There was a significant association ($p < 0.05$) between the adolescents' gender and sexual activity, with the highest percentage among male participants (38.6% vs. 23.1%) (Table 3).

There was also a significant association between the age group of adolescents and the variable sexual activity (Table 3), being higher in the age group of 15 to 18 years than in the age group of 12 to 14 years. Comparing these age groups, in numerical terms, the following percentages were found, respectively: 45.4% x 13.7% for sexual activity (Table 3).

Table 3 – Bivariate analysis and crude prevalence ratios for the use of sexual activity, according to sex and age of the adolescents. Recife - PE.

	SEX						
VARIABLE	**Male**			**Female**		**Value of p** (a)	**PR (95% CI)**
	n	**%**		**n**	**%**		
Sexual activity							
Yes	61	38,6		56	23,1	0,001*	1,00
No	97	61,4		186	76,9		0,60 (0,44 a 0,81)
	AGE GROUP (years)						
VARIABLE	**12 a 14**			**15 a 18**		**Value of p** (a)	**RP (IC a 95%)**
	n	**%**		**n**	**%**		
Sexual activity							
Yes	28	13,7		89	45,4	< 0.001*	1,00
No	176	86,3		107	54,6		3.31 (2.27 to 4.82)

(a) p-value determined by Pearson's Chi-square test.
* Significant difference of 5.0%.
PR: prevalence ratio; CI: confidence interval.

DISCUSSION

When asked about their sexual behaviors, the data analysis showed that approximately one third (30.6%) of the adolescents had already had sexual intercourse, corroborating the results of PeNSE 2019, indicating that 35.4% of schoolchildren aged 13 to 17 had already had sexual intercourse at some point, which represents a reduction of 2.1 p.p. in relation to the result of 2015 [2](IBGE, 2019). In the United States, the evaluation of high school students in 2023 revealed that 32% of students had already had sexual relations in the last three months prior to the survey (CDC, 2024).

In the subgroup that had sexual intercourse, the first sexual intercourse occurred mainly in the age groups of 12 to 14 years (47.2%). In the study by Silva et al (2015) with adolescents aged 14 to 19 years, they observed that 49.25% had already started their sexual life, 49.25% with a mean age at first sexual intercourse of 15.23 years. In an evaluation of unprotected sexual activity, Vieira et al. (2021) observed that the prevalence of sexual activity was 47.3%, with a mean age of sexarche of 14.1 years, and a trend toward early sexual initiation in males. One third of the first sexual relations were unprotected (33.9%).

Another study evaluating sexual practice in adolescence found that of 10% of adolescents reported sexual initiation at < age of 13, these results suggest vulnerability to sexual violence, because children at this age cannot distinguish sexual abuse from deliberate and consensual sexual relations (ARRUDA et al 2020). It is noteworthy, therefore, that when young people start their sexual life early, it is a worrying fact, considering that not all adolescents are properly protected against sexually transmitted diseases, and that girls are also exposed to early pregnancy.

Evaluating sexual behavior and practices among adolescents is a complex condition, due to the different existing conceptions, the sociocultural influence on the behaviors and practices adopted is great Castro et al. (2017).

Data from PeNSE in 2015 revealed that, of adolescents who had an active sexual life (19.5%), who became pregnant at some point, this percentage is 9.0%. In the Northeast Region, of the girls who had an active sexual life, 13.3% declared that they had already become pregnant (IBGE, 2015). Compared to PeNSE 2019, it was observed that, from a regional point of view, the highest percentage of pregnancy continued to be recorded among schoolchildren in the Northeast Region (10.9%), whose percentage in the State of Alagoas reached 15.3% (IBGE, 2019).

Most adolescents (40.1%) had sexual intercourse with only one partner, but a significant percentage (26.4%) had sexual intercourse with four or more partners. In a similar study conducted by Vieira and collaborated with 499 adolescent students in Pouso Alegre, Minas Gerais, he found that the prevalence of sexual initiation among participants was 47.9%, with a mean age of 14.1 years, and a tendency for early sexual initiation in males (VIEIRA ET AL 2021).

The percentage of condom use by the adolescent and/or his partner in the last sexual intercourse was significant (69.0%), however, 30.0% of the adolescents did not use condoms in the last sexual intercourse, corroborating the results of Vieira et al (2021) indicate that one third of the first sexual relations of the adolescents in their study were unprotected (33.9%). Adolescents' lack of knowledge about contraceptive methods can result in unprotected sexual behavior, which increases the risk of pregnancy and sexually transmitted diseases in this group (MOLINA et al, 2015). It is therefore clear that there is a need to ensure that all young people receive effective education and skills to protect themselves and others from HIV infection, other STDs and unwanted pregnancies.

The magnitude of the problem is evidenced by sexual and reproductive health challenges, such as the high number of teenage pregnancies, early marriages, and sexually transmitted infections. Awareness of these challenges can facilitate the development of

interventions and the implementation and integration of comprehensive sexuality education (Chavula et al, 2020).

Studies suggest that high school provides a window of opportunity for parents and teachers, who can educate adolescents about healthy sexual experiences, the benefits found in the responsible approach to Sex Education, in the form of prevention of cases of early pregnancy and abortions in adolescence, the transmission of sexually transmitted infections, as well as the detection of cases of child abuse that, most of the time, they happen in the family environment (Chavula et al, 2020; MIRANDA & CAMPOS, 2022).

The lack of this education in sexual behaviors in adolescence makes adolescents start their sexual lives unprepared and vulnerable to unwanted pregnancies and STIs. Health and education professionals, supported by the government, should develop sex education programs that ensure that adolescents have healthy sexual experiences (ARRUDA et al, 2020).

In the correlation study, there was a significant association ($p < 0.05$) between the gender of adolescents and the practice of sexual activity, with the highest percentage among male participants (38.6%). Corroborating with PeNSE 2019, in which 39.9% of male students reported having had sexual intercourse at some time, while among female students in this same group the percentage was 31.0% (IBGE, 2019). However, in the survey of the high school student in the United States in the year 2021, it revealed that female students were more likely than male students to be sexually active.

There was also a significant association between the age group of adolescents and the variable sexual activity, being higher in the age group of 15 to 18 years. In the 2019 PeNSE, it was observed that the percentage of students who have already had sexual initiation among students aged 13 to 15 years was 24.3%, while in the age group of 16 to 17 years the percentage more than doubled (55.8%) (IBGE, 2019).

The results of this study point to limitations in relation to the specific sample of a region of Brazil, and it cannot be deduced that the conclusions found are applicable in other Brazilian regions or in other countries. They also point out that school health programs can help young people adopt lasting attitudes and behaviors that promote their health and well-being, including behaviors that can reduce the risk of HIV and other STDs.

Considering the various spaces in which health professionals, especially nursing professionals, can work, and considering the implementation of school health and effective measures of interaction between health services and schools, there is a need to advance strategies that understand adolescents and communicate effectively with this public. It should be noted that the study may contribute to the development and elaboration of

programs that provide adequate sex education to adolescents in schools. This approach could reduce risky sexual behaviours and generally improve the sexual health of adolescents. **Implications for the field of health and nursing:** Nursing and school health actions act in the praxis of health promotion and have a positive impact on raising the health status of the school community, on prevention and health promotion in an equitable and comprehensive way.

CONCLUSION

The results obtained on behavioral risk factors of adolescents, such as age at sexual initiation, number of partners and use of condoms, follow the pattern of other studies in the area, implemented in different geographical and cultural contexts that point to the precocity of sexual life and exposure of adolescents to pregnancy and sexually transmitted diseases.

It can be observed that the results are still insufficient to understand, in depth, the elements that make up the world of adolescents, when dealing with such burning issues of their daily lives, such as risks, sociability, pleasure, human development in the context of sexual relations. Considering, within this horizon, the continuity of this research, the need to deepen studies on adolescents and to understand their behavior and feelings in relation to sexuality, pregnancy and sexually transmitted diseases is highlighted.

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PERSONALITY RIGHTS AND THE INCLUSION OF PEOPLE WITH HEARING IMPAIRMENT: CHALLENGES AND THE APPLICABILITY OF ASSISTIVE TECHNOLOGIES

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ABSTRACT

This article explores the inclusion of people with hearing impairment, analyzing the relationship between personality rights and the application of assistive technologies. Historical evolution demonstrates significant advances, from social exclusion in Antiquity to the recognition and protection of fundamental rights in the contemporary era. Assistive technologies, such as hearing aids, cochlear implants, and transcription apps, play a crucial role in promoting autonomy and accessibility. However, obstacles such as high costs, lack of professional training and social resistance still limit the full applicability of these technologies. Brazilian legislation, especially the Brazilian Law for the Inclusion of Persons with Disabilities, and the policies of the Unified Health System (SUS), are fundamental in promoting social inclusion and guaranteeing the rights of these people. The need for a continuous and collaborative effort between governments, health institutions, educators and society is highlighted to ensure the full citizenship and active participation of people with hearing impairment. This article concludes that the promotion of personality rights and the inclusion of assistive technologies are essential for a more just, inclusive and accessible society.

Keywords: Accessibility. Autonomy. Hearing impairment. Inclusion.

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INTRODUCTION

The inclusion of people with hearing impairment is a constant challenge in contemporary society. Despite legal and technological advances, there are still many barriers that hinder these people's access to basic rights of citizenship and social participation. Hearing impairment affects millions of people around the world, impacting their ability to communicate and interact socially. This article aims to explore the personality rights of these people, analyzing the challenges faced and the applicability of assistive technologies as tools to promote inclusion.

One of the main problems faced by people with hearing impairment is the lack of awareness and sensitivity on the part of society and institutions. While there are laws that guarantee specific rights, the implementation of these measures is often insufficient or ineffective. Communication is a fundamental need for the full exercise of personality rights, and the absence of adequate adaptations in public and private environments can result in social exclusion and discrimination.

Assistive technologies have played a crucial role in improving the quality of life of people with hearing impairments. Devices such as hearing aids, cochlear implants, and visual alert systems are examples of how technology can help these people communicate and be independent. However, access to these technologies is still limited for many, due to economic, educational, and cultural factors. The high cost and lack of information about the benefits and functioning of these devices prevent many people from taking full advantage of their potential.

In addition to technological challenges, there are also issues related to education and the job market. The school inclusion of children with hearing impairment requires not only the presence of assistive equipment, but also the training of teachers and curricular adaptation. In the professional environment, the lack of effective inclusion policies and discrimination can limit employment and career development opportunities for these people. Existing legislation needs to be complemented by practical actions that ensure equity in access to education and work.

This article argues that true inclusion of people with hearing impairment will only be possible through a joint effort between governments, civil society, business and educational communities. It is essential to promote awareness about the rights of these people and the advantages of assistive technologies, in addition to ensuring that public policies are effectively implemented. Only with a holistic and integrated approach will it be possible to overcome obstacles and ensure that people with hearing impairment can fully exercise their personality rights.

METHODOLOGY AND OBJECTIVE

First, it aims to analyze the relationship between personality rights and the inclusion of people with hearing impairment, identifying challenges and proposing appropriate solutions so that the rights of this population are enforced. The general objective of this study is to understand how personality rights are intertwined with the inclusion practices of people with hearing impairment, highlighting the challenges faced by this population. In addition, it seeks to propose viable solutions that can effectively promote inclusion and ensure that these rights are respected and protected.

The methodology of this study is built on in-depth research on several fronts. Initially, we carried out a detailed bibliographic review, according to Pereira (2018), who highlights the bibliographic review as an essential tool for data collection. This review uses a variety of sources, including journals, scientific articles, books, and published documents, with the aim of responding to the objectives outlined and obtaining truthful answers to the research problem. The literature review legitimizes the study by providing a solid and up-to-date theoretical basis.

In addition to the literature review, the methodology includes an in-depth analysis of relevant legislation and jurisprudence. This critical and interpretative analysis allows us to evaluate the current laws and judicial decisions that affect the inclusion and rights of people with hearing impairment. This detailed examination helps to identify gaps and opportunities for improvement in public policies and legal practices that directly impact this population.

To complement the theoretical analysis, the case study was used as a method. According to Marconi and Lakatos (2003), the case study involves the collection of information directly from the source, through observations and on-site interviews. This approach ensures that the information is accurate and that the study participants actively contribute by providing a detailed and contextualized view of the reality studied. This is particularly useful for understanding the specific experiences and needs of people with hearing impairment in different contexts.

The analysis of the research was carried out with a qualitative approach, according to Oliveira (2013), which prioritizes a detailed and contextual analysis of the facts and factors that influence the theme studied. The qualitative approach allows a critical and multidisciplinary analysis, seeking to present a comprehensive and clear view of the legal and social mechanisms that guarantee the rights of people with hearing impairment. This method provides a deep understanding of the historical, social, and structural conditions that shape the experience of these people.

Finally, the methodology of this study combines literature review, analysis of legislation and jurisprudence, and case study, with a qualitative approach. This set of methods aims to provide a detailed and comprehensive understanding of the relationship between personality rights and the inclusion of people with hearing impairment, offering valuable insights for the formulation of public policies and inclusive practices.

HISTORICAL EVOLUTION OF THE RIGHTS OF PEOPLE WITH HEARING IMPAIRMENT

The inclusion of people with hearing impairment is a topic of increasing relevance in the contemporary scenario, both in the social and legal spheres. This article seeks to explore how personality rights apply to this population, highlighting the challenges faced and proposing legal solutions to ensure effective inclusion. The history of the rights of people with disabilities is marked by a gradual evolution, from social exclusion to the recognition of their fundamental rights.

In antiquity, people with disabilities were often seen as a burden on society. Historical records show that in ancient Greece and Rome, these people were often deprived of basic rights and, in some cases, even eliminated from society. This exclusion was based on the belief that people with disabilities could not contribute meaningfully to society, reflecting a limited and discriminatory understanding of their capabilities and potential.

With the advent of Christianity, there was a gradual change in perspective. Charity and assistance to those in need, including people with all types of disabilities, came to be seen as virtues. However, it was only in the modern era that more structured movements began to emerge in defense of the rights of these people. In the eighteenth century, influenced by the Enlightenment, thinkers began to question the marginalization of people with disabilities. Jean-Jacques Rousseau, for example, defended the education of all children, regardless of their physical or mental conditions, arguing that education was essential for the complete development of the human being.

In the 19th century, significant advances were achieved, with the creation of the first institutions specialized in the education and rehabilitation of people with disabilities. These institutions marked the beginning of a more systematic and scientific approach to inclusion, providing people with hearing impairments and other conditions with opportunities for personal and professional development. The recognition that these people could benefit from educational and therapeutic interventions was a crucial step towards inclusion and respect for their rights.

For Norberto Bobbio (1992), the twentieth century marked a turning point with the emergence of civil rights movements and the growing awareness of human rights. After

World War II, the Universal Declaration of Human Rights, adopted by the UN in 1948, established an important milestone by recognizing the dignity and equal and inalienable rights of all human beings, including persons with disabilities. Bobbio highlights: "[...] the Universal Declaration of Human Rights represents a historic advance in the protection of the fundamental rights of all individuals" (Bobbio, 1992, p. 36).

In Brazil, the protection of the rights of people with disabilities was significantly influenced by the Federal Constitution of 1988, which enshrined the dignity of the human person as one of its foundations. The enactment of the Brazilian Law for the Inclusion of Persons with Disabilities (Law No. 13.146/2015), known as the Statute of Persons with Disabilities, represented a significant advance in guaranteeing rights and promoting inclusion. According to Maria Aparecida Gugel: "[...] the Brazilian Inclusion Law is a milestone in national legislation, as it establishes clear guidelines for the promotion of accessibility and inclusion" (Gugel, 2016, p. 22).

This legislation has provided a robust legal framework that requires the adaptation of public and private settings to ensure accessibility for people with hearing impairments. In addition, it promotes awareness of the importance of inclusion and equal opportunities, reinforcing that society must be designed to include all its members, regardless of their abilities. Brazilian legislation represents a commitment to the promotion of dignity and human rights, reflecting a significant evolution in the recognition and support of the needs of people with disabilities.

The 21st century continues to witness advances in the inclusion of people with hearing impairments, driven by technological developments and growing global awareness of the importance of human rights. Assistive technologies, such as hearing aids, cochlear implants, and visual alert systems, play a crucial role in improving the quality of life of these people by facilitating their communication and social interaction. However, access to these technologies is still limited for many due to economic, educational, and cultural factors, highlighting the continued need for efforts to ensure that all people with hearing impairments can fully enjoy their rights.

ASSISTIVE TECHNOLOGIES FOR PEOPLE WITH HEARING IMPAIRMENTS

Assistive technologies for people with hearing impairment, according to the World Health Organization (WHO), are tools, devices, and resources developed to improve communication and quality of life for individuals with hearing loss. Some of the main technologies, according to Alves and Santos, (2019), include:

1- **Hearing aids:** Small devices that amplify sound, helping people with hearing loss to improve different environments. There are behind-the-ear (behind the ear) and in-ear (inside the ear canal) models.
2- **Cochlear Implants:** Electronic devices that are surgically implanted in the inner ear. These implants bypass the damaged parts of the ear and directly stimulate the auditory nerve, providing a sense of sound for people with severe or profound hearing loss.
3- **Frequency Modulation (Fm) System:** These are devices that capture the sound of an interlocutor's voice through a microphone and transmit it directly to the hearing aid or cochlear implant of the person with hearing impairment, reducing the impact of background noise.
4- **Infrastructure Amplification System (Magnetic Induction):** Devices installed in environments such as theaters and conference rooms, which transmit sound directly to telecoil-equipped hearing aids, improving sound quality and reducing interference.
5- **Real-Time Transcription Apps:** Mobile apps that use voice recognition to transcribe what is being spoken in real-time, allowing people who are deaf or hard of hearing to follow conversations and presentations.
6- **Vibrotactile or Visual Warning Devices:** Systems that use vibrations or visual signals, such as flashing lights, to alert the person to alarms, doorbells, phone ringing, or other emergencies.
7- **Closed Captioning and Sign Language Interpretation Services (SLI):** Features such as closed captioning for TV shows and videos, as well as live or video Sign Language interpretation services to facilitate communication.
8- **Augmentative and Alternative Communication (AAC):** Tools that range from communication boards with symbols to applications and software that help in the communication of people who use Sign Language or have difficulties in oral expression.
(Alves and Santos, 2019).

These technologies aim to ensure the inclusion and autonomy of people with hearing impairment, allowing them to actively participate in various daily activities. According to the WHO, assistive technologies are essential to promote the independence and inclusion of individuals with hearing loss, allowing their participation in educational activities, in the labor market, and in social life. Access to these technologies is essential to achieve universal health coverage goals and to improve overall well-being (World Health Organization, 2019).

In addition, the WHO emphasizes that, globally, many individuals who require assistive technologies for hearing still face access difficulties, especially in low- and middle-income countries, which makes it difficult to include these people (Alves and Santos, 2019). In Brazil, the Brazilian Law for the Inclusion of Persons with Disabilities (Law No. 13.146/2015) reinforces the importance of these technologies by establishing clear guidelines for the promotion of accessibility and inclusion (BRASIL, 2015).

The National Health Policy for Persons with Disabilities, established by the Ministry of Health, also highlights the need to expand access to assistive technologies, ensuring that all people with hearing impairment can enjoy their rights fully and equally (BRASIL, Ministério da Saúde, 2010). Studies show that the implementation of assistive technologies contributes significantly to social inclusion and the improvement of the quality of life of these people (Lopes, Santos and Silva, 2020).

As Marconi and Lakatos (2003) point out, the application of these technologies must be accompanied by effective public policies and a continuous effort to raise society's awareness of the importance of inclusion. Qualitative research, according to Oliveira (2013), is essential to understand the impacts of these technologies on the lives of people with hearing impairment and to identify best practices and areas for improvement.

In short, assistive technologies represent a significant advance in promoting the inclusion of people with hearing impairment. However, it is essential that governments and society at large commit to ensuring access to these technologies for all who need them, contributing to a more inclusive and equitable world for all.

OBSTACLES TO THE APPLICABILITY OF ASSISTIVE TECHNOLOGIES

The obstacles to the applicability of assistive technologies for people with hearing impairment are diverse and represent significant challenges to be overcome. One of the main obstacles is the high cost of devices, which often makes it difficult to access technologies that could improve the quality of life of these people. The World Health Organization (WHO) highlighted that "[...] the cost of assistive technology devices is often prohibitive for people with disabilities, especially in low- and middle-income countries" (WHO, 2019, p. 5). This economic factor prevents many people with hearing impairment from acquiring the devices they need to improve their hearing and quality of life.

In addition, the lack of training of health professionals and educators to properly prescribe assistive technologies also represents a significant obstacle. According to a study carried out by the Federal University of São Paulo (UNIFESP), "[...] the lack of knowledge and adequate training of health professionals is an important barrier to the prescription and effective use of assistive technologies" (UNIFESP, 2018, p. 10). Without proper training, many professionals are unable to recommend the best technological solutions for their patients, limiting the benefits of these technologies.

Another important obstacle is society's resistance to promoting the inclusion of people with hearing impairment and the lack of effective public policies in this regard. The United Nations (UN), in its report on the rights of persons with disabilities, highlighted that "[...] the lack of effective inclusion policies and programs contributes to the marginalization and exclusion of people with hearing impairment" (UN, 2020, p. 15). The absence of structured programs and social resistance to inclusion result in barriers that hinder these people's access to fundamental rights.

The bureaucracy and complexity of the processes to obtain assistive technologies are also relevant obstacles. Often, people with hearing impairments face complicated and

time-consuming procedures to obtain assistive devices, which can discourage and delay access to necessary technologies. Streamlining these processes and ensuring a more efficient and accessible system is crucial to promoting effective inclusion.

Another challenge is the lack of information and awareness about the available technologies. Many people with hearing impairment and their families are unaware of assistive technology options that can improve their quality of life. This may be due to the lack of awareness and education campaigns on the advantages and uses of these technologies, both for the general population and for the potential users themselves.

In the face of these obstacles, it is essential that governments, health and education institutions, and society in general mobilize to overcome these challenges and ensure universal access to assistive technologies for people with hearing impairment. The implementation of effective public policies, investment in professional training, simplification of bureaucratic processes, and the promotion of awareness campaigns are essential measures to ensure the inclusion and respect of the personality rights of these people.

Only with an integrated and collaborative approach will it be possible to promote the dignity and well-being of people with hearing impairment, ensuring that they can fully participate in all spheres of social, educational and professional life. Overcoming the aforementioned obstacles is a vital step towards building a fairer and more inclusive society, where all individuals have the opportunity to fully exercise their rights and potential.

RESISTANCE FROM SOCIETY AND THE LACK OF EFFECTIVE PUBLIC POLICIES

Society's resistance to promoting the inclusion of people with hearing impairment and the lack of effective public policies are significant obstacles that directly impact the applicability of assistive technologies. According to data from the 2019 National Health Survey (PNS), carried out by the Brazilian Institute of Geography and Statistics (IBGE) "[...] only 32.8% of people with hearing impairment use some type of assistive technology in Brazil, which demonstrates the lack of access and incentive to use these resources" (IBGE, 2019, p. 25).

Society's resistance to promoting the inclusion of people with hearing impairment is often related to prejudices and stereotypes about deafness. As pointed out by a study by the University of São Paulo (USP) "The lack of sensitization and awareness in society about the needs and potential of deaf people contributes to the exclusion and marginalization of these individuals" (USP, 2017, p. 12).

The lack of effective public policies is also an important obstacle to the promotion of the inclusion of Persons with Disabilities, as stated in Law No. 13146/2015, in its article 5

"[...] it is the duty of the State to promote social inclusion and the full exercise of the rights of people with disabilities, ensuring access to adequate assistive services and technologies".

In the face of these challenges, it is essential that effective public policies are implemented that promote the inclusion of people with hearing impairment and ensure universal access to assistive technologies. In addition, continuous work is needed to raise awareness in society to overcome prejudices and stereotypes and promote equal opportunities for people, regardless of their hearing condition.

ABSENCE OF LIBRAS INTERPRETERS AND THE DIFFICULTY IN ACCESSING INFORMATION FOR PEOPLE WITH HEARING IMPAIRMENT

The absence of Libras interpreters and the difficulty in accessing information for people with hearing impairment are significant challenges that directly impact the inclusion and exercise of the personality rights of these people. According to data from the Census of the Brazilian Institute of Geography and Statistics (IBGE, 2019), Brazil has more than 10 million deaf people and 2.7 million with profound deafness. Libras, Brazilian Sign Language, is the main form of communication and expression for people with this disability.

The Libras interpreter is the person responsible for translating sign language into spoken language and vice versa, in any modality, whether oral or written.

The absence of Libras interpreters in public spaces, such as hospitals, schools and government offices, hinders communication and access to essential services for people with hearing impairment. As highlighted in a study by the State University of Campinas (UNICAMP) "[...] the lack of Libras interpreters in public services compromises access to information and basic rights of deaf people, making it difficult for them to integrate into society" (UNICAMP, 2018, p. 14).

It is also salutary to say that the difficulty in accessing information is an additional obstacle faced by people with hearing impairment. The lack of subtitles in television programs, the absence of translation of online content into Libras and the scarcity of adapted educational materials are just a few examples faced by part of this population. As highlighted by the World Health Organization (WHO) in its report on accessibility of information for people with disabilities "The lack of access to information compromises the autonomy and social participation of people with hearing impairment" (WHO, 2017, p. 20).

Given this scenario, it is essential that effective measures are adopted to ensure the presence of Libras interpreters in public spaces and promote the accessibility of information for people with hearing impairment. The implementation of inclusion policies and society's

awareness of the needs and rights of these people are essential steps to overcome these obstacles and promote equal opportunities for all.

SOCIAL INCLUSION OF PEOPLE WITH HEARING IMPAIRMENT: LEGISLATION AND SUS POLICIES IN FOCUS

The social inclusion of people with hearing impairment is an extremely important and relevant topic, which involves not only accessibility issues, but also human rights and equal opportunities. In this context, Brazilian legislation, especially the Statute of Persons with Disabilities and the policies of the Unified Health System (SUS), play a fundamental role in promoting inclusion and guaranteeing the rights of these people.

The Brazilian Law for the Inclusion of Persons with Disabilities, also known as the Statute of Persons with Disabilities, establishes clear guidelines and fundamental guarantees for social inclusion and the promotion of the rights of people with disabilities. This legislation aims to ensure equal opportunities, accessibility and the full participation of these people in society, including those who are hearing impaired. Through the Statute, principles and rights are established that aim to ensure the inclusion and autonomy of people with disabilities, contributing to a fairer and more egalitarian society (BRASIL, 2015).

Within the scope of the Unified Health System (SUS), specific guidelines and policies are also established for the care and inclusion of people with hearing impairment. The National Health Policy for Persons with Disabilities, for example, seeks to guarantee access to quality health services and promote social inclusion, autonomy and programs aimed at the prevention, promotion, treatment and rehabilitation of the health of these individuals (BRASIL, Ministério da Saúde, 2010). These policies are essential to provide comprehensive and effective support to people with hearing impairment, allowing them a better quality of life and full participation in society.

It is essential to emphasize the importance of an integrated and articulated approach between legislation, public policies and the performance of health professionals and other sectors involved, in order to ensure effective social inclusion and respect for the rights of this portion of the population. The implementation and strengthening of these policies and guidelines contribute to the construction of an inclusive, egalitarian and accessible society for all. As Lopes, Santos and Silva (2020) point out, the interaction between these different actors is crucial for the effectiveness of inclusion policies.

In addition to public policies, raising awareness and sensitization of society in relation to the rights of people with hearing impairment are equally important. Educational initiatives and information campaigns can help combat stigma and discrimination, promoting

a culture of respect and appreciation of diversity. According to Alves and Santos (2019), education is a key factor in promoting inclusion and equal opportunities for all individuals.

It is commendable to recognize that the legislation and public policies of the SUS play an essential role in promoting the social inclusion of people with hearing impairment, ensuring access to quality health services, respect for fundamental rights, as well as the promotion of autonomy and active participation of these people in society. However, the continuous engagement and commitment of all sectors of society is necessary to ensure full inclusion and respect for the diversity and dignity of each individual.

As Pereira (2018) observes, research and development of assistive technologies are also essential components in promoting inclusion. These technologies, when accessible and well integrated with health and education services, can significantly transform the lives of people with hearing impairment, providing them with greater opportunities for participation and autonomy.

Therefore, the social inclusion of people with hearing impairment requires a multifaceted approach, which involves robust legislation, effective public policies, professional training, social awareness and technological innovation. Only in this way will it be possible to build a truly inclusive and just society, where everyone can fully exercise their rights and live with dignity and equality.

HUMAN RIGHTS AND INCLUSION OF PEOPLE WITH HEARING IMPAIRMENT: AN INTERNATIONAL PERSPECTIVE

Human rights play a key role in promoting inclusion and ensuring equal opportunities for all people, including those with hearing impairments.

The international perspective, represented by international norms and treaties, establishes essential guidelines for the protection and promotion of the rights of these individuals, contributing to a more just and inclusive society.

The United Nations Convention on the Rights of Persons with Disabilities is an international milestone in guaranteeing the rights of persons with disabilities, which includes those who are hard of hearing. According to the UN Committee on the Rights of Persons with Disabilities, the Convention aims to ensure equal opportunities, accessibility and respect for the dignity and autonomy of people with hearing impairment (UN, 2006).

The ratification and implementation of the Convention by the signatory countries are fundamental to ensure the inclusion and respect for the rights of people with hearing impairment at a global level. As stated by the UN Special Rapporteur on the Rights of

Persons with Disabilities, it is essential to ensure the inclusion and active participation of these persons in society (UN, 2018).

However, international bodies play a crucial role in monitoring and promoting the rights of people with hearing impairment. The UN Committee on the Rights of Persons with Disabilities carried out periodic evaluations of signatory countries to ensure compliance with the provisions of the Convention and the promotion of inclusion and equal opportunities for these people.

In this way, the continuous commitment to the promotion of human rights and the guarantee of full citizenship and active participation of people with hearing impairment, in all spheres of social and political life, is essential to intentionally aim at a truly effective and globalized inclusion that is respectful of human diversity.

PERSONALITY RIGHTS AND INCLUSION OF ASSISTIVE TECHNOLOGIES: ADVANCES IN THE PROMOTION OF AUTONOMY AND ACCESSIBILITY

Personality rights, which encompass fundamental and inalienable prerogatives of each individual, find in the inclusion of assistive technologies an important ally in promoting autonomy and accessibility for people with disabilities. Technological advancement has enabled the development of innovative solutions that expand opportunities for active participation in society, ensuring the full and effective realization of the rights and dignity inherent to these people.

Assistive technologies, such as voice recognition software, smart prosthetics, alternative communication applications, among others, play a crucial role in breaking down barriers and overcoming limitations imposed by physical, sensory, or cognitive disabilities. These tools provide the inclusion of people with different needs and enhance their skills, allowing interaction in various social, educational and professional contexts. According to Lopes, Santos and Silva (2020), the importance of assistive technology in the inclusion of people with hearing impairment is indisputable, as it facilitates access to information and improves communication.

The use of assistive technologies not only enables the independence and self-sufficiency of people with disabilities, but also contributes to the appreciation of their capacities. By recognizing the importance of accessibility and inclusion, assistive technologies become allies in the pursuit of equal inclusion, in which everyone has the opportunity to fully exercise their rights and enjoy a dignified life. As highlighted by Alves and Santos (2019), social inclusion and the promotion of autonomy are central objectives of assistive technologies, which help to eliminate the barriers faced by people with disabilities.

In this sense, the promotion of universal accessibility and the continuous development of assistive technologies are essential to ensure the inclusion and active participation of all people in society. By considering personality rights as essential pillars of human dignity, the incorporation of assistive technologies into the daily lives of people with disabilities represents a significant step towards building a just and equitable society. The World Health Organization (WHO) emphasizes that the inclusion of assistive technologies is crucial to achieving the full and equal participation of people with disabilities (World Health Organization, 2019).

In addition, it is necessary to highlight the importance of public policies in promoting accessibility and inclusion. The Brazilian Law for the Inclusion of Persons with Disabilities (Law No. 13.146/2015) and the National Health Policy for Persons with Disabilities are examples of legislative and administrative efforts to ensure that persons with disabilities have access to assistive technologies and can exercise their personality rights in a full and dignified manner (BRASIL, 2015; BRAZIL, Ministry of Health, 2010). Legislation provides a legal framework that guarantees accessibility and inclusion, while public policies translate these guarantees into concrete actions.

The continuous development of new assistive technologies and the adaptation of existing ones to the specific needs of people with disabilities are essential aspects for the promotion of autonomy and inclusion. Technological innovation must be accompanied by investments in research and development, as well as by the training and qualification of professionals to use and recommend these technologies effectively (Pereira, 2018).

It is equally important that society as a whole is involved in this process of inclusion, promoting a culture of respect and appreciation of differences. Raising awareness and sensitization of the population about the benefits and importance of assistive technologies are key steps to reduce the stigma and discrimination that often accompany disabilities. As Marconi and Lakatos (2003) observe, raising society's awareness is crucial for the successful implementation of inclusion policies.

Therefore, personality rights and the inclusion of assistive technologies represent significant advances in the promotion of autonomy and accessibility for people with disabilities. The integration of these technologies into the daily lives of people with disabilities, combined with effective public policies and a culture of inclusion, is essential to ensure that everyone can fully exercise their rights and live with dignity and equality. Only through a joint and continuous effort will it be possible to build a truly inclusive and equitable society.

CONCLUSION

The historical trajectory of personality rights and the evolution of assistive technologies for people with hearing impairment reveal significant advances in the promotion of autonomy and accessibility of these individuals. However, even with the benefits provided by assistive technologies, challenges and obstacles still persist, limiting their full applicability and impact on the lives of these people. Society's resistance and the lack of effective public policies are considerable obstacles to the dissemination and use of these technologies, hindering the social inclusion and active participation of people with hearing impairment. The absence of Libras interpreters and the barriers to access to information highlight the need for concrete measures to ensure equal opportunities and respect for the fundamental rights of this population.

In this context, Brazilian legislation, especially the Brazilian Law for the Inclusion of Persons with Disabilities and the policies of the Unified Health System (SUS), play a crucial role in ensuring access to quality health services and promoting the autonomy of people with hearing impairment. The international human rights perspective reinforces the need for global collaboration and commitment to ensure the full citizenship and active participation of people with hearing impairment in all spheres of society. The implementation and strengthening of these policies are essential to create an inclusive environment, where assistive technologies can be effectively applied to improve the quality of life of these people.

Finally, the promotion of personality rights and the inclusion of assistive technologies represent significant advances in the search for a fairer, more inclusive and accessible society for all. The recognition of the importance of the autonomy, accessibility and dignity of people with hearing impairment should guide the implementation of policies and practices aimed at ensuring the full realization of the rights of these individuals. Only through a joint and continuous effort will it be possible to overcome the existing obstacles and promote the effective inclusion of people with hearing impairment, ensuring that everyone can fully exercise their rights and live with dignity and equality.

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THE MONTUBIA CULTURE AS A HISTORICAL MEMORY OF ART, CULTURE, IDENTITY, BELIEFS, AND VALUES

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ABSTRACT

The research aimed to analyze the preservation and transmission of the unique cultural heritage to future generations, thus ensuring the appreciation of their identity, traditions, and ways of life. The methodology visualized were quantitative and qualitative methods, the technique that was used within the process was the survey, the research work was carried out from the descriptive character. For the processing of the information, the SPSS 27 software used in this research process was used, it helped through Cronbach's alpha of alpha resulting in the reliability of the Montubia culture, 950 which evidenced that the visualized instrument was reliable. The most important conclusion of the research is that it was evident that higher education students are interested in learning more about the Montubia culture, accepting that it is their pleasure to participate in these activities, where it allows them to know in more detail the significance of the Montubia culture.

Keywords: Practical learning. Troubleshooting. Cultural research methodology. Historical memory.

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INTRODUCTION[7]

To carry out this research it is necessary to highlight that the Montubia culture plays an important role in society because it represents a significant part of the Ecuadorian identity, because it is a unique fusion of indigenous, Spanish, African influences, thus recalling ancestral roots, so that future generations have more than knowledge, something that identifies them wherever they are, That they have the motivation to know about this Montubia culture but not be ashamed of it and can discover even more of how much they can explore, the objective of this research is to analyze the preservation and transmission of the unique cultural heritage to future generations, thus ensuring the appreciation of their identity, traditions, and ways of life.

Culture is the human construction seen as a social fabric, which develops over time, which encompasses customs, ways of life, knowledge and degree of artistic and industrial development, in an era, social group, etc. (Espinales, 2023, p. 3)

The author argues that culture is a human construction that develops over time, it is constantly being formed and transformed, all cultures express needs, desires, beliefs and values, therefore, they are different in each social group. Likewise, culture is a form of identity, a source of innovation and belonging that allows individuals and communities to thrive in a changing environment, culture is a fabric, that is, it is a network of human interactions and, therefore, it also reflects customs, knowledge and the degree of artistic progress. scientific and industrial.

The Montubia culture is characterized by its traditional music and dances. Montubia music is a mixture of Afro-Ecuadorian and Latin rhythms, which merge to create a unique melody. (Magazine, 2021, p. 16)

According to the author, Montubia music is an important part of traditional culture and has a great influence on the social life of the Montubios. Music is used to express feelings, emotions, share stories and traditions, and as a form of entertainment and celebration. Musical instruments are also an important element of Montubia music, these instruments used include the rondador, the marimba, the bandolín, the quijada and the drum machine, among others. In short, Montubia music is much more than just melodies, it represents the richness and diversity of Ecuador's traditions.

Traditional festivals are a fundamental part of Montubia culture. During these celebrations, rodeo, horse races and bull riding competitions are held, where the montubios demonstrate their skill and bravery. (post, 2020, p. 24)

[7] Contribution of the Montubia tradition to the socio-cultural, economic, agricultural, agricultural, food, hospitality-tourist development of the Sucre - San Vicente community and the Bolívar canton

Based on the criterion, it is stated that the traditional festivals in the Montubia culture are events of color, music, dance and traditions that reflect the identity and folklore of a peasant community within the coastal region. These celebrations are important times to bring families and friends together, strengthen social cohesion, and celebrate the cultural richness of the area. The traditional festivals of the Montubia culture are more than just festive events; They are profound manifestations of the history, spirituality and joy of a people who seek to preserve and share their cultural roots with pride.

Their main type of art was painting, the murals of the Montubio people that can be seen throughout Manabí are the result of the inspiration of a group of guardians of this ethnic group. In each space in which the ideas of the artists are captured, the daily reality of its inhabitants is portrayed. (Salazar, 2021, p. 8)

Murals are an invaluable resource for cultural preservation, as they offer a visual voice for the experiences and stories of the Montubio peoples. By showing the colorful and challenging daily life, murals help pass on their culture to the future generation and by providing a window into the past of the Montubio peoples, they are a crucial resource to preserve their culture and maintain their legacy. In addition to being a source of inspiration for today's artists, they also help connect visitors with the history and culture of the Montubio peoples.

Historical memory must serve to build the future of Manabí, today, full of laments and complaints, biting accusations of corruption everywhere. (Ramos, 2022, p. 7)

According to the author, historical memory can serve as a reminder of the negative consequences of corruption in the past and motivate society to work on transparency, accountability and justice. Not only does it help us understand our past, but it also provides us with valuable lessons to build a more prosperous and just future. By reflecting on the mistakes of the past and facing the challenges of the present, Manabí and its community can chart a path to a more hopeful future full of opportunities for all.

Memory is an essential part of the social and urban identity of cities, associating itself with objects, processes and places that bring together the meaning and symbolism of the historical experience of citizens in a spatial context. (Paz, 2016, p. 10)

The author mentions that historical memory is, without a doubt, a fundamental component of the social and urban identity of cities through objects, processes and places loaded with meaning and symbolism, the collective memory of a community is reflected in the space it inhabits. These elements not only serve as tangible reminders of the city's history, but also contribute to the construction of a shared narrative that unites its inhabitants around their past, present and future.

METHODOLOGY

In the study carried out referring to the Montubia culture as a historical memory of art, culture, beliefs and values, in which through the qualitative and quantitative method with the representation of numerical data as well as analyzing the data that were collected with the instrument used, which in this case was the survey.

The population that was studied was the Eloy Alfaro Lay University of Manabí, sucre extension, through a probabilistic sampling, this allowed a random selection of the sample of 80 people, 50 nursing students and 30 law students. SPSS 27 software was used for reliability analysis and question analysis.

RESULTS

RELIABILITY STATISTICS

Cronbach's alpha	N of elements
,950	4

As evidenced, the reliability is positive, Cronbach's alpha is 0.95, which gives a good level of reliability of the instrument used.

Table 1. Do young people and adolescents have knowledge of the Montubia identity as a history of their identity?

		F	%	PV	PA
Valid	VERY LITTLE	14	17,5	17,5	17,5
	LITTLE	35	43,8	43,8	61,3
	A LOT	31	38,8	38,8	100,0
	Total	80	100,0	100,0	

As evidenced by the fact that 38.8% have stated that young people and adolescents have knowledge of the Montubia identity as a history of their identity, 43.8% maintain that they have a little knowledge about this Montubia identity, although a low level is 17.5% who do not consider that today's young people are full of knowledge about their Montubia identity. This meant that young people have good knowledge of the Montubia identity, which suggests that a significant part of the population is familiar with this history and culture, but it is also considered that a certain part have only a little knowledge, are less informed or less committed to the identity, likewise it is observed that the very few young people lack knowledge about their identity which could have implications in the preservation of Montubia culture in the long term.

Table 2. Does the Montubia culture help to identify artistic, gastronomic and social expression in the family nucleus?

		F	%	PV	PA
Valid	VERY LITTLE	5	6,3	6,3	6,3
	LITTLE	26	32,5	32,5	38,8
	A LOT	49	61,3	61,3	100,0
	Total	80	100,0	100,0	

As evidenced by the fact that 61.3% have stated that the Montubia culture helps the identification of artistic, gastronomic and social expression in the family nucleus, 6.3% maintain the Montubia culture as an identification of expression, although a low level is 32.5 that do not consider both culture and the identification of social expression in the family nucleus. This means that a large significant majority of students consider that Montubia culture plays a relevant role in family life and in expressing themselves towards others, but also a certain number recognize the importance of Montubia culture by valuing and accepting it. It is also observed that a considerable part of the population has a lack of access to the Montubia culture or a loss of connection with family cultural traditions.

Table 3. Would you like to learn more about the Montubia culture?

		F	%	PV	PA
Valid	NOTHING	1	1,3	1,3	1,3
	VERY LITTLE	9	11,3	11,3	12,5
	LITTLE	22	27,5	27,5	40,0
	A LOT	48	60,0	60,0	100,0
	Total	80	100,0	100,0	

As evidenced by the fact that 60.0% have stated that they would like to know more about the Montubia culture, while 27.5% maintain an interest in knowing more about the Montubia culture, along with 11.3% although a very low level of 1.3 that they have no interest in knowing more about the Montubia culture. This means that even the Montubia culture can continue to expand and that many people can get to know about it and how incredible it is. This means that most express a strong interest in Montubia culture and a significant level of curiosity, but also a certain percentage still present students who are open to learning more about the culture. Likewise, only a small percentage has no interest in knowing more about the Montubia culture.

Table 4. Do you participate in murals, parties, celebrations where the Montubia culture is evident?

		F	%	PV	PA
Valid	NOTHING	10	12,5	12,5	12,5
	VERY LITTLE	21	26,3	26,3	38,8
	LITTLE	28	35,0	35,0	73,8
	A LOT	21	26,3	26,3	100,0
	Total	80	100,0	100,0	

As evidenced, 26.3% have stated that they have participated in festivals where the Montubia culture is shown, while 35.0% maintain a participation in celebrations about the Montubia culture, together with 26.0% although a low level of 12.5% that they have participated in a festival about the Montubia culture. This means that a large percentage maintains an interest in participating in activities of the Montubia culture, thus motivating them to know more about the culture and how diverse it can be and how much can be explored of it.

Table 5. Do you agree to receive training regarding the Montubia culture so as not to lose identity?

		F	%	PV	PA
Valid	NO	5	6,3	6,3	6,3
	YES	75	93,8	93,8	100,0
	Total	80	100,0	100,0	

As evidenced by the fact that 93.8% have stated that they consider that they agree to receive information regarding the Montubia culture so as not to lose their identity, however, 6.8% did not agree to receive the information obtained. This means that the vast majority of people are interested in not losing the identity of the Montubia culture, but rather, they want to learn more and obtain more information in order to fill themselves with knowledge and rescue the customs and traditions of this Montubia culture. This means that students agree to receive information about the Montubia culture, indicating a strong interest in and learning about this cultural identity, these students recognize the importance of keeping the culture alive and are willing to learn more about it, but also a considerable percentage are not interested in learning about the Montubia culture leaving aside their interest in their roots.

DISCUSSION

By analyzing the different works carried out by various authors such as (Silva, 2017, p. 3) (with the theme lo montubio), he has come to the conclusion that it is important to highlight that popular cultural expressions, such as music, dance, and folk art, are not only manifestations of cultural identity, but also forms of cultural resistance to cultural

domination. The expression of the people is fundamental to the identity and cohesion of groups such as the Montubio people, while the elitist culture reflects the power and influence of the ruling classes. These expressions are a celebration of cultural diversity and a reminder of the importance of valuing and preserving the traditions of marginalized groups.

In the work of (Torbay, 2017, p. 1). The theme Montubia culture and its traditions: contribution to rural tourism on the Ecuadorian coast, here we can realize that, in the first place, the Montubia traditions, which range from music and dance to gastronomy and handicrafts, offer visitors a fascinating vision of the daily life and beliefs of this people. Something good about this is that it not only allows us as Montubios to connect with this culture but also to those who wish to know it and can have that direct connection.

Also in the work carried out by (Patricia, 2011, p. 16) (with the theme of the Montubia culture in the teaching-learning process) this article recognizes the importance of the montubios within the socio-political experience and civic and social disposition of the coastal people is fundamental to build a more inclusive society and aware of its diversity, The Montubios, as an integral part of the social fabric of the coastal regions, have historically contributed with their culture. The lack of knowledge has led to their needs and problems being put aside, thus limiting their participation in everything that our Montubia culture can offer. However, it is essential that from the coast and beyond, a commitment is made to value and respect the rich regional diversity, recognizing the historical, social, cultural and ethnic legacy of the Montubios.

CONCLUSIONS

- Historical memory represents a powerful tool to understand the consequences of corruption in the past, and at the same time it encourages us to seek transparency, accountability and justice in our society. Reflecting on the mistakes of the past provides us with a guide to face current challenges with determination and wisdom, allowing them to build a more hopeful future full of opportunities for all.
- Historical memory is fundamental to building and preserving the cultural identity of a society. A community can better understand its present and orient itself towards a more just and equitable future through reflection and recognition of past events, both positive and negative.
- With its artistic, culinary, agricultural, and social expressions, the Montubia culture is a cultural treasure that enriches Ecuador's diversity, reflecting a history

of resistance, adaptation, and pride in its ancestral heritage.

- Ecuador has as one of its great ethnic groups that of the montubio with which many feel identified or sympathize, in addition, it is very important in the historical cultural field of the country.

RECOMMENDATIONS

- Create proposals for educational and cultural initiatives that highlight the importance of historical memory in the fight against corruption and the construction of a fairer society. This could include the can generate a greater commitment to transparency, laying the foundations for a brighter future for all.
- Protect and conserve historical sites, monuments, documents, and objects relevant to the history of the community. This includes initiatives to restore and maintain these heritage elements.

Teach local and national history in an inclusive way in curricula to foster inclusive education, giving importance to the culture to which they belong and teaching from generation to generation. These teachings could be included in school curricula so that the identity that represents us does not disappear.

- To raise awareness among the Ecuadorian population of the origin of their roots, through cultural activities to carry out directed talks, in order to publicize the importance of the Montubia culture, and for the community to know and learn the origin of their ancestors and the culture that is born from there to the present day.

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"SEXTA DO PÉ-DE-MEIA" AND THE PLACE OF WORKSHOPS WITH FAMILIES IN BASIC SOCIAL PROTECTION

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ABSTRACT
This article analyzes the role of workshops with families held within the scope of the Family Protection and Integral Care Service (PAIF) in the prevention of rights violations, protection of families and promotion of proactive actions in the context of Basic Social Protection (PSB). Through writing, we address the experience of the "Sexta do Pé-de-Meia" project, implemented in a Social Assistance Reference Center (CRAS), highlighting the intersectoriality between public policies and the valorization of community knowledge. The research shows how the workshops can enhance the active participation of families and respond in an integrated way to territorial specificities, increasing the effectiveness of social protection actions.

Keywords: Pé-de-meia. Workshops with families. Intersectoriality. Writing. Public policies.

INTRODUCTION

Historically, in Brazil, Social Assistance was characterized by a philanthropic and paternalistic approach, without the regulation of public policies formalized in laws that met the demands of individuals in situations of social vulnerability. This configuration relegated citizens to a condition of dependence on the goodwill of others.

It was only with the promulgation of the Federal Constitution of 1988 that Social Assistance began to be recognized as a duty of the State and a right of the citizen. Subsequently, in 1993, with the approval of the Organic Law of Social Assistance (LOAS), Social Assistance was consolidated as a universal public policy of social protection (Brasil, 1993).

However, it was also necessary to create the National Social Assistance Policy (PNAS) (Brasil, 2004) and the Basic Operational Norm of the SUAS (NOB-SUAS) (Brasil, 2005) to face structural and operational challenges that limited the effective implementation of Social Assistance in Brazil.

Of these legal and normative arrangements, we highlight the Basic Social Protection (PSB), a central component of the Unified Social Assistance System (SUAS), in its function of preventing situations of vulnerability and social risk, strengthening family and community bonds in vulnerable territories.

This protective function requires the articulation of strategies that, in addition to promoting social rights, consider the diversity of contexts and the specificities of local demands, as well as the various possible changes in public policies neighboring Social Assistance: Health, Education, Social Security, Public Security Policies, among others.

It is in this wake that the Social Assistance Reference Center (CRAS) assumes a central role, as it acts, through intersectoriality, as a point of convergence between these public policies and the realities experienced by families in their territories with the purpose of executing the PSB through services, projects, programs and benefits.

To meet these objectives and consolidate Social Assistance as a right without this becoming philanthropy and benefit, CRAS starts from social work with families, made possible through the Family Protection and Integral Care Service (PAIF) to carry out individualized actions, community actions, guidance, family monitoring and workshops with families. These actions aim to enable families' access to basic rights, ensure their social participation and promote autonomy.

In this broad scope of possible actions within Basic Social Protection, we specifically chose workshops with families. These emerge as relevant instruments to promote coexistence and active participation, contributing to the construction of effective responses

to the needs of the population. The effectiveness of these workshops, however, depends on their ability to incorporate intersectoriality between public policies, recognizing that complex social issues can rarely be solved by a single sector and necessarily depend on articulation with other public policies.

This is what leads us to write, in this text, an experience that condenses these operators and circumscribes our objective: to analyze and reflect on the role of workshops with families, carried out within the scope of the PAIF, in the prevention of situations of violation of rights, in the protection of families and in the promotion of the proactivity necessary for effective social work in the context of the PSB.

Thus, in this article, we seek to discuss how Basic Social Protection can materialize the intersectoriality between public policies and appropriate the communicative indices generated by the community to produce a qualified, attentive, proactive and protective action, considering not only the existing demands, but also what is produced in progress.

We will start, initially, from the need to situate the place of the Social Assistance Reference Centers (CRAS) within the protective levels of the National Social Assistance Policy (PNAS) and briefly discuss their function within the assistance practices. It is necessary, at this first moment, to specify the configurations of this institution, which assumes the exclusive responsibility for the execution of the PAIF and, therefore, for embodying the actions that make up this service.

Then, we will analyze the role of intersectoriality among public policies and how workshops with families can constitute an important methodological and work strategy in the context of community communication. However, it is essential to highlight that we do not adopt here a specialized perspective that starts exclusively from what SUAS technicians and workers consider as relevant topics. On the contrary, our objective is to start from the communicative indices generated by the community itself, in order to plan and implement actions that dialogue directly with local demands.

This way of listening-experiencing (Viana and Neves, 2021) what is conveyed in the enunciative developments of the people assisted led us to build a workshop with families about the Pé-de-meia Program, later renamed by the CRAS team as "Sexta do Pé-de-meia". Established by Decree No. 11,901/2024, this program emerges as a public policy with the aim of offering financial-educational incentives aimed at actions for students to remain in public high school and calls on the PSB to rearrange itself in its ways of working, especially with regard to referrals and information provided to the people assisted.

To analyze and reflect on this experience, we used the methodology of writing, as proposed by Conceição Evaristo (2007), with the purpose of articulating a work experience

in a CRAS, the subjectivity of the people involved in the construction of this experience and the production of knowledge that results from it. The records of speech collected were organized and recreated in the form of fictionalized narratives (Costa, 2014), replacing the names of the people with names of neighborhoods in the city of Parnaíba-PI.

Incorporating excerpts from these statements is essential to demonstrate the power and applicability of writing in the context studied. In addition, the presence of narratives reinforces our ethical and political commitment to not only talk about subjects, but to allow their experiences to be expressed, even if in fictional form, with their complexities and contradictions preserved.

THEORETICAL FRAMEWORK

CRAS AND BASIC SOCIAL PROTECTION (PSB)

Basic Social Protection (PSB), a protective level of the Public Social Assistance Policy (PNAS), aims to prevent situations of vulnerability and risk by strengthening family and community bonds. It plays an essential role in ensuring access to basic rights and community life, standing out as a public policy of a universal nature.

Thus, the execution and materialization of the PSB occur through the Social Assistance Reference Center (CRAS), which divides its functions into two main fronts: the provision of the Integral Family Protection and Care Service (PAIF) and the territorial management of the social assistance network.

The first involves actions such as individualized and/or collective welcoming, workshops with families, community activities, individualized actions and referrals (BRASIL, 2012b). The second, in the scope of territorial management, covers the articulation of the social assistance network of basic social protection, the promotion of intersectoriality and the realization of active search in the territory (BRASIL, 2009).

These two functions of the CRAS are complementary and interdependent: while the PAIF offer enables the referral of users to the services and provides information on demands to be answered, the management of basic social protection in the territory ensures that action with the family is the axis around which local services are organized and that the referrals made by the CRAS are effective and problem-solving (BRASIL, 2009).

Having situated the CRAS and its main functions, it is necessary to specify which work guideline guides the actions of the PAIF as a service. According to the Technical Guidelines on PAIF, Vol. 2 (Brasil, 2012b), PAIF actions – reception, referral, community actions, workshops – are based on the concept of social work with families as a theoretical-methodological operator that should be taken as a common understanding of technicians

and managers in SUAS.

Social work, within the scope of the assistance policy, is understood as a set of procedures carried out based on ethical and technical-operational assumptions, with the purpose of contributing to coexistence, recognition of rights and possibilities of intervention in people's social life (Brasil, 2012b). It should be noted that the Technical Guidelines, when discussing the place of social work within the scope of the PAIF and constructing its definition, end up oscillating between, on the one hand, relying on the primacy of specialized knowledge as the only knowledge that guides the actions in the SUAS, rejecting common sense knowledge and, on the other hand, encouraging the technicians to enable and value the participation of families in the construction of actions.

This leads us to the following questions: how to think about an action? Where does it start from and to which horizon does it point? Acting as professionals in the SUAS – or in any other public system – requires us to be attentive to what concerns us, but also to what challenges us from other places: legislative changes in other public policies, doubts and repetitive questions that are vocalized from the people assisted and, also, what is created from specialized knowledge.

That's how we learned about the Nest egg. Working at a Social Assistance Reference Center (CRAS) in the municipality of Parnaíba – PI, questions suddenly begin to arise about what emerges as something new in other contexts: Am I entitled? How do I receive it? Why am I not receiving? What do I do for my daughter to have access?

The implementation of the Pé-de-meia, in another public policy, challenges our work experience in the form of incessant questions. People who can even take the CRAS as a starting point or finish line, either to seek guidance and a more effective referral to the social assistance network and/or other intersectoral institutions or, on the contrary, to go to the CRAS as a last attempt, after several refusals of care and guidance in public institutions.

These and countless other questions can be experienced by SUAS technicians[11], in at least two ways: listening-experimenting and, with that, building something in the territory and in the institution; or, on the contrary, reproducing the logic of the dispatch, just answer: *this is not where it is solved, look for another institution!* We bet on the first path and made it the construction of a workshop with the families, which was later named "Sexta do Pé-de-

[11] In small municipalities I (up to 2500 families referenced), 2 technicians with higher education, 1 of whom is a social worker and the other, mandatorily, a psychologist; 2 mid-level technicians. In small municipalities II (up to 3500 families referenced), 3 technicians of higher education, 2 of whom are social workers and, mandatorily, 1 psychologist; 3 mid-level technicians. In medium, large, metropolis and Federal District municipalities (for every 5,000 families referenced), 4 higher education technicians, 2 social workers, 1 psychologist and 1 professional who makes up the SUAS Social Worker and Psychologist, Lawyer, Administrator, Anthropologist, Accountant, Economist, Domestic Economist, Pedagogue, Sociologist; 4 mid-level technicians.

meia" and implemented in a fixed way within the institution's work processes.

This experience leads us to reflect on the importance of intersectoriality between public policies and the need for practices that consider the specificities of the territories and populations served, promoting an integrated and contextualized action.

INTERSECTORIALITY BETWEEN PUBLIC POLICIES AND THE PÉ-DE-MEIA PROGRAM

Intersectoriality is understood as the articulation between different public policies – such as health, education, social assistance, work and housing – to offer coordinated responses to the needs of the population. This concept is based on the understanding that complex social problems, such as poverty and social exclusion, cannot be solved in isolation by a single sector or institution (Brasil, 2004).

In the context of SUAS, intersectoriality translates into collaboration between services from different areas, such as health, education, work, security and social assistance, to meet the multifaceted needs of families and individuals. Through this approach, it is possible to build more complete and effective solutions that address the multiple dimensions of social vulnerability. Intersectoriality represents, therefore, a necessary approach to expand the State's capacity for action and enhance the impacts of public policies, promoting an integrated and responsive protection network.

In the case of the Pé-de-meia, intersectoriality is materialized in the promotion of joint work between the CRAS and other public policies in the territory. PAIF's actions are not limited only to issues related to social assistance. They incorporate, in an interconnected way, themes of health, education, rights, personal finances and family life. This allows the demands of families to be addressed in a comprehensive way and for services to complement each other effectively.

Thus, within public policies, even in a short period of time, several legislative changes may expand and/or mitigate access to certain rights, as well as modify the criteria for access to benefits. These changes directly interfere with the dynamics of the affected families and unfold inside public institutions. Depending on how they are received, these developments give us the possibility of making viable what, until then, may seem somewhat nebulous, both for families and for us.

Among the exemplifying possibilities, we would like to highlight the approval of Law No. 14,818, of January 16, 2024, regulated by Decree No. 11,901, of January 26, 2024, which instituted the financial-educational incentive, in the form of savings, for students enrolled in public high school. Popularly known as Pé-de-meia, this legislative proposal is based on certain objectives: to democratize young people's access to secondary education

and encourage them to remain in it; mitigate the effects of social inequalities on the permanence and completion of secondary education; reduce school dropout and dropout rates; contribute to the promotion of social inclusion through education and stimulate social mobility (Brasil, 2024).

As a public policy, the Program arises in the context in which data from institutions such as the Education Observatory (Instituto Unibanco, 2025) indicate that school dropout and dropout have a class, race, and gender cut: of the 9 million people who did not complete high school, 58.1% were men and 41.9% were women. Of these, 71.6% declared themselves black or brown. In addition, 41.7% of young people between 14 and 29 years old stopped attending school due to the need to work to provide the minimum necessary for themselves and their families.

Well, what is the relationship between this and CRAS? For our part, we can say, all of it. Retracing our theoretical path, CRAS carries out social work with families through the PAIF, using instruments such as reception, workshops and referrals to better manage the needs of the territory under its responsibility. Thus, the implementation of a public education policy of this magnitude signals the need for SUAS technicians to act in a preventive, protective, and proactive manner.

In this scenario, what would it mean, therefore, to act based on the insignia of prevention, protection and proactivity? The preventive action aims to avoid occurrences that interfere with the exercise of citizenship rights; protective action means concentrating efforts on interventions that seek to support, support and enable families' access to their rights; and, finally, proactive action is related to intervention in the face of problem situations that hinder the population's access to their rights, but which have not yet been identified as such (Brasil, 2012a).

In this way, and starting from intersectoriality as a matrix of action, we seek to reflect on an experience that integrates the role of workshops with families in the prevention of rights violations, in the protection of families and in proactive action, which should guide efficient social work.

This intersectoriality, in turn, is directly linked to community interaction. The Pé-de-Meia workshops function as a space for dialogue and exchange of experiences, in which the needs and knowledge of the community become important elements for the construction of knowledge. Through this community interaction, the workshops are consolidated as a meeting point for the active participation of families, who cease to be mere recipients of policies and start to act as protagonists in the construction of proposals aligned with their specific realities.

COMMUNITY COMMUNICATION AND WORKSHOPS AS A PARTICIPATION STRATEGY

Community communication is a powerful tool to foster social participation and give voice to the populations served by public policies. According to Paulo Freire (1987), dialogue is fundamental for emancipation, allowing subjects to recognize themselves as agents of transformation of their own realities. In the context of OHP

An important community communication strategy is the workshops with families, which "aim to stimulate reflection on a topic of interest to families, on vulnerabilities and risks, or potentialities, identified in the territory, contributing to the achievement of acquisitions [...]" (Brazil, 2012b, p. 24). In this sense, they present themselves as privileged places for the construction of spaces for active listening, exchange of knowledge and strengthening of bonds.

More than punctual activities, they are educational and transformative practices, which promote the active participation of individuals and reinforce the sense of community belonging. By incorporating the community's communicative indexes, the workshops can qualify the intervention of the PSB, promoting more assertive, proactive and protective actions. This process requires, however, a sensitive approach that is attentive to local dynamics, as well as articulation with other sectors and public policies, in order to ensure integrated and effective responses, as discussed earlier.

In order to assist in the process of choosing topics to be worked on in the workshops with PAIF families, the Guidelines suggest topics such as: right to income transfer; the right to basic civil documentation; the right to culture, sports and leisure; rights of children and adolescents; women's rights; rights of the elderly; rights of people with disabilities, among others.

By connecting community practices to public policies, it seeks to highlight the role of workshops as instruments that not only strengthen bonds, but also promote critical reflections on social conditions and stimulate the protagonism of the subjects. In addition, the active participation of the community in the construction of these actions strengthens the social bond and amplifies the impact of social protection policies, creating a more cohesive network that is situated according to local needs and contexts.

METHODOLOGY

The methodological construction of this article is based on writing, a concept developed by Conceição Evaristo (2007), as a practice that articulates experience, subjectivity and knowledge production. Unlike a merely descriptive approach, the write-up positions the narrative as a political space of resistance, offering a way to give voice to the

subjects involved in public policies of basic social protection.

In the context of this study, writing becomes central to narrate the experience of implementing the workshops of the Pé-de-meia project at CRAS. This methodological approach connects the PAIF guidelines to the realities experienced in the territory, valuing local communicative indices and social practices shared by the community.

According to Evaristo (2009), writings go beyond the factual report, by proposing narratives in which researchers are involved, actively participating in the processes of subjectivation that emerge from the practices experienced. This methodological implication allows us to capture the intersectoral impacts of the workshops in the PSB, using the narratives of the participants as a common thread. The experiences shared during the workshops were recreated based on collectively constructed memories, dialogues and reflections, respecting the identities, contexts and singularities of the participants.

The use of writing in this study not only records the experiences, but also re-signifies the practices based on the dynamics and specificities of the territory. As Barossi (2017) argues, literary narrative in the academic field allows exposing fissures and contradictions in public policies, in addition to revealing strategies of resistance developed by the subjects involved. In the case of Pé-de-meia, the writing offers a critical lens to understand how the PAIF guidelines are transformed by local demands and practices, connecting these to the objectives of the SUAS.

Data collection was carried out through participant observations and narrative records during the workshops held at CRAS. Our methodological choice is in line with the reflections of Luís Oliveira (2009), who identifies body, condition and experience as central elements of writing. These elements are present in the narrated stories, in which the individual trajectories of the participants are intertwined with the social structures that shape their experiences within the scope of the PSB.

The collected records were organized and recreated in the form of fictionalized narratives, a resource that, according to Luis Costa (2014), expands the possibilities of analysis by intertwining individual and collective experiences. The stories, protected in their confidentiality and adapted literarily, preserve the integrity of the participants while highlighting the impacts of the workshops. Fictionalization, in this case, does not compromise veracity, but expands the power of the narratives.

These fictionalized statements are fundamental to demonstrate the power and applicability of writing in the studied context, reinforcing the ethical and political commitment that the methodology carries to not only talk about subjects, but to allow their experiences to be expressed, even if in fictional form, with their complexities and contradictions preserved.

In addition, the choice of writing as a methodological approach dialogues with the ethical principles of SUAS, which proposes a policy based on equity, social participation and the strengthening of community bonds. As Henrique Melo and Maria Godoy (2016) point out, writing is configured as a political and aesthetic act, allowing writing to be both a form of denunciation and a tool for emancipation.

By transforming experiences into narratives, writing not only records the implementation of the workshops, but also offers a critical analysis of the challenges and potentialities of intersectoral action within the scope of the SUAS. In this way, the stories narrated become part of a collective process of knowledge production, valuing subjectivity and contributing to a broader understanding of the OHP and its role in confronting social inequalities.

RESULTS AND DISCUSSIONS

When it was implemented as a public policy, the pulverization of information about the Pé-de-meia program in the official and unofficial means of communication resonated in our daily work as a demand expressed for guidance and doubts. In this scenario, it was possible to perceive that the individualized resolution of all the demands for guidance could overload the daily work, requiring the complementary construction of other intervention strategies.

Therefore, as previously pointed out, we bet on workshops with families, which have as their scope possible themes related to the family sphere and the community/territorial sphere (Brasil, 2012b). We understand that the proposal of the workshop with families, by taking the Pé-de-meia as a theme, intersects these two cuts.

At the same time, it uses the communicative indices conveyed by the community and the territory to produce qualified and effective interventions, which contribute to the construction of social protection that goes beyond prevention, promoting a strengthened family life and active citizenship. In addition, these workshops can provide the sharing of experiences, the development of negotiation and mobilization skills, with a view to exercising protagonism and autonomy.

In the process of planning and operationalizing workshops with families, Technical Guidelines Vol. 2 (Brasil, 2012b) highlight that, in order to support their realization, it is important to define the number of participants, with a minimum of 7 and a maximum of 15 people. It is recommended that the workshops be integrated by family guardians, with the prior definition of the professionals who will conduct the activities, and that they last from 60 to 120 minutes, and may take place in a single meeting or in successive meetings.

In our experience, we have gathered as much information as possible about the obstacles and barriers faced by families to access the Pé-de-meia-Programa and about effective ways to overcome these obstacles – whether institutional, access, information, technological support, among others. To publicize the workshop, we used institutional social networks and word of mouth, promoting the event that was scheduled to take place on a Friday at CRAS, open to the public and without the need for prior registration.

We were aware that this format of unrestricted opening to the public could generate difficulties during the execution of the workshop, but we were willing to mobilize the necessary resources to ensure that everything occurred satisfactorily. On the scheduled date, we received, in all, about 15 families, composed mostly of mothers and/or grandmothers, accompanied by teenage children and/or grandchildren. These adolescents were duly enrolled in high school and faced difficulties in accessing or even confirming whether they had become beneficiaries of the Pé-de-meia.

The meeting began with a brief presentation of the workshop proposal, followed by an invitation for all the people present to introduce themselves. Subsequently, there was a moment of shared reading on the main objectives of Decree No. 11,901/2024 – which regulates Law No. 14,818/2024 and institutes the Pé-de-meia Program – and its purpose.

Next, each participant was invited to report their difficulties, with emphasis on the points in which the attempt to access the law encountered barriers that made the success of the process unfeasible, whether for the family or for the adolescent.

Transforming these reports into fictionalized literary narratives, according to our methodological notes, we highlight some of the statements expressed by the families throughout the workshop. To preserve the identity of the participants, the names were modified, being replaced by names of neighborhoods in Parnaíba-PI: Pindorama, Nossa Senhora de Fátima, Mendonça Clark and Santa Luzia.

At this point in the report on the difficulties faced, Mrs. Pindorama shares that, moments before, she had left a banking institution in search of information on how to access her granddaughter's nest egg benefit. She reports, with a tone of discontent, that she had to take her granddaughter along, which resulted in a lack of class. Despite the effort, the situation remained unresolved. According to her, the bank employees informed: *It's not here, you need to look for the CRAS.*

Our Lady of Fatima, in turn, highlights her dissatisfaction with the lack of information available at the school. She explains that no one knows how to clearly guide how to access the Nest egg. The only answer he receives is: *The government took the information automatically and the families have to wait.*

These two difficulties had already been voiced in the daily life of the institution, so that we were previously able to carry out an institutional visit to the Municipal Department of Education and also to a high school, in order to understand how these institutions were organizing themselves in relation to this new public policy. They knew little or nothing about it, only that each school needed to join the program and send a list of students to the Ministry of Education and since then they have had no news about what to do and how to guide families.

Mrs. Mendonça Clark, who was accompanied by her daughter, comments briefly: *Now I see the curumin wanting to study*, pointing out that the financial incentive of the program has worked as a catalyst, motivating adolescents to return or remain in the school environment.

Mrs. Santa Luzia, present at the workshop to discover strategies for accessing the program, expresses a critical tone when she recalls: *In my time there was no such thing.* Despite recognizing the benefits of the incentive, his speech carries the mark of generational comparisons that raise reflections on changes over time.

In addition, we observed that, although the program is recognized as important in encouraging young people to return to the classroom, it is not exempt from generating concerns related to other material needs. One participant vents: *I don't have a cell phone, my son doesn't either, how am I going to do it?*

Thus, we perceive that the Nest Egg, by seeking to reduce social inequalities through education, ends up revealing inequalities of another order. Although it proposes solutions, the program encounters barriers in structural and material issues that remain complex and challenging.

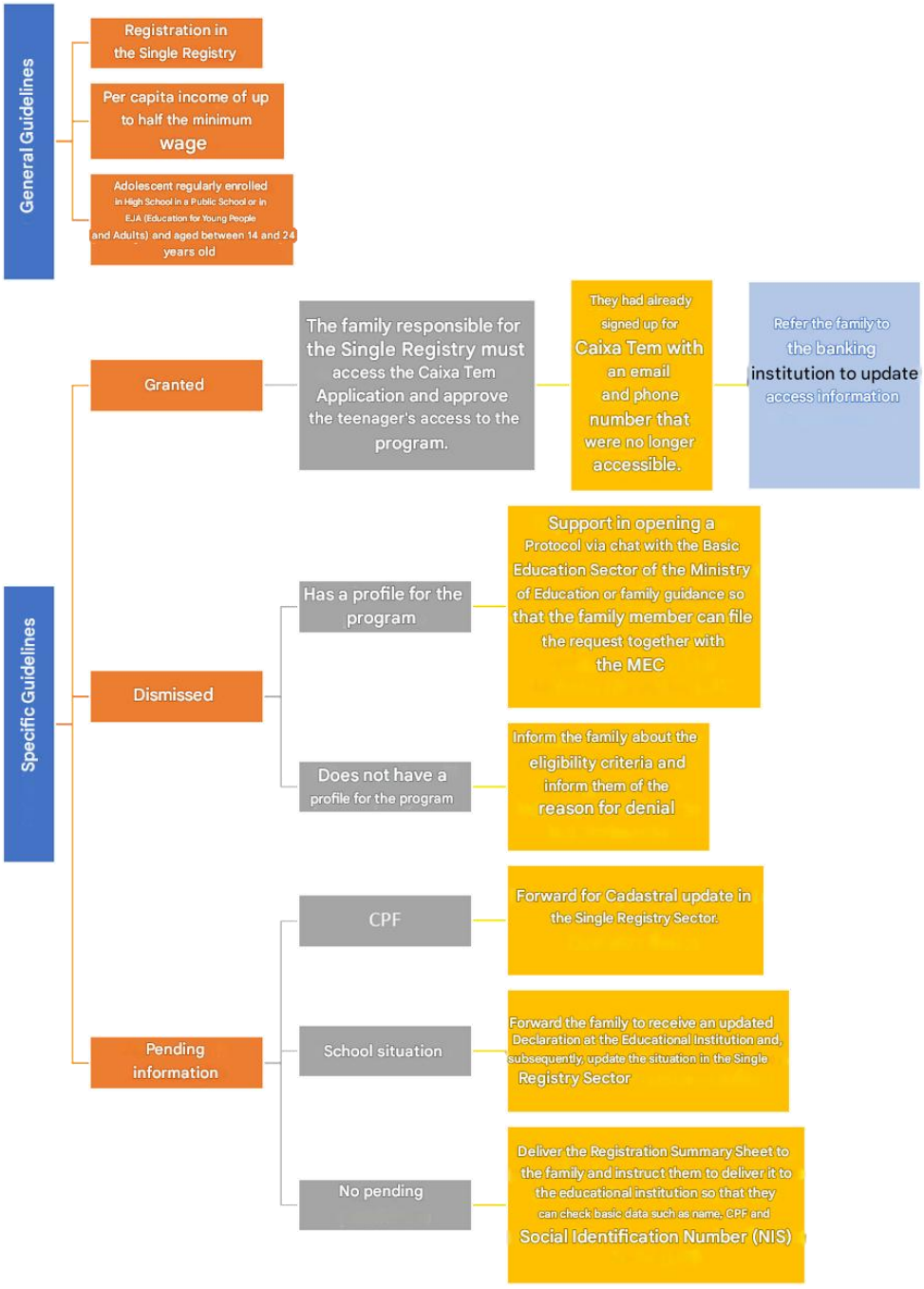
Thus, it is important to highlight that, in all group work, information constitutes the basic input to be introduced, with the objective of promoting changes in representations and practices, through a creative process that stimulates reflection, coexistence and action (Brasil, 2012b). In contrast to the hegemonic logic of specialized discourses, which attribute to technicians and social workers the knowledge to be transmitted and position families as mere receptacles, in this workshop we prioritize the appreciation of the voices of families.

They were encouraged to share not only their difficulties, but also the solutions and strategies used to overcome the obstacles they faced. Throughout the meeting, points of coincidence, divergence, identification, surprise, indignation and other affections were woven, as mentioned above. We emphasize that most of the solutions found collectively actually came from community knowledge: the arduous walk between institutions; the negatives from other sectors; cut, incomplete and discontinuous information; our institutional

visits to institutions of reference in public education policy; and the communicative indices of families, who held information on various platforms, social networks, rumors and television programs.

This process of collectivization allowed us to raise the difficulties faced, the relevant information, the strategies employed and the reapplicable guidelines. These elements were organized in a systematic way (Flowchart 1) to facilitate analysis and application.

Flow Chart 1



Source: Prepared by the authors.

According to the Technical Guidelines (Brasil, 2012b), the workshops can emphasize reflection, coexistence and action. By systematizing the results, we highlight that the workshop built with the families made it possible to materialize the expected results in these three emphases, according to the orientation of the booklets.

In the emphasis of the reflection, the development of the families' capacity to systematize and reflect on the given issue was stimulated, to know their rights, as well as to develop and strengthen social support networks. In the emphasis on coexistence, communication skills, interaction, mutual protection among family members, the ability to manifest their needs and desires and strengthening of groups in the territory that have common goals were stimulated.

Finally, with the emphasis on action, the adoption of an investigative attitude by the participants was demanded, which makes it possible to understand and problematize obstacles that prevent or hinder access to rights, seeking to develop processes of cooperation and social mobilization.

CONCLUSION

It is tempting, when reflecting on the Pé-de-meia, to limit it to an economic initiative aimed at confronting school dropout and dropout. However, this prospect is not sufficiently fruitful. Although precarious income and social vulnerability are fundamental determinants in the statistical data on school dropout and dropout – discouraging young people from staying in school – it is essential to broaden the discussion to other levels.

It is necessary to intersect data, promote the intersectoriality of policies, deterritorialize limited imaginaries, transdisciplinarize institutional knowledge and, above all, listen to community knowledge to identify the dynamics that permeate the community. The basic needs of the population are multiple and, in the case of populations in situations of social vulnerability, go beyond material survival (Andrade; Romagnoli, 2010). In this sense, the initiative, understood as a financial-educational incentive, goes beyond its initial purpose. When it is instrumentalized within the scope of the Social Assistance Policy, it takes on new contours, performs other functions and achieves varied results.

Through workshops with families and based on this experience, the institution consolidated what was later called "Sexta do Pé-de-meia", a fixed project, carried out weekly, in which people have space to express doubts, share difficulties and get guidance on access to the benefit.

As Andrade and Romagnoli (2010) point out, it is necessary to stimulate the community's ability to identify its own demands and organize itself to create the necessary

devices to improve their living conditions. It is community knowledge that shapes service, reinvents needs and drives the dissolution or reinvention of practices, workshops, actions and interventions.

The results of the program transcend the numbers and are manifested in visible and invisible dimensions of the daily life of the families, the professionals involved and the role that the institution can play in the territory. Among these results, the following stand out: the encouragement of participation and social protagonism; the development of autonomy strategies; the overcoming of institutional, social, technological and information barriers; and the engagement of the student himself in the achievement of his rights.

Its analysis highlights its power as an instrument for promoting citizenship and social transformation, especially in the context of populations in vulnerable situations. However, its effective implementation requires overcoming gaps that compromise the quality and achievement of its objectives.

One of these gaps is in the planning and execution of the workshops, which require continuous and careful preparation. The choice of themes, the techniques used and the articulation with qualified professionals are important elements that require solid institutional support. For this action to be effective and of quality, the training and continuing education of SUAS technicians must be guaranteed by social assistance managers, with access to technical and material resources that support this process.

In addition, the consolidation of the nest egg as a public policy requires a solid evidence base on its effective impacts. Quantitative and qualitative studies that evaluate the results of its implementation, in different contexts and territories, are indispensable. Researchers and institutions such as IBGE and DIEESE can play an essential role in this regard, contributing to the continuous improvement of the program and to the construction of more integrated and effective social policies.

Only by filling these gaps will it be possible to ensure that initiatives such as Pé-de-meia transcend their immediate dimension, becoming sustainable and transformative practices, aligned with the demands and potentialities of the communities they seek to serve. Thus, the urgency of public policies that articulate knowledge, resources and actions towards equity and social justice is reinforced.

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ADMINISTRATIVE STRATEGIES AND THE INTERNAL COMMUNICATION SYSTEM: LESSONS FROM THE CASE OF THE COMPANY T&L

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ABSTRACT

This scientific article presents a research with the objective of analyzing the efficiency and effectiveness of the Internal Communication System in the Company T&L. In this study, the definition of effectiveness in the communication system between the sectors of the Company was presented, as well as the level of communication and the elements that influence the sectors in their communication process. Reports on the improvement in the internal communication system, as well as its implications debated based on the view of various authors of our literature, will also be part of this one. And finally, the opinions of some will be analyzed along with the opinion of this research, concluding with the presentation of a proposal that will improve communication between all sectors of the company in order to improve respectively the other problems that are caused by the lack of good communication.

Keywords: Efficiency and effectiveness. Communication System. Internal Area.

INTRODUCTION

The proposal of this research arose from the elaboration of an organizational diagnosis applied in a company in the area of car rental in Manaus, which through data collection was presented the radar graph that enabled the visualization of all areas of the company, thus facilitating the work of analysis and interpretation of data, allowing the choice of the most critical area. Therefore, it was found necessary through this to obtain information that proves the existence of factors that can contribute to the improvement of the internal communication system in an organization, also arousing the interest of academics, with the purpose of achieving improvement in the company's internal communication system.

The objective of the article is to propose improvement in the internal communication system of the company T & L. Specifically, it was to analyze the existing communication system in the organization, the effectiveness and efficiency of the communication system identified in the organization were ascertained and finally the proposal for improvement in the communication system was presented.

Business Communication is a systemic activity, of a strategic nature, linked to the highest echelons of the company and whose objectives are: to create – where it does not yet exist or is neutral – to maintain – where it already exists – or even to change to favorable – where it is negative – the company's image with its priority audiences

For a communication to achieve its objective in a positive way and the message conveyed to have a common sense, it is necessary to align the communication with three important points: efficiency, effectiveness and effectiveness. Effectiveness is nothing more than achieving objectives that have been proposed, that is, it is the result achieved, while efficiency is the means by which it will lead to achieving such results correctly and intelligently. And effectiveness is the sum of the two points mentioned, so that it can generate a good result within organizations.

THEORETICAL FRAMEWORK

WHAT COMMUNICATION IS

Communication is everything that is intended to be transmitted or shared with the intention of understanding and understanding the message, through gestures, words, signs, etc. According to (Pimenta, 2009) the etymology of the word 'communication' is from Latin, with its historical and linguistic context *communication*, to make it common, in this way it is possible to understand that communication arises from the moment that what is transmitted,

Information has a meaning common to all those involved in the communication process: sender and receiver.

This process brings together two or several actors (senders and receivers) who exchange information. In all communication there is a sender, which transmits the coded message to the receiver. The latter decodes and interprets the message, leading him to a certain action. The receiver is the one to whom the message is intended, when there are several receivers for the message, these are defined as public. According to Chiavenato (2004, p. 304), "communication is the point that connects individuals to share feelings, ideas, practices and knowledge".

COMMUNICATION PROCESSES

For a communication to achieve its objective in a positive way and the message conveyed to have a common sense, it is necessary to align the communication with three important points: efficiency, effectiveness and effectiveness. Effectiveness is nothing more than achieving objectives that have been proposed, that is, it is the result achieved, while efficiency is the means by which it will lead to achieving such results correctly and intelligently. And effectiveness is the sum of the two points mentioned, so that it can generate a good result within organizations. The way the message is conveyed is fundamental to the organization. Inefficient communication will leave room for noise and lack of understanding between the parties.

For (Maximiano, 2000) efficiency is determined by the relationship between the results obtained and the resources invested, which may include costs, efforts or other means. The higher this ratio, the more efficient the process. To achieve high efficiency, it is essential to perform the task with as little effort and waste as possible, employing correct and intelligent methods.

Without the understanding of the action plan by all stakeholders, the goals of time, cost and quality will not come out in the shortest possible time. Therefore, it is necessary to define coherent forms of communication that must be present in operational routines, because by experiencing the procedures and organizational standards, the possibilities of errors become minimal, accelerating the process of profitable development and reducing the excessive expenditure of business resources.

According to (Pimenta, 2009) effectiveness is related to management skills in optimizing resources for communication. Such resources are the skills that each person has to read, listen and interpret the information transmitted, making communication an efficient means within organizations.

To succeed in any activity, planning is necessary, and in this stages, execution time, cost-benefit, among other means, are foreseen, which will be responsible for achieving a certain goal.

Therefore, for the defined goal to be achieved, effective communication is necessary. For (Robbins, 2002), effective communication requires that the message be conveyed in an evident and understandable way, so that the public understands what is being communicated without ambiguity. The effectiveness of communication is measured through the result of communication, it is the action expressed by the receiver. Only the transmitter of the message will be able to confirm whether it was really effective or not.

TYPES OF COMMUNICATION

For communication to reach its destination successfully, channels are used, responsible for transmitting information. These channels are divided into: verbal (oral and written), non-verbal, and symbolic. According to (Bowditch and Buono, 2002) communication involves more than just talking; it encompasses a variety of modes that can be understood in different ways by different people. Therefore, it is essential to be aware of the fact that meanings can vary and that effective communication requires attention to all available modes.

Verbal

This is divided into: oral verbal (through the emission of sounds and words) and written verbal (through registers). This approach explores the importance of discourse as a key tool for human interaction and individual growth. Verbal communication is the form frequently used during daily life, through which the message channel is transmitted with greater agility, according to (Abdikarimova; Tashieva, 2021). Verbal-oral: it is the most frequent form of communication, and occurs through the emission of sounds and words. Being one of the most effective means that exist, information transmitted through word formation. Verbal-written: it is the form of communication whose main objective is to record moments, opinions, ideas and feelings in a formal way. The most used means for this type of communication is the use of correspondence in general (business letter, letter, circular, request, telegram, e-mail, fax, bulletin board, bulletin board, posters, etc.).

This channel is widely used in the business environment, as it is through it that organizations transmit their information in a way that everyone receives and understands properly and at the same time. the importance of formal communication methods in carrying

out knowledge-based work, underlining how these structured channels support collaboration and coordination between teams." (Rogers; Li, 2020).

On this subject (Pimenta, 2009), he states that: While speech is ephemeral and flexible, writing has the ability to capture and transmit human thought in a lasting and structured way. Written language makes it possible to define styles by creating their own characteristics through the form of communication, these characteristics being particularities of a people, person or organization. Through this language it becomes possible to archive his memory, making him free in the search for new knowledge. (Rogers; Li, 2020).

Non-verbal

Nonverbal communication is the opposite of verbal communication, as it is not done with verbal signals, nor with speech or writing. This can be observed through body expressions, facials, gestures, postures, etc. On this subject (Bowditch and Buono, 2002) the distinction between sign language and broader non-verbal communication.

Although sign language is a form of nonverbal communication, the concept of nonverbal communication encompasses an even wider variety of modes of message transmission. In the organizational environment, this type of communication occurs daily, however, due to the lack of perception of this language, the message ends up going unnoticed or misinterpreted by those who receive it.

Symbolic

Communication is also carried out through symbols and acts that have meaning, without the need to use words, writing or even expressions. Pimenta (2009, p. 16) cites as examples: "the National Anthem, the Flag, the Heroes and other signs used in everyday life, such as: wedding ring (commitment), wearing black at the wake (respect, affection, pain), sending flowers (passion, admiration, gratitude, affection)". These symbologies are used to describe actions and situations that occur in the daily life of each person. According to (Bowditch and Buono, 2002) symbology is a primordial tool for communication in personal aspects that can determine how individuals are perceived in complex societies.

This type of language describes actions and represents the profile of each person, through what they have, where they are located, what they use, etc. It is important for symbolic communication to be integrated into words, so that the combination of the two does not interrupt the sending of the message.

PLANNING TOOLS

Planning before moving forward with any process is always necessary, as well as before using the tools, which are basic techniques that facilitate the processes involved. Marshall Junior. *et al*, (2008, p.181) comment on the following: "The tools used in management processes have been structured, especially from 1950 onwards, based on existing concepts and practices".

In the words of (Oliveira, 2010) The objective of planning is to create administrative methods, tools and mentalities that enable the analysis of the future consequences of current decisions, aligning with organizational objectives and improving speed, consistency, efficiency and effectiveness in future decision-making.

The use of planning tools allows a global view of the process, which allows managers to analyze processes and make decisions for improvement more quickly and coherently.

PDCA

The PDCA cycle is a management method that aims at the objective of continuous improvement of processes and activities, and makes information easier for those who use it to understand.

According to (Marshall Junior, et al., 2008) the **PDCA Cycle** as an essential management method for continuous improvement within organizations. This cycle consists of four phases: Plan, Do, Check, and Act, which together form the basis of the continuous improvement philosophy. The repetitive and continuous practice of these steps leads to systematic and sustainable improvement, as well as helping to standardize organizational practices.

Plan: They establish the objectives and goals that are intended to be achieved, so that methods, procedures and standards can be developed to achieve them. Usually, goals are unfolded from strategic planning and must be defined with important information, such as knowing what the customer wants and market trends. ***Do*** (execution): This is the implementation phase of planning. Education and training must be provided for the execution of the methods developed in the planning phase. Throughout the execution, the data that will be used in the verification phase must be collected. ***Check***: verifies that what has been executed is in accordance with the plan and the established goals. The results obtained are verified. Usually, control and monitoring tools are used for this purpose, with control charts, histograms, check sheets, among others. ***Act:*** In this phase there are two types of actions. The first is to identify the causes of unwanted effects and prevent them with corrective actions so that they do not recur in the event that the planned goals have not

been achieved. The second consists of adopting as a standard the one planned in the first phase, since the planned goals have been achieved.

Elseograma

The flowchart is a graphical representation that makes it easier to understand how business processes work. In this way, this method describes the existing processes and the correct order of how it should be practiced.

The importance of flowcharts as fundamental tools to standardize and understand processes within any organization, promoting operational efficiency and clarity (Campos 2004). The processes are identified precisely through the flowchart, which has the function of facilitating the processes.

Ishikawa Diagram

Kaoru Ishikawa immortalized the new way of thinking about management through his cause and effect diagram, or fishbone diagram as it is popularly known, with quality control as the main focus of this tool.

According to (Vieira Filho, 2010) this diagram, also called Ishikawa or Fishbone, is used to present the relationship between the result (Effect) and the factors (Causes) of the process that, for technical reasons, may have affected the result considered. There are situations in which the diagram is presented in a complex way, and when this happens, it is allowed to open a new diagram in order to unfold new causes and detail them more accurately, allowing a more thorough verification.

Check Sheet

The purpose of the check sheet is to frequently measure whether the events are correct. But one of its greatest characteristics is that it is used as a starting point in the vast majority of problem request cycles within a production sector. The check sheet is a tool used to quantify how often certain events occur in a certain period of time. (Marshall Jr *et al.* 2008).

METHODOLOGY

DOCUMENTARY ANALYSIS

According to (Gil, 2008), documentary research is a valuable method to understand historical, social and cultural contexts, requiring analytical skills to interpret materials in their original form without altering them. Thus, this technique aims to analyze all the relevant

documents of the organization, allowing the analysis and collection of information of great value for the formulation of the relative research.

Documentary information should be relevant to all types of case studies, this type of evidence source can take many forms and should be the subject of explicit data collection plans.

INTERVIEW

Interviews are crucial tools for broadening understanding of complex subjects in scientific and social studies. They help investigators to apprehend subtleties that would be difficult to achieve by other methods, becoming indispensable for the thorough and contextualized evaluation of information according to (Roesch, 2009).

The interview is an excellent research tool, it is widely used in the world of organizations, with multiple purposes.

The interview used as a field research instrument used in this study was an interview script, with 10 open and clear questions, for the collection and analysis of data and applied to four employees of the organization from different sectors with a focus on the result of the problem raised in the project.

DIRECT OBSERVATION

Observation is a method of data collection that employs the senses to acquire information about particular aspects of reality. Observation is not limited to simply seeing and listening; it involves a detailed analysis of facts or phenomena that are the focus of the study as per (Lakatos, 2009).

The direct observation technique was used to analyze and observe the Human Resources department, in more detail the company's sales sector, in order to obtain the necessary information for its improvement in communication.

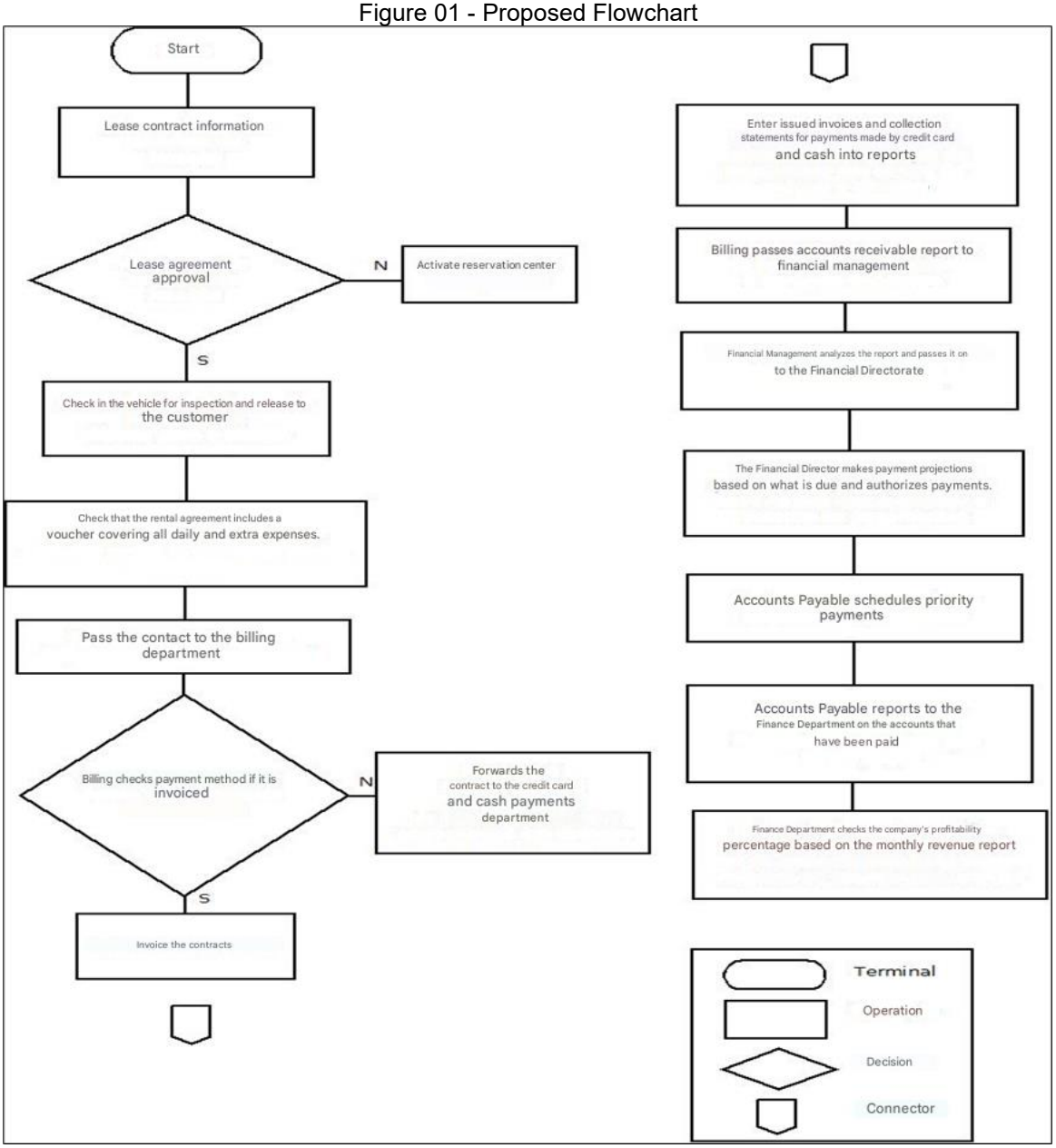
According to the direct observation research it will be to check positive and negative characteristics with regard to Communication. The current market scenario requires professionals who generate results and improve the work environment, focusing on the results they want to be obtained by the company.

INCOME STATEMENT

Communication is an extremely important tool since it is seen as a competitive advantage for organizations, increased work productivity and relationship building.

The causes that generate the Communication Failure were identified (FIG. 01). This is because the company did not have a flowchart. Employees have all the understanding of the business process existing in the company, but on a day-to-day basis there are some internal communication deficiencies, and the flowchart makes it easier to understand the execution of activities. Here is the suggested flowchart. We sought to map the entire process and in view of this, the following flowchart proposed in FIG 01 was presented:

Figure 01 - Proposed Flowchart



Source: The Authors, 2015

According to FIGURE 1, it is possible to visualize and classify what is start, operation, decision and final result, the logical sequence of the processes that occur in the Tomaz and Lucena company. The company implementing the proposed flowchart, the operational process will be more effective and objective in the routines passed on to the financial sector,

facilitating the procedure between one of the most important departments, which is the billing department. The difficulty of closing the final billing report by group, where there are problems in identifying the form of payment of lease contracts. With the implementation of three forms of payment (FIG. 01), the information passed to the financial board will no longer have divergences.

For the implementation of the project, the following planning tools were used: 5W2H, the Check Sheet, the Ishikawa Diagram and the Schedule. Among them, the Ishikawa Diagram and the Check Sheet had greater efficiency in the use of the tools.

In the 5W2H, the procedures that would be taken for the implementation of the improvement proposal were established, which determined the fulfillment of the established goals in order to achieve the project objective.

In goal 1, the analysis of internal communication was established, which we achieved the results through direct observation, failures and difficulties were identified, communication data collection, the means of communication that employees used, employees' ability to communicate and the interest on the part of management. Communication is critical to the success of any organization.

In goal 2, the efficiency and effectiveness of internal communication was ascertained, using means of documentary research, direct observation and interview. We check if the message transmitted is clear, precise and staged to the right place at the right time, the noises existing in internal communication, and the verification of the communication systems used (Unirent System). It was identified that messages are transmitted efficiently, but it is not always effective.

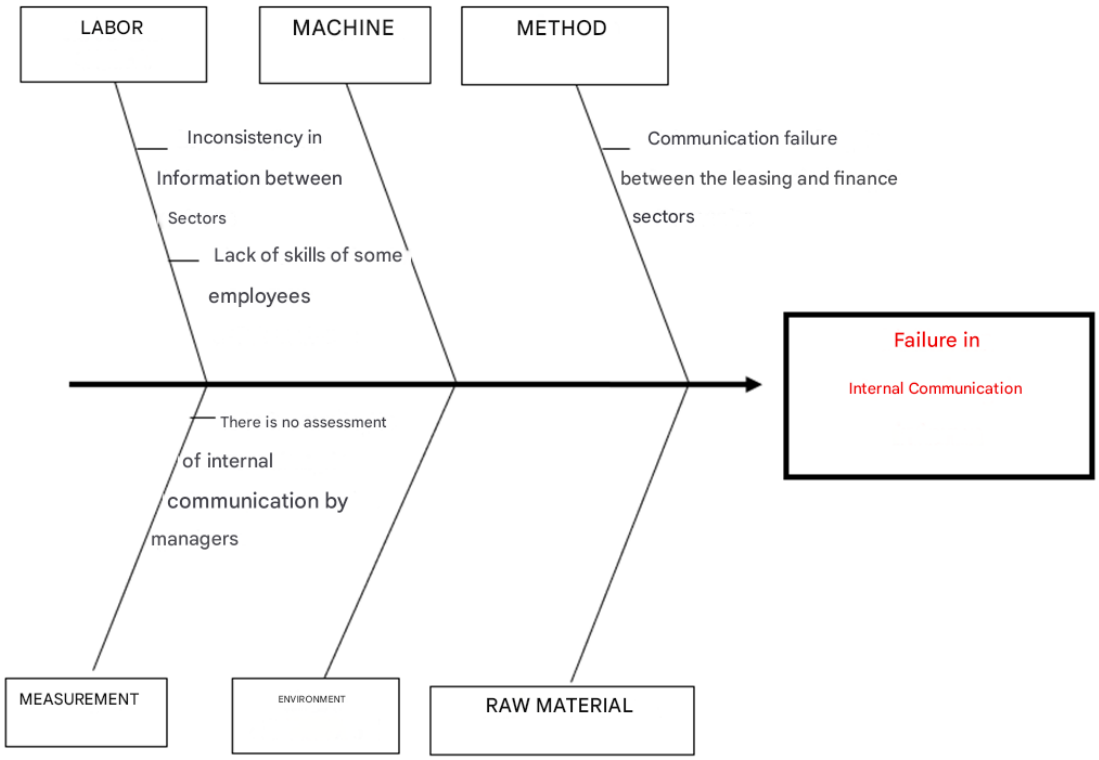
In goal 3, the improvement proposal was presented, which consisted of making employees aware of the importance of internal communication as part of strategic management in an organization and as an improvement in the relationship between employees. It was also proposed to identify employees' communication skills, test feedback, and train through courses and lectures.

The possible causes and effects were identified through the Ishikawa Diagram, which is a tool in which the causes and results considered are managed, which allows us to investigate a new verification in detail.

In goal 1, the causes that generate Communication Failure were identified (GRÁF. 01). These causes are due to the fact that there is inconsistency of information between the rental sectors and the financial sector, the messages transmitted often arrive incorrectly, which ends up harming the process of activities. This is because some employees lack the ability to communicate better accurately and clearly. We also identified that there is difficulty

in interpreting communication through internal documents and there is no evaluation of internal communication by managers. If there were a constant evaluation of the level of internal communication of the Tomaz e Lucena organization, the effects would be highly positive results.

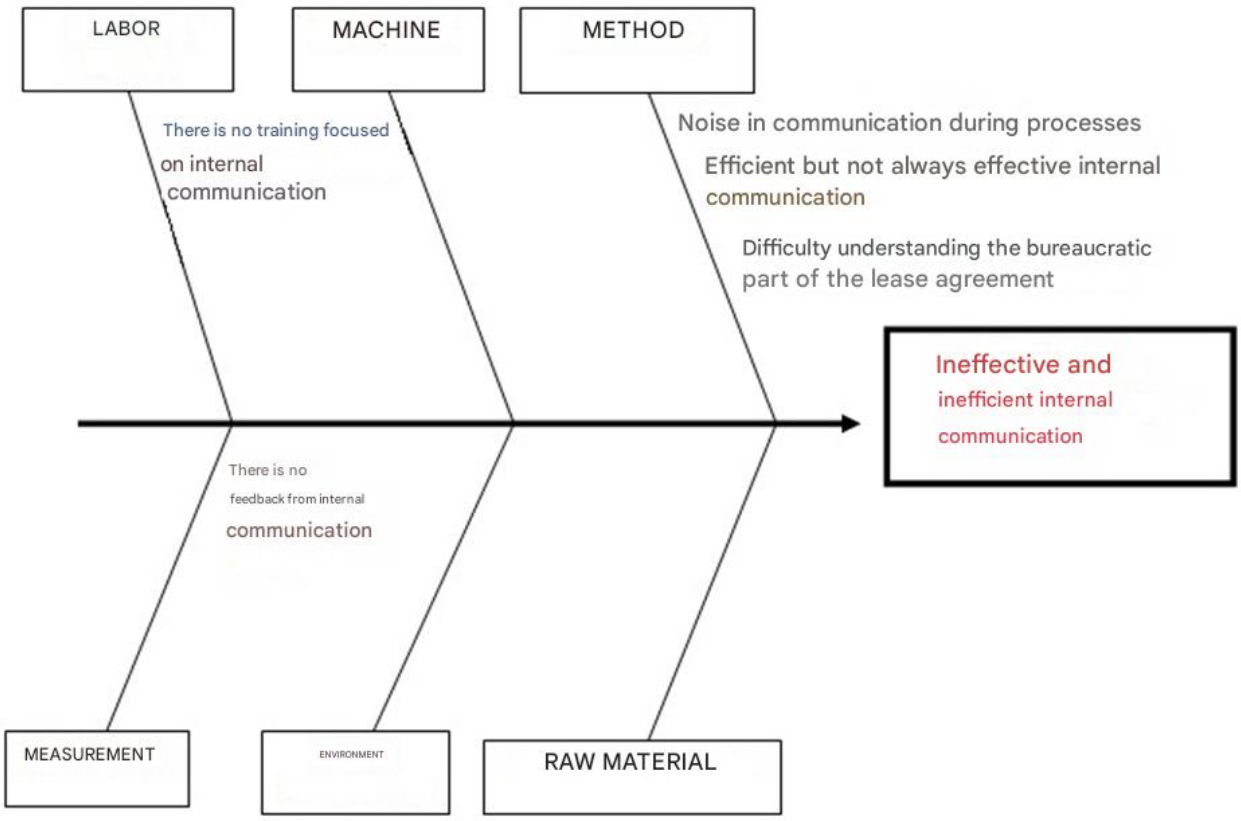
Graph 01 - Ishikawa diagram



Source: The Authors, 2023.

In goal 2, after verifying the efficiency and effectiveness of internal communication (GRÁF.02), we identified that there is no training focused on internal communication (courses, lectures), there is no communication feedback, there are communication noises during the processes, employees find it difficult to understand the bureaucratic part of the lease contracts and the internal communication carried out is efficient and not always effective, resulting in inefficiency and ineffectiveness in internal communication.

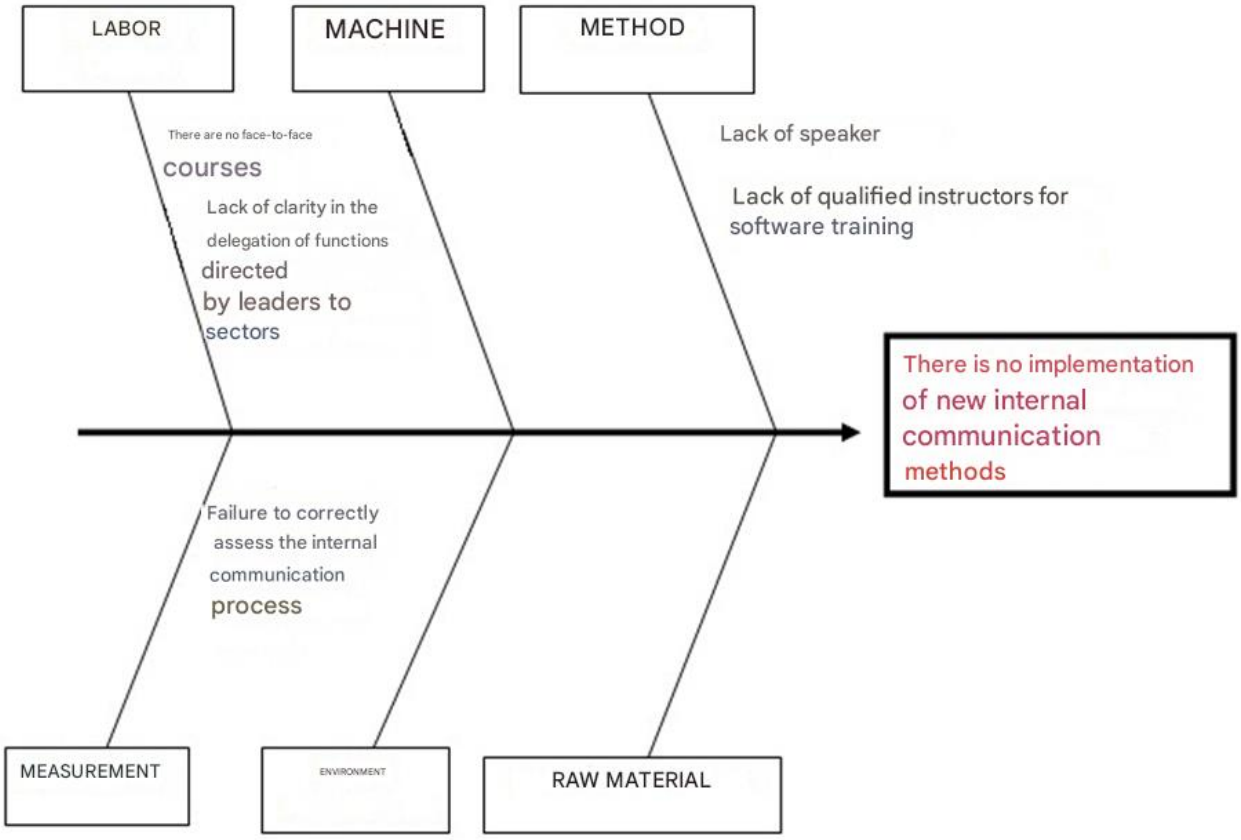
Graph 02 - Ishikawa diagram



Source: The Authors, 2023.

In goal 3, the causes found would be the lack of face-to-face courses, lack of clarity in the delegation of functions directed by leaders to the sectors, and the lack of correct evaluation of the communication process (GRÁF. 03). Lack of a speaker to give lectures on communication awareness and lack of trained instructors in software training. The effect caused is that there is no implementation of new methods of internal communication.

Graph 03 - Ishikawa diagram



Source: The Authors, 2023.

The check sheet was used to measure and list the main undesirable causes of the three goals and to take measures to solve the problems, planning a deadline and the way to be carried out, to achieve the objective of the proposal to improve T&L's internal communication.

Table 1 - Check Sheet

Folha de Verificação Responsável pela Atualização: Ismael Carlos e Miriely Gomes

Tema do Projeto: Proposta de Melhoria no Sistema de Comunicação Interna na Tomaz e Lucena

Grupo: 09

	Causas Priorizadas (escolher no mínimo 5 de cada Problema) LISTAR AS PRINCIPAIS CAUSAS	Medidas a Serem Tomadas (Alinhar, se possível com o Plano de Ação) - UMA AÇÃO	Responsável	Cronograma					Item de Verificação (método para medir)
				Agosto	Setembro	Outubro	Novembro	Dezembro	
Meta 01	Incoerência das informações	Entrevistar os colaboradoes	Ismael			x			Entrevista
	Falta de habilidade de alguns colaboradores	LNT	Miriely			x			Identificar quais são as maiores nescessidades
	Falha de comunicação via documentos internos	Melhorar as fichas de Inspenções dos veículos	Ismael			x			Trazer informações mais claras e objetivas na F.I
	Falha de comunicação entre os setores de locação e financeiro	Mapear os processos de comunicação dos dois setores	Ismael			x			Análise documental
	Não há avaliação sobre comunicação interna por parte dos gestores	Programar reuniões mensais	Ismael			x			Conscientizar os gestores
Meta 02	Não há treinamentos voltados para a comunicação interna	Identificar os tipos de treinamentos	Miriely				x		Programar treinamentos
	Ruídos na comunicação durante os processos	Sensibilizar o comportamento das pesoas no ambiente de trabalho	Ismael				x		Palestra sobre comportamento organizacional
	Comunicação interna é realizada com eficiência mais nem sempre é eficaz	Sensibilizar os funcionarios a serem proativos em suas atividades	Ismael				x		Fazer avaliação de atividades realizadas
	Dificuldade de entendimento na parte burocrática nos contratos de locação	Treinar os agentes de locação, para entenderem as leis contratuais do ramo de locação	Ismael				x		Trazer palestrantes capacitados
	Não a feedbaks da Comunicação Interna entre os setores	Plano de acompanhamento	Miriely				x		Relatórios de acompanhamento
Meta 03	Não há cursos presenciais	Pesquisar cursos nescesários e disponibilizar	Miriely				x		Análise documental
	Falta de clareza na delegação das funções direcionadas pelos Gerentes dos setores	Fazer reunões semanais	Miriely				x		Agendar reunões
	Falta de palestrantes	Contratar palestrantes	Miriely				x		Fazer entrevistas
	Falta de instrutores capacitados nos treinamentos dos sofwares	Contratar instrutores	Miriely				x		Pesquisar intrutores específicos nos software internos
	A não avaliação correta sobre o processo de Comunicação Interna	Programar treinamentos	Miriely				x		Entrevista

Source: The Authors, 2023.

The theme on Internal Communication chosen brought us the perception that managers should give more importance to these communication systems, because it is a fundamental element in the execution of the processes that give movement to the company,

in addition to building relationships in the organization. The contribution of this work to our learning highlighted that everything that is done has to have a positive result

FINAL CONSIDERATIONS AND RECOMMENDATIONS

The study enabled us to verify the importance of internal communication as a management strategy for organizations. The subject researched identified that with ineffective internal communication, organizations cannot achieve their goal and affects their market positioning.

Communication is an extremely important tool since it is seen as a competitive advantage for organizations, increased work productivity and relationship building. Employees transmit the messages and they must be decoded and received intelligently and correctly so that the process is monitored and the activities are carried out effectively.

The objectives of the project were not fully achieved, as it was under analysis for its implementation. It was recommended that the management of the company Tomaz e Lucena see communication as a strategy tool and that they monitor internal communication between employees and between sectors. If employees do not have mastery of communication, processes fail and consequently hinder execution, which often give problems that are irreversible. It is clear that it is not enough just to implement the project. Rather, to carry it out effectively and intelligently. Failures in internal communication, the inappropriate means of passing on information can cause inconveniences that are difficult to solve, which slows down the processes in the execution of tasks.

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ANTI-RACISM THROUGH IMAGES: STUDY OF THE PEDAGOGICAL DIDACTIC MATERIAL OF THE MUNICIPAL EDUCATION NETWORK OF SANTO ESTEVÃO-BA

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ABSTRACT

In this text, the analysis of an image is presented, in this specific case, a comic strip that brings the discussion about the myth of reverse racism, it is part of the notebook of remote activities for elementary school final years (6th to 9th grade) in the municipality of Santo Estevão-Ba, specifically the edition notebook 3 The face of Racism in Brazil. These notebooks considered by the municipal school network of Santo Estevão-Ba, as a pedagogical didactic material, are objects of research by the author in the academic master's degree in education at the State University of Feira de Santana.

The object of analysis of this text is a comic strip that contains a dialogue between young people, the girl Niara, created by the cartoonist Aroeira, has been bringing a dialogue where the questioning of reverse racism appears.

As an imagetic resource, the comic strip analyzed has a discursive potential when dealing with the racial theme, as a paradox, a contradiction, using a sarcastic message in the content of the phrase "reverse racism there" [...], a simple and provocative reading for the student's understanding. The comic strip analyzed as an image demonstrates the intrinsic relationship between Education and Drawing, which should be valued in the field of didactic materials, and its discursiveness.

Keywords: Image Analysis. Discourse Analysis. Myth of Reverse Racism.

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INTRODUCTION

The present work intends to bring a reflection on the use of images in a pedagogical didactic material built during the pandemic period, regarding the field of study of the education of ethnic-racial relations and images. These notebooks were part of the emergency actions of the municipality of Santo Estevão-Ba, when school activities were suspended in March 2020.

The qualitative and documentary research will take images in their pedagogical function to think about the Education of ethnic-racial relations and the importance of studies with racial cutouts through images, these as elements loaded with meanings will be discussed through the Discourse Analysis (DA) of the French line of Pêcheux.

For this text, the dimension of Education and Drawing will be explored, the latter understood as the construction of knowledge, Drawing as an image here in this study will be highlighted in the ideas of Joly (1994, p. 13), "it indicates something that, although it does not always refer to the visible, borrows some traits from the visual and, in any case, depends on the production of a subject: imaginary or concrete, the image passes through someone who produces and recognizes it".

In this study, which takes for analysis an image, exemplified in a comic strip, represented here as an imagetic element, it has a content that deals with reverse racism as a myth, a discussion that integrates the field of racial discussions in education. Within this prerogative, it is intended to discuss how the comic strip and the dialogue it contains is producing meanings, in the dialogical relationship of Discourse Analysis (DA) of the French line of Pêcheux, the image is understood as a discourse in movement within the understanding of problematizing the ways of reading, Orlandi (2000).

Bringing this study, a didactic production, elaborated by educators, has as its research objective, now in this textual cut, to analyze the discursive potential of the imagetic text through the comic strip as a didactic resource that brings a playful proposal to work on the racial theme, the myth of reverse racism.

GETTING TO KNOW THE OBJECT OF STUDY: THE REMOTE ACTIVITIES NOTEBOOK THE FACE OF RACISM IN BRAZIL

For this study, the discussions are concentrated in the notebooks of issue number 3 intended for students in the 6th and 7th grades of the final years of Elementary School. The notebook is distributed by area of knowledge, Humanities, Exact Sciences and Languages, it is important to mention that unlike textbooks that are part of a government policy, the PNLD, this material has no commercial destination, it is not linked to publishers,

the questions were built by teachers from each area of knowledge (Humanities, Exact Sciences and Languages).

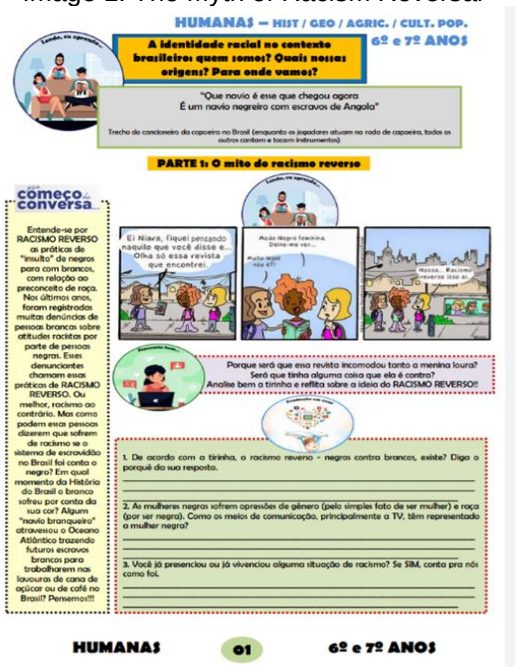
We can say that notebook 3 is crossed in contributing to the historical understanding of the past of blacks in Brazil, mainly because it portrays racial identity. For Gomes (2005), discussions about identities have their complexities, due to the additions that need to be made when specifying which identities one wants to discuss, while formations in their complexities, are added to it the "adjectives, personal, social, ethnic, black, gender, youth, professional" etc. (Gomes, 2005, p.40).

For Kabele Munanga (2005), the construction of black identity in Brazil should be understood in its political sense, as a:

> awareness of an ethnic-racial segment excluded from participation in society, for which economically, as free labor as slaves, and also culturally, at all times in the history of Brazil. (Munanga, 2005:187)

Reverse racism is not a concept to adjectivate any kind of discriminatory practice from blacks to whites, because they have not historically been judged due to their physical appearance, according to Gomes (2005), blacks were adjectivated by racist postures as "good" or "bad", such as Afro hair, being identified by racist postures as "hard hair".

Image 1: The Myth of Racism Reversal



Source: Caderno A cara do Racismo no Brasil. (SANTO ESTEVÃO, 2020, p.1

The character of this comic is Niara, a character created by cartoonist Renato Aroeira, a black teenager full of reflections and who explains, in a didactic way, racial and social inequalities in Brazil, we point out a brief description of the elements of the image.

Exploring the colors, the cartoonist presents characters with young characteristics, such as Niara with orange hair and noticeable curly, black skin, all are in an environment outside the school space, on a sidewalk, the boy with brown hair, skin with a lighter shade than Niara's, brings in his hands a black women's fashion magazine and questions Niara on a subject that both have already discussed, the way the boy arrives with the magazine, it is as if he found something that was good for the girl to see, an interesting subject, Niara begins to read the magazine enthusiastically and checking the content, this reading is observed with strangeness, by the white character with yellow hair, with some indignation.

The indignation of the yellow-haired girl is noticed and characterized by the raised eyebrows, indicating a disgruntled expression, the white girl then questions the content of the magazine, as it is a magazine of black models, and states: "Our reverse racism there!". The image and reading of the comic strip provoke meanings about the place of being black in the construction of Brazilian history that permeate the exclusion of beauty media, stereotypes about the black body, structural racism and the invisibility of the role of whiteness in this social place that was projected for black men and women in Brazil.

According to Orlandi (2000), imagetic reading through DA allows the analyst to "displace the relationship between form and content, through the elaboration of the material form, putting in its place the subject/meaning relationship, thinking about meaning in its contradictory material dimension". (Orlandi, 2000, pg13).

When we combine image analysis with discourse analysis discussions, in the didactic material, we intend to demonstrate that the image being a language, this one loaded with meanings, it is soon noticeable that the author of the comic strip built through the image a sequence of reflections, that the ideology of racial superiority is present, based on white supremacy, which has a strong narcissistic component (Bento, 2003).

Following the dialogue of the strip, the white girl questions the place of the black woman in a beauty magazine, it is noted that Niara's pleasure is the result of the lack of protagonism of the black body in this place of beauty, in contrast to this, it arises to the negative interpellation of the white girl, demonstrating the ideology of whiteness in Brazil (Bento, 2003) for the white man to leave the place of normality in his eyes, is to leave the standard, hence the statement*: "reverse racism, that's it"* in the dialogue of the white girl.

THE EMERGENCY INSTITUTIONAL PLAN: EDUCATION MOBILIZING A NETWORK OF KNOWLEDGE IN TIMES OF COVID-19

Brazilian education has faced a great challenge since March 2020, due to the Covid-19 Pandemic, due to the need for an almost instantaneous readaptation to virtual teaching models to continue the progress of the school year. States and municipalities continued in the struggle to create strategies to maintain education, even with all the impasses of this model. Thus, they created educational projects that, among other things, the production of new teaching materials.

In view of the public health emergency, the municipalities focused on the information and recommendations made available by official bodies such as: the World Health Organization (WHO), the Ministry of Health (MS), the Ministry of Education (MEC), the National Union of Municipal Education Directors (UNDIME) under the aegis of Provisional Measure 934, of April 1, 2020, establishes exceptional rules on the academic year of basic education and higher education resulting from the measures to face the public health emergency situation dealt with by Law No. 13,979, of February 6, 2020, in these terms the educational technical team of the city of Santo Estevão prepared the *Municipal Contingency Plan to face covid-19 for education.*

The plan was prepared in an expanded meeting with the participation of members of the Municipal Department of Education of Santo Estevão, Municipal Council of Education (CME) and School Feeding Council (CAE) and the Council for Monitoring and Social Control of FUNDEB (CACS-FUNDEB), whose purpose is to operationalize services of the Municipal Education System, with the objective of offering guidelines for the continuity of the functioning of education and ensuring the the right to education provided for in the Federal Constitution and in the Law of Guidelines and Bases of Education (LDB), taking into account the exceptional nature of the pandemic experienced by society due to the health problems caused by covid-19.

The work proposal for the Emergency Plan was then presented to the professionals of the municipal education network, and was institutionalized and standardized by the Official Gazette of the Municipality in 2020. Among the actions proposed by this plan is the preparation of notebooks with activities to be developed remotely. According to the Official Gazette, which regulates the notebooks as remote activities, says that:

> The year 2020-2021 (curricular continuum) was made available to all students in the network. Groups were created in the watsapp app for each class, with a teacher responsible for mediating and answering questions about the activities proposed in each notebook. After the delivery of the activities, the teacher corrects and prepares the student's descriptive opinion. (Santo Estevão, 2021)

The intention, then, is to replace face-to-face teaching in municipal schools to continue schooling, now remotely, thus mobilizing a network of knowledge in times of Covid-19, with one of the main objectives being to define strategies for the fulfillment of the 800-hour workload of the school year, taking into account the safety rules imposed by the pandemic.

In this way, the notebooks can be classified as didactic material with the purpose of evaluating the student and their learning while the pandemic lasts, and our purpose in this text is to discuss the pedagogical potential of the notebooks and the meanings produced about the black person in notebook number 3, The face of racism in Brazil.

In theory, the structure of the activities is innovative, notably because the proposal is for didactic material aimed at the school community, aiming to strengthen learning during the period of suspension of face-to-face teaching, at this time of pandemic.

The municipal school network of Santo Estevão in the public network serves students of different cultural belongings and who need to see themselves represented.

In view of the empirical material, we cannot fail to consider important issues, such as Education for Ethnic-Racial Relations (ERER), this knowledge must be present and worked on in all pedagogical activities and teaching materials, with a view to a citizenship and anti-racist formation, which guarantees an identity and cultural formation to students. In this aspect, the present study proposes the following problematization: What meanings do the images that are in the remote activity notebooks produce for an education of ethnic-racial relations?

To answer it, we rely on the theoretical-methodological device of Discourse Analysis (DA) of Peucheuxitian orientation in order to understand discourses that, together with the analysis of images (Panofisktinian) will give us subsidies to discuss the notions of subject, discourse and silencing (ORLANDI, 2007)

EDUCATION FOR ETHNIC-RACIAL RELATIONS

Education for Ethnic-Racial Relations is a theme widely discussed by many theorists in the field of education, and also supported by laws nº 10.639/03,

> "Art. 26-A. In elementary and secondary schools, official and private, the teaching of Afro-Brazilian History and Culture becomes mandatory.
> § 1 The syllabus referred to in the caput of this article will include the study of the History of Africa and Africans, the struggle of blacks in Brazil, black Brazilian culture and blacks in the formation of national society, rescuing the contribution of black people in the social, economic and political areas pertinent to the History of Brazil.
> § 2 The contents related to Afro-Brazilian History and Culture will be taught within the scope of the entire school curriculum, especially in the areas of Art Education and Brazilian Literature and History. (BRAZIL, 2003)

And 11.645/08, which amend the Law of Guidelines and Bases of National Education, including, the items:

> § 1 The syllabus referred to in this article will include various aspects of the history and culture that characterize the formation of the Brazilian population, based on these two ethnic groups, such as the study of the history of Africa and Africans, the struggle of blacks and indigenous peoples in Brazil, the black and indigenous Brazilian culture and the black and the Indian in the formation of national society, rescuing his contributions in the social, economic and political areas, pertinent to the history of Brazil.
> § 2 The contents referring to Afro-Brazilian history and culture and of Brazilian indigenous peoples will be taught within the scope of the entire school curriculum, especially in the areas of artistic education and Brazilian literature and history." (BRAZIL, 2008).

With this, the teaching of Afro-Brazilian, African and Indigenous History and Culture in Brazilian Basic Education becomes mandatory. This was one of the most important achievements of popular movements in favor of an anti-racist education, which affirms the relevance of its debate and approach in basic education, to overcome discriminatory actions that create an inferior social image of blacks and indigenous people.

When dealing with ethnic-racial relations in the curricular references of Elementary School Final Years in the municipality of Santo Estevão, we note, within the scope of this discussion, that there is the inclusion of the theme in question, highlighting the importance of ethnic-racial relations and the survey of reflections about this study in the document,

> Every reference is a guide, not a recipe to be applied. Therefore, it is important to have knowledge about the population constitution. It is from it that the guiding cultural subsidies for the elaboration of the documents that guide the curricular proposal of the municipality and the schools will come, with attention to the knowledge produced that emerges in the daily life of the communities. In it, contradictions, inequalities and individual and collective issues marked by prejudices, stereotypes and structural racism in Brazilian society will appear. These moments of tension will serve as material for the elaboration of socially alive issues – that is, contextualized approaches to real and complex problems, which will lead to a critical formation of reality and should be treated in an interdisciplinary way, demanding integration between teachers and joint planning. (Santo Estevão, 2020, pg 37)

However, when we came into contact with this material, we observed that there was no in-depth study on the theme of black ethnicity, the focus of this study. Nor was Law 10.639/03, which aims to disseminate knowledge about the history of Africa and its descendants in the diaspora, with the intention of showing the historical contribution of blacks in the formation of our country and disseminating information that contributes to the elimination of inequalities and racial discrimination.

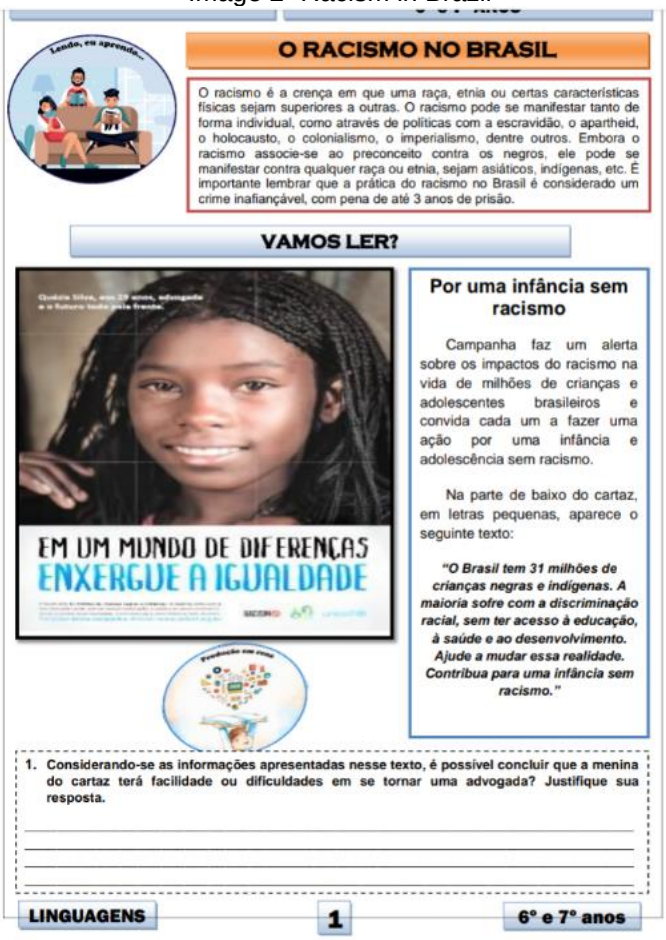
In this sense, in relation to the ethnic-racial perspective, the didactic material provided by the Municipality of Santo Estevão still needs to be deepened in the curricular issues that deal with the Education of Ethnic-Racial Relations for Elementary School Final Years. Hence the importance of advancing in the analysis of a didactic material built by the Municipal Education Network of Santo Estevão observing several aspects, and here we take as a specific object the discussions of image representations on Cultural and Racial Diversity. We reinforce to teachers the importance of studying and debating the construction of a didactic material consistent in the proposal of education for racial equality, considering that, since 1988, the Brazilian Constitution has enshrined the principle of equality or non-discrimination, in its article 5, according to which "everyone is equal before the law, without distinction of any nature"; and the crimes resulting from prejudice of race or color were defined by the Law 7.716/1989.

Significant advances also came in the wake of Decree 4.886/03 that enacts the National Policy for the Promotion of Racial Equality (BRASIL, 2003), with affirmative actions aimed at balancing inequalities associated with race and ethnicity, and with the Statute of Racial Equality - Law 12.288/2010, (BRASIL, 2010). These documents were guidelines for the guarantee and defense of individual, collective and diffuse rights and for combating discrimination and other forms of ethnic-racial and religious intolerance.

THE ANALYSIS OF THE IMAGE OF THE FRATERNITY CAMPAIGN

About image 2, inserted in the language area notebook, which brings *Racism in Brazil as its* theme. The image is of a black child, the slogan of the 2010 campaign of the United Nations International Children's Emergency Fund (UNICEF), the national campaign for a childhood without racism.

Image 2- Racism in Brazil



Source: Notebook 3, language section, pg.1

The section of the languages section begins the discussion on racism in Brazil, using a photo extracted from the campaign "In a World of Differences, See Equality" partnership between the MEC (Ministry of Education) and Unicef, objective of the campaign launched on November 29, 2010, to warn about the impact of racism in schools and promote initiatives to reduce inequalities (Black and Indigenous Children. Available at: https://noticias.cancaonova.com/brasil/unicef-launches-campaign-to-end--prejudice-against-children/, accessed on 25/08/2021).

It is noticeable that in every analysis of images, it is necessary to recognize their history, when we analyze photographs, paintings, we think about historical representations, as well as strips, cartoons, cartoons, open a tangle of possibilities, they offer elements capable of leading to various readings, being in fact a pertinent objective to recognize the intrinsic values, we then analyze this image of the language notebook as belonging to the third level, as explained by Panofsky (1986, p. 51)

> Intrinsic meaning or content: it is apprehended by the determination of those underlying principles that reveal the basic attitude of a nation, of a period, of a social class, of a religious or philosophical belief – qualified by a personality and condensed into a work.

Next to the image of the black child there is a text alluding to the campaign with the title *for a childhood without racism*, being an example of how the reading of the image combined with the verbal text, allows us to understand the negative impact that racism brings when suffered in childhood, especially at school age.

The question proposed to fix the learning is as follows:

> Question 1 - Considering the information presented in this text, is it possible to conclude that the girl in the poster will have ease or difficulties in becoming a lawyer? Justify your answer.
> (Notebook 3, Humanities section, pg.1)

We observed that there is a complementation of information between the elements of the image of the black girl, the reading of the text and the proposed question, a form of contribution to an anti-racist Education. The slogan "In a world of differences, see Equality", complements the discussion and makes the student strengthen his black identity and the conception of the opportunity for growth through studies for black children.

To perceive the discourse of the symbolic as Pêcheux (1991, pg.119) says

> To accept all these questions as serious, and not as folkloric or as "annexes to literature", means not to treat language as a mere medium, which allows us to describe these processes (a mirroring of these processes), but rather as a field of forces constitutive of these processes, through "language games", the metaphorical treading of meanings and the paradoxes of enunciation, that discursiveness works in and against the "bodies" of rules of each language.

We can conclude that if it is a campaign alluding to a government agency, talking about equality for black children, often submerged in the discourse with a certain naturalness, the correct thing would be to talk about equity, in the sense of fostering public policies and existing laws on the Education of ethnic-racial relations.

In this way, we can say that the questions proposed to the student demonstrate the lack of a political and ideological analysis of the image, which points us to the problem of working with these teachers to intentionally look at the images used in the didactic material.

We understand in this study that,

> For educational practice, it is of great importance that visual resources are used as methodologies, in order to streamline the teaching-learning process. Thus, as pedagogical resources, the educational system makes use of didactic materials in which images appear in their various forms, such as painting, photography, drawing, virtual images, among others that are of great use for content learning (SOUZA, 2016, p. 107).

FINAL CONSIDERATIONS

Most students in the public school system are an audience of black boys and girls, and it is opportune to use means such as visual language, such as comic strips to bring them closer to discussions such as the one posed by the activity of notebook 3 and analyzed here in this text. Reverse racism being placed as a myth, and exemplified through visual language, brings together and simplifies the understanding of this complexity, in a historical and social way.

To deny reverse racism is to contribute to the school as an institution going against this possible place of perpetuation of inequalities, because for a long time the absence of Afro-Brazilian, African and indigenous culture in school curricula has historically denied and/or repressed the values and traditions of Afro-Brazilians and other discriminated groups in Brazilian society.

In view of these considerations, we emphasize the importance of the imagetic representations about cultural diversity and ethnic-racial relations in the analyzed notebook and in the selected image, as the image that is dialoguing about the myth of reverse racism. Thus, we conclude that the remote activities notebook, *The face of racism in Brazil,* through the analyzed comic strip is a didactic material that, even in an incipient way, explores images and works on ethnic-racial relations, contributing to the discussion and enhancing the teacher's work with the confrontation of racism and ethnic issues.

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BRIEF REVIEW OF CONCEPTS ENGINEERING OF HADFIELD STEEL PROPERTIES AND APPLICATIONS

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ABSTRACT

Hadfield manganese austenitic steel, characterized by high strength and exceptional abrasion resistance, is widely employed in industries such as mining, cement, and railways. Its composition, typically 1–1.4 wt% carbon and 10–14 wt% manganese, ensures superior wear resistance and ductility under stress. The steel's remarkable work-hardening ability, attributed to dislocation accumulation and twinning, enhances its mechanical properties. However, challenges such as carbide precipitation at grain boundaries lead to embrittlement and reduced weldability, necessitating precise control during casting and heat treatment. Key methods such as solutionizing, rapid quenching, and heat treatment at temperatures ranging from 950°C to 1000°C are essential to dissolve carbides and improve mechanical properties. The steel's machinability is hindered by its high strain-hardening capacity and low thermal conductivity, resulting in rapid tool wear. To address this, hot machining and advanced cutting tools, such as carbide and cubic boron nitride, are employed to improve performance. Despite these challenges, Hadfield steel remains the material of choice for wear applications due to its unique combination of toughness and work-hardening properties. Ongoing research aims to optimize its performance, particularly in high-abrasion and impact conditions. The integration of modern techniques like additive manufacturing and cryogenic treatments has been highlighted as potential solutions to further enhance its properties.

Keywords: Abrasion. Carbide precipitation. Hadfield steel. Heat treatment. Wear resistance.

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INTRODUCTION

Hadfield steel, a high-manganese alloy, is extensively used in industries like mining, metallurgy, and railway engineering due to its remarkable wear resistance under high-stress conditions. Its exceptional work-hardening capabilities, primarily attributed to dislocation accumulation, twinning, and dynamic strain aging, significantly improve its mechanical properties during service (Dastur & Leslie, 1981). Despite these advantages, recent research has focused on optimizing its performance through surface hardening, alloying, and impurity reduction, as well as understanding its deformation mechanisms and microstructural changes, particularly during solidification and cooling. Cooling rates during crystallization and post-solidification phase separation critically influence the microstructure, with faster cooling rates reducing austenite grain size and mitigating shrinkage stresses, while phase separation controls the formation and distribution of carbides (Gorlenko, Vdovin, & Feoktistov, 2016). However, carbide precipitation at grain boundaries remains a major issue, leading to embrittlement, reduced impact resistance, and poor weldability. Controlling welding temperatures, utilizing rapid cooling methods like solutionizing, and maintaining an austenitic microstructure are essential to mitigate carbide formation. In machining, Hadfield steel's high strain-hardening capacity, low thermal conductivity, and toughness present significant challenges, resulting in rapid tool wear and surface hardening (Silva, Teixeira, Costa, Corrêa, & Ribeiro, 2024; Teixeira, Damasceno, & de Lacerda, 2024). Hot machining and the use of advanced cutting tools, such as coated carbide and cubic boron nitride, improve tool life and surface finish. Despite these machining and welding challenges, Hadfield steel remains the material of choice for demanding wear applications, due to its unique combination of toughness and work-hardening properties. Ongoing research aims to enhance its performance in abrasive and impact wear conditions, particularly in mining and mineral processing industries.

ENGINEERING OF HADFIELD MANGANESE AUSTENITIC STEEL: PROPERTIES AND APPLICATIONS

Hadfield manganese austenitic steel is a high-strength, abrasion-resistant alloy characterized by its toughness and exceptional work-hardening ability, widely used in mining, cement, and railway industries. Its composition, typically 1–1.4 wt% carbon and 10–14 wt% manganese, ensures superior wear resistance and ductility under stress. Precision in casting is critical, with controlled melting temperatures in induction furnaces and the use of molding materials like olivine or chromite sand influencing grain size and mechanical properties. Manganese stabilizes austenite and enhances abrasion resistance, while

carbon and chromium influence carbide formation, wear resistance, and toughness. Optimized heat treatments and alloying are essential to balance mechanical properties and prevent defects, reinforcing its relevance in engineering applications (Minatto, Costaa, & Daleffe, 2020; Sabzi & Farzam, 2019).

Hadfield manganese austenitic steel exhibits a fully austenitic microstructure, though casting processes often lead to carbide formation at grain boundaries and within grains due to carbon segregation. These carbides negatively impact toughness and ductility, especially in thick sections where low thermal conductivity reduces quenching rates. Heat treatments such as austenitizing at 950°C–1000°C and rapid cooling in water or salt baths are employed to dissolve carbides and enhance mechanical properties. Dislocation accumulation and mechanical twinning, rather than martensitic transformations, are the primary mechanisms driving work hardening, which is critical for wear resistance (Silva, Teixeira, Siqueira, & Lacerda, 2024; Teixeira, de Lacerda, Florencio, et al., 2023). Surface treatments like shot peening improve surface hardness, but this effect diminishes toward the softer core (Nascimento & Teixeira, 2024). Additionally, improper heat treatment can result in brittle phases like Fe_3C or pearlite, further affecting performance. Effective thermal management during heat treatment is essential to prevent defects caused by thermal expansion and low thermal conductivity, particularly in high-carbon alloys (Okechukwu et al., 2017).

Hadfield steel faces challenges in weldability due to carbide precipitation, particularly at grain boundaries, leading to embrittlement and brittleness in the heat-affected zone (HAZ). Proper temperature control during welding and heat treatment, such as solutionizing at 1050°C followed by rapid quenching, helps maintain its austenitic microstructure. Its machinability is hindered by high strain-hardening capacity and low thermal conductivity, causing rapid tool wear, though hot machining (300°C–420°C) and advanced cutting tools improve performance. Despite these issues, Hadfield steel remains the material of choice for wear applications due to its unique combination of toughness and work-hardening properties, surpassing alternatives like austempered ductile iron and high-chromium white cast iron. Researchers advocate for economical hardfaced wear components tailored to abrasive and impact-intensive industries (Okechukwu et al., 2017).

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The study conducted by Pinto Junior, Teixeira, and Silva (2024) involved a bibliometric analysis of scientific literature on steel microstructures, mechanical properties, and processing techniques. Utilizing databases such as Taylor & Francis, Springer, Wiley, and ScienceDirect, 11 out of 32 articles were selected for an integrative review following the PRISMA protocol. Key findings highlighted the significant influence of processing methods, heat treatments, and alloy compositions on steel properties, including high-strength, wear-resistant, and Hadfield steels. Topics such as deformation-induced hardening, additive manufacturing, and cryogenic treatments were emphasized. The results underscore the pivotal role of microstructural evolution in enhancing mechanical and corrosion resistance properties, reflecting ongoing advancements in metallurgy and materials engineering.

FINAL CONSIDERATIONS

In conclusion, Hadfield manganese austenitic steel continues to be a vital material in engineering applications, particularly in industries that demand high wear resistance and toughness, such as mining, railway, and cement sectors. Despite its remarkable properties, the challenges related to carbide precipitation and reduced machinability remain a significant focus of research. Advances in heat treatment and alloying techniques, such as solutionizing and rapid quenching, have proven to be effective in controlling carbide formation and enhancing the mechanical properties of the steel. Furthermore, surface treatments like shot peening have been explored to improve surface hardness, although their benefits decrease towards the material's core. Ongoing research continues to refine the balance between improving wear resistance and addressing issues such as embrittlement, weldability, and machinability, ensuring the material remains a reliable option in demanding applications.

The ongoing evolution of Hadfield steel's properties is a testament to the effectiveness of modern engineering practices in optimizing materials for specific industrial requirements. While challenges in its weldability and machining persist, innovations in cutting tools, heat treatment processes, and surface hardening techniques are contributing

to overcoming these limitations. Research, including bibliometric studies like those conducted by Pinto Junior, Teixeira, and Silva (2024), continues to highlight the importance of understanding the underlying microstructural mechanisms and processing parameters that govern the steel's performance. The continued development of more efficient production and processing methods promises to further enhance the material's versatility and performance, ensuring its place in industries reliant on wear-resistant materials.

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SURGICAL INTERVENTIONS IN CLAVICLE SHAFT FRACTURE: A DETAILED LOOK THROUGH THE SPECIALIZED LITERATURE

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ABSTRACT

Clavicle fractures are relatively common injuries, accounting for 44% of shoulder girdle fractures and 2.6% of all fractures. They occur more frequently in active young men, especially those involved in high-impact activities. For this reason, this study aims to present the main surgical interventions used in clavicle shaft fractures. This is a literature review, which was carried out between June and July 2024, which used the SciELO database, in which the term "clavicle fracture" was searched, followed by subsequent

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analysis of articles published in the last 5 years, 6 articles were selected. It was observed that the Blocking Plate was the main technique used in surgical interventions for clavicle shaft fractures. Despite this, there is still a great deal of debate about the optimal approach to treating these fractures. In general, the patients who underwent the surgical approach presented good results in bone consolidation and few complications after the procedure.

Keywords: Bone fractures. Orthopedic procedures. General surgery.

INTRODUCTION

A fracture occurs due to intense, single, or repetitive overload, causing the bone to rupture. This trauma also damages adjacent soft tissues, which leads to a loss of structural continuity, deformity, pain, and impairment of support function. In addition, the fracture ruptures the blood vessels of the bone and periosteum, releasing biochemical factors that induce bone healing and healing (Gueorguiev-Rüegg & Stoddart, 2020).

Clavicular fractures are relatively common injuries, accounting for 44% of shoulder girdle fractures and 2.6% of all fractures (Postacchini et al, 2002). They occur more frequently in active young men, especially those involved in high-impact activities, whose most common causes include falls on the shoulder, indirect trauma, or direct impacts, such as in traffic accidents or sports injuries. They vary in severity depending on the intensity and direction of the force applied (Bucholz et al, 2013).

The majority (80 to 85%) occur in the midshaft, a more vulnerable region due to its narrow cross-section and central positioning, which makes it more susceptible to the transmission of compressive forces applied to the shoulder. Usually, the indications for surgery for this type of fracture are debatable, as some doctors prefer conservative treatment, while others opt for surgical intervention (Bucholz et al., 2013).

Surgical fixation can be performed by means of devices, such as screws, non-locked plates, locked plates, and tension band wires, which are fixed externally to the bone, under the soft tissue covering, and offer complementary stability on the bone surface. Each method has specific advantages depending on the type of fracture and the need for mechanical support (Schütz & Rüedi, 2013)

Screws are powerful resources for osteosynthesis, especially when they are used in conjunction with plates to provide additional stabilization. The same screw can have different functions depending on its shape and application technique. Two of the fundamental principles of conventional screws are: compressing from the fracture plane to promote the union of bone fragments (compression screw) and fixing the plate to the bone to maintain structural stabilization (plate screw) (Schütz & Rüedi, 2013).

Modern locked head screws offer angular stability to the implant due to their threaded head that attaches to the corresponding thread on the plate, forming a screw-plate system with angular stability. This mechanism prevents compression of the plate against the bone by transferring the load directly between the screws and the plate, similar to how an external fixator works, but positioned under the soft tissues, a concept called the "internal fixator principle". In "hybrid fixation," which combines conventional and locked screws, it is crucial

that all conventional screws are inserted before the locked ones in each fragment, to ensure the stability of the assembly (Frigg, 2016).

Compression screws can be inserted independently or through a hole in the plate. In any application, the compression between the bone fragments - or between the plate and the bone - generates preload and friction, factors that prevent the displacement of the fragments under external forces. During insertion, the surgeon drills into the bone with a drill with a diameter slightly larger than the smallest diameter of the chosen screw. To increase safety, especially in cortical bones and in dense cancellous bones of young patients, it is recommended to open the thread before inserting the screw. In more malleable bones, the screw can be inserted without the need for a thread. Self-tapping screws are a practical alternative, as they cut the thread during insertion, but require experience for proper application (Schütz & Rüedi, 2013).

Table 1, prepared by Schütz & Rüedi, presents the types and functions of screws according to clinical use.

Table 1. The various functions of screws and clinical examples

Name	Mechanism	Clinical example
Plate screw without locking	Preload and friction are applied to generate force between the plate and the bone	Application of plate to the forearm
Compression screw	The sliding hole allows compression between the bone fragments	Fixation of a butterfly or cuneiform fragment, or fracture of the medial malleolus
Screw with locked head	Used exclusively with locking plates; Threads on the screw head allow for mechanical coupling to a reciprocating thread on the plate, providing angular stability	Fracture-metaphyseal complex Osteoporosis
Locking screw	Attaches an intramedullary pin to the bone so that length, alignment, and rotation are maintained	Femoral intramedular pine or blocked tibial
Anchor bolt	An attachment point used for anchoring a loop with metal wire or sturdy suture	Anchorage by tension band in a proximal humerus fracture
Push-pull parafuso (i.e. "come in and know")	Temporary fixation point, used to reduce distraction and/or compression fracture	Use of an articulated compression device
Reduction screw	Conventional screw passed through a plate to pull the fracture fragments in the direction of the plate; Once alignment has been achieved, the bolt can be removed or changed	Minimally invasive osteosynthesis technique with plate to reduce multifragmented fracture to plate
Parasitic *poller*	Screw used as a support point for redirection of an intramedullary pin	Fracture in the proximal tibia during intramedullary pinning

In addition to the compression screw, as previously stated, compression plates ensure absolute stability and promote bone healing. However, to avoid direct contact between the plate and the bony cortex, which can reduce vascularization and increase the risk of necrosis, Tepic and Perren (1995) developed the principle of the "internal fixator." This method brought a new concept of fixation independent of continuous contact with the bone cortex.

On the other hand, non-surgical - or conservative - treatment is adequate for most clavicle fractures. However, surgical intervention may be indicated when the fracture cannot be adequately reduced or stabilized, or when early movement provides a significant functional advantage. The main objectives of surgery include anatomical reduction and stabilization of the fracture, to restore alignment and integrity of the limb, as well as to control pain and allow early movement, promoting rapid return of function. The benefits must be weighed against the risks associated with anesthesia, the surgical procedure, and the insertion of materials, which can increase the risk of complications such as infections and implant rejection (White, 2017).

In view of this, this study aims to review the literature to compare the benefits and repercussions of surgical approaches in the treatment of clavicular shaft fractures.

METHODOLOGY

This is a literature review carried out between June and July 2024, using the SciELO database, where searches containing the term "clavicle fracture" were consulted, restricting it to articles published in the last 5 years. The initial search brought 10 articles and after screening, which used as a criterion to choose studies related to clavicle shaft fracture, 6 articles were selected for this review.

The phases of this research were organized as follows: first, the appropriate descriptors were determined; Then, in a sequential manner, the search strategy was elaborated, the databases were chosen, the most relevant titles were selected, and the texts were read completely. Finally, these stages culminated in the elaboration of the text.

According to item III of Resolution No. 510/2016, due to the use of secondary data in the public domain, it was not necessary to submit the project to a Research Ethics Committee.

RESULTS

Table 2 presents the results of the research, organizing the studies according to the author, year, methodology and results of the research. This framework was chosen for its

ability to provide a comparative view of the selected studies

Table 2. Studies listed according to author, year, methodology and results

Author, year	Methodology	Results
Amaral, F.E. *et al*, 2024	Prospective case series evaluating displaced fractures of the middle third of the clavicle to blocked IMO, with procedures performed by a single surgeon. The patients were evaluated at 12 months using the University of California at Los Angeles (UCLA) scale and by radiographs of the anteroposterior (AP) clavicles with cranial inclination and flow rate of 45°, in addition to reports of complications.	A total of 15 patients were evaluated. The median surgical time was 50 minutes (IQR 35). The UCLA scale at 12 months had a median of 35 (IQR 2). All patients had fracture healing. Minor complications occurred in three cases (20%): two (13.3%) with plaque prominence and one (6.7%) with local paresthesia. Major complications occurred in only one case (6.7%), with suture dehiscence, requiring surgical reapproach.
Rodrigues, L.M. *et al*, 2023	Analysis of case series. The sample included individuals undergoing surgical treatment for clavicle fractures.	In total, 88 subjects met the predetermined criteria. Of these, 75 (85.22%) were male; car accidents corresponded to the largest etiological group, reaching 48% of prevalence; there was a slight predominance on the right side, totaling 45 cases (51%); most fractures were classified as Allman type I; an infection rate was observed in 1.13% of cases; and the development of pseudoarthrosis was identified in 2.27% of the patients.
Mendes Junior, F.A. *et al*, 2021.	This was a longitudinal, observational study with 32 consecutive patients (31 men; mean age, 41 years) with comminuted fractures of the clavicle shaft who were surgically treated using the minimally invasive osteosynthesis technique with a 3.5 mm reconstruction plate in the upper position. Patients were clinically and radiologically evaluated for a minimum follow-up period of 12 months.	In 30 patients (93.72%), fracture healing occurred in a mean time of 17 weeks (range, 12 to 24 weeks). The median follow-up time was 21 months (range, 12 to 45 months). No implant breakage or pseudoarthrosis was recorded. There were no complaints of paresthesia around the surgical incisions. The surgically treated shoulder had lower passive elevation and longer clavicle length ($p < 0.05$) compared to the contralateral shoulder. The functional assessment revealed a mean Arm, Shoulder and Hand Disability (DASH) score of 1.75, which is considered satisfactory. Age > 60 years showed a negative correlation with the DASH score ($p < 0.05$).
Hehn, F.H.S. *et al*, 2020.	This was a retrospective cross-sectional study in which 36 patients who suffered fractures of the middle third of the clavicle and who were surgically treated between January 2012 and February 2017 were evaluated. They were evaluated for fracture types, age, smoking, osteosynthesis material, and scores on the Constant-Murley Shoulder Rating Scale and Modified University of California at Los Angeles (UCLA-M).	The mean scores of Constant-Murley and UCLA-M were 91.59 and 31.29, respectively. The mean age was 37.62 years, and was statistically related to the type of osteosynthesis ($p < 0.05$), but the osteosynthesis material was not significant with the improvement in the rates of functional scores.
Xu, H.; Nie, Y.; Han, L.; Li, L.; Sui, H. 2020.	Fifty patients with proximal clavicle fractures received surgical	Surgery time (t=2.063, P=0.058), intraoperative bleeding (t=1.979,

	treatment. They were divided into a clavicular T-plate group and a double mini-plate group. The duration of the operation, blood loss during the operation, fracture healing time, and incision infection were evaluated between the two groups.	P=0.062) and fracture healing time (t=1.082, P=0.066) were not statistically significant in both groups. Patients were followed for 12-18 months; one patient in the T-plate group had early nail removal, but no clinical symptoms. At the 2-month follow-up, the ASES score in the double mini-plate group was significantly better than in the T-plate group (P<0.001); but at the 6-month follow-up, 1 week before the removal of internal fixation and the final follow-up, the two groups showed no significant differences (P>0.05).
Kilinc, B.E.; Oc, Y.; Erturer, R.E. 2020.	Forty patients were retrospectively included. The patients underwent an anterior posterior radiograph of the right shoulder after the examination. The results were evaluated by the patient's return to daily activities, Constant score, Arm Disability, and Shoulder and Hand score, followed by radiological and clinical examination.	Fourteen (35%) patients were female and 26 (65%) were male. The mean age was 36.2 years. Twenty-six patients had fractures of the right clavicle and 14 patients were discharged. Twenty-three fractures were type 2B1 and 17 fractures were type 2B2. The mean follow-up time was 36.4 months. Radiological consolidation was 9.1 ± 1.3 weeks. All patients had excellent results. The mean Constant score was 97.2 ± 1.8, the mean arm disability and shoulder and hand score were 3.8 ± 2.4.

DISCUSSION

Rodrigues *et al* (2023) conducted an observational and cross-sectional study with 88 patients, of both genders and under the age of 60, who underwent surgical approach for clavicle fracture between May 2020 and February 2024 at a specialized orthopedics center. In all, 81.81% had clavicular shaft fractures. The materials used in osteosynthesis are listed in Table 3, ordered by prevalence. The study did not detail the materials used specifically for shaft fractures, which represents a limitation in the analysis. Despite this, the study allowed us to observe how the different plates constitute a common approach in surgical treatment.

Table 3. Materials used in clavicle osteosynthesis procedure in a study by Rodrigues *et al* (2023)

Material used	n	%
Blocked clavicle plate	46	52,27
Rebuild plate	15	17,04
Rebuild locked board	11	12,5
Kirschner wire with anchor	6	6,8
Kirschner's Fio	4	4,5
Kirschner wire with ligation	3	3,4
Locked T-plate	1	1,1
Single Plate (DCP)	1	1,1

Prepared by the authors

Another approach explained by the study was the use of Kirschner sutures. Created in 1909 by Martin Kirschner, it is a metal device widely used in orthopedic surgeries to stabilize fractures and facilitate healing. These devices offer an effective and safe solution to maintain the stability necessary for recovery (SBCOC, 2024). However, the use of Kirschner wires can be associated with several complications, which include: vascular and nerve injuries, tendon ruptures, osteomyelitis, loss of fracture reduction or dislocation, superficial infections, and wire migration (Tan *et al*, 2016). These complications can significantly affect the clinical outcome and recovery of the patient, highlighting the importance of close follow-up during the postoperative period.

In the study by Amaral *et al* (2023), the results of the treatment of 15 clavicle shaft fractures using the Minimally Invasive Osteosynthesis with Locked Plate technique were analyzed. All patients had bone healing within three months. Regarding complications, three patients had minor complications: one with anterior paresthesia of the clavicle and two with prominence of the plaque, without the need to remove the synthesis material. There were no cases of hypertrophic scarring or skin irritation. Only one patient had a major complication, with dehiscence of the surgical scar, requiring cleaning, debridement, and suturing in the surgical environment. The study demonstrated that minimally invasive treatment for displaced clavicle fractures achieved excellent clinical and radiographic results, with complete consolidation in all cases and a lower complication rate compared to studies that used open plate fixation.

According to Hehn *et al* (2020), the optimal approach for the treatment of fractures of the middle third of the clavicle is still a widely debated topic in the literature, reflecting the continuous search to optimize the prognosis of patients and allow a complete return to their

usual activities. Recent studies have favored surgical intervention, as it has been shown to reduce the incidence of pseudoarthrosis and inadequate union, in addition to improving shoulder function. The most common osteosynthesis involves fixation with a plate and screws positioned in the upper part of the clavicle, corroborating the research by Rodrigues *et al* and Amaral *et al* with the main complications related to the use of surgical material.

The main criticism of the surgical treatment of clavicle fractures lies in the prominence of the synthesis material, given that the clavicle is located in a subcutaneous position. This aspect was also observed in the study by Hehn *et al*, where 44.1% of the patients reported discomfort due to plaque protrusion, a finding that is consistent with the technique used and with data from other studies. Similarly, Wang *et al* (2015) found 40% of complications associated with the prominence of the plate or screws, while Nourian *et al* (2017) also noted that the superior approach results in a high rate of problems with the plates and often requires further surgery to remove the implant.

The study by Mendes Junior *et al* (2021) covered a sample of 32 patients who underwent surgery for multifragmented fracture of the clavicle shaft. **Table 4** below, created by the authors, summarizes Mendes Junior's findings, contributing to the understanding of the main postoperative repercussions in this study.

Table 4. Main postoperative repercussions of clavicle osteosynthesis in the study by Mendes Junior *et al* (2001)

Observed Appearance	n	%	Main flaw	n	Failure rate
Performed 12-hole implant	28	87,5	Needed to remove the 12-hole implant	5	15,6
Bone healing over a mean period of 17 weeks, with no cases of pseudoarthrosis or infection	30	93,7	Failure of osteosynthesis	2	6,25

Prepared by the authors

Of the patients who presented osteosynthesis failure, both were 61 years old and had implant loosening in the initial phase, without plaque rupture. One patient, who was an alcoholic, was released 1 week postoperatively, while the other, with type 2 diabetes, had the failure after 8 weeks. Both patients were reoperated with open reduction and internal fixation with plate and screws, without the need for bone grafting, and evolved with fracture consolidation. Other complications reported in the study are shown in **Table 5**:

Table 5. Post-surgical complications found in 32 patients who underwent surgery for multifragmented fracture of the clavicle shaft in a study by Mendes Junior *et al*

Complication	n	%
Discomfort on the plate	6	18,8
Pain during exertion	5	15,6
Hypersensitivity	2	6,2
Pain at rest	1	3,1

Prepared by the authors

FINAL CONSIDERATIONS

The literature on clavicle shaft fractures is extensive and up-to-date, considering that this is the main region affected by trauma to this specific bone. Epidemiological data revealed that these injuries mostly affected people who engage in high-impact activities, with car accidents being a frequent source of these fractures.

Despite the importance of surgery, there is still disagreement among experts about the ideal approach. Although conservative treatment is widely recommended, surgical treatment has demonstrated a high success rate and low complication rates, allowing a faster return of the patient to their usual activities.

Regarding surgical techniques, it was observed that blocking plates were the most used, while Kirschner wires were less frequently used. These findings highlight the need for further studies that can guide the choice of the optimal approach for each type of fracture and patient.

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AUGUSTYN LOUIS CAUCHY: A GENIUS WHO REVOLUTIONIZED SCIENCE

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ABSTRACT

Augustin-Louis Cauchy was a prominent mathematician of the nineteenth century whose contributions have left an indelible mark on modern mathematics and various areas of science. His pioneering approach to mathematical analysis set a new standard for rigor and clarity, revolutionizing the way mathematical problems were approached. Through his meticulous work, Cauchy laid the groundwork for many branches of mathematics, ensuring that fundamental concepts such as boundaries, continuity, and derivation were accurately understood and defined. Among his innumerable contributions, his emphasis on function theory and complex analysis stands out remarkably. Theorems such as the Cauchy-Riemann theorem and the residual theorem are essential pillars in this field. In addition, his work on differential equations and infinite series has been crucial for the development of theories that we continue to use today. Cauchy did not limit himself to advancing pure mathematics; Its impact is also felt in applied areas such as physics and engineering. His research in elasticity theory and partial differential equations has provided vital tools for practical problem-solving in these disciplines.

Keywords: Theory of Functions. Complex Analysis. Cauchy-Riemann. Residue Theorem. Differential Equations.

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INTRODUCTION

The history of mathematics is marked by great figures who have left a lasting legacy in this discipline essential to understanding the world around us. One such big name is Augustin-Louis Cauchy, a 19th-century French mathematician whose contributions have had a profound impact on various fields, from mathematical analysis to physics to engineering. This article proposes to explore Cauchy's life and works, highlighting his innovative approach and his obsession with precision and clarity. We will investigate their contributions to function theory, calculus, and number theory, as well as their influence on practical areas such as theoretical physics and engineering.

Throughout this journey, we will dive into his key theorems and discover how his legacy lives on in modern mathematics, inspiring new generations of mathematicians and scientists.

CONCEPTUAL ELEMENTS

AUGUSTINCAUCHY "A PRODIGY OF MATHEMATICS

Augustin-Louis Cauchy (August 21, 1789 – May 23, 1857) was an influential French mathematician of the nineteenth century. Coming from an aristocratic family, Cauchy received a privileged education that fostered his talent in mathematics from a young age. At the age of 16, he entered the École Polytechnique, where he studied under renowned mathematicians such as Lagrange and Laplace.

Throughout his life, Cauchy made key contributions in areas such as mathematical analysis, number theory, mechanics, and optics. Among his most notable achievements are the Cauchy-Riemann Theorem, Cauchy's Theorem for integrals, as well as important contributions to the theory of elliptic functions and to the understanding of limits and continuity.

He also conducted significant research in number theory and partial differential equations. Cauchy was known for his energetic personality and his advocacy of mathematical rigor, which sometimes brought him into conflict with his contemporaries. His influence endures in modern mathematics, and his legacy is celebrated by mathematicians and scientists around the world. From his early years at the École Centrale du Panthéon and the Lycée Louis-le-Grand to his training at the École Polytechnique and the École des Pontset Chaussées, Cauchy left an indelible mark on the mathematical world.

His passion and exceptional abilities manifested themselves from a young age, and his contributions laid the foundation for his renown as one of the most outstanding mathematicians of his time.

MATHEMATICAL CONTRIBUTIONS MADE.

It introduces the fascinating world of Cauchy's applications, exploring how his theorems and concepts have permeated through different branches of mathematics, from the theory of complex variable functions to the solution of differential equations, Cauchy's legacy manifests itself in a wide range of applications.

THEORY OF COMPLEX VARIABLE FUNCTIONS

Augustyn Louis Cauchy, a prominent French mathematician of the nineteenth century, made significant contributions to the Theory of Complex Variable Functions. His accomplishments in this field include.

CAUCHY-RIEMANN THEOREM

Cauchy formulated the conditions necessary for a complex function to be holomorphic (differentiable) at a point. These conditions are known as the Cauchy-Riemann equations and are fundamental in the study of analytical functions in the complex plane (Clarke, 2004).

RIGOROUS DEFINITION OF BOUNDARIES

Cauchy is known for establishing a precise and rigorous definition of what is now known as the limit of a function. He introduced the idea that a function tends to a limit L when the difference between the function and L becomes arbitrarily small as the independent variable approaches a certain value.

CAUCHY'S THEOREM ON LIMITS

He proposed Cauchy's theorem on limits, which states that if two functions have the same limit when a variable approaches a given value, then the sum, product, and quotient of these two functions also have the same limit at that point. This theorem is essential for the analysis of limits of complex functions and the application of boundary properties in calculation (Hernández, 1993).

INFINITESIMAL ANALYSIS ACQUIRES SOLID FOUNDATIONS

Infinitesimal analysis acquires solid foundations with Augustyn Louis Cauchy due to his fundamental contributions in the formulation of rigorous definitions and theorems that established a solid mathematical foundation for this field.

FUNDAMENTAL THEORIES

Cauchy formulated and proved a number of fundamental theorems in analysis, such as Cauchy's theorem on limits and the mean value theorem. These theorems provided essential tools for understanding the behavior of functions in the context of limits and derivatives. In addition, it established the basis for future developments in calculation and analysis (Hernández, 1993)

EMPHASIS ON RIGOROUS DEMONSTRATION

He emphasized the importance of rigorous mathematical demonstrations. His formal and methodical demonstrations helped raise the level of precision and rigor in mathematics. This led to a more rigorous and consistent approach in infinitesimal analysis.

INFINITE SERIES THEORY

He made important contributions to the theory of infinite series, including the precise definition of convergence and divergence of series. This was essential for understanding the behavior of functions in terms of infinite series and provided a basis for the theory of analytic functions (Gale, 1999).

CAUCHY'S THEOREM

Cauchy's theorem is a fundamental result in the field of complex analysis that states that if a function is holomorphic (also called analytical) in a simply connected region, then the integral of the function along a closed curve contained in the region is equal to steel. In other words, if a holomorphic function in a region that has no "holes" and is closed, the integral of that function around any closed curve contained in that region is equal to zero (Ana Lucca, 2018).

CONTRIBUTIONS TO THE ANALYSIS

Louis Cauchy made important contributions to mathematical analysis, but his work did not focus on group permutation theory. Rather, Cauchy is known for his influence in areas such as mathematical analysis, number theory, function theory, and calculus.

DEFINITIONOFHOLOMORPHIC FUNCTIONS

Cauchy is credited with making fundamental contributions to the definition and theory of holomorphic functions in the context of complex analysis. His work laid the foundations for the development of this area of mathematics.

Every holomorphic function can be separated into its real and imaginary parts f(x+iy) =u(x,y)

+ iv(x,y), and each of them is a harmonic function in R2(each satisfies Laplace's equation. One of Cauchy's most outstanding contributions is the Cauchy–Riemann theorem, which establishes the conditions necessary for a complex variable function to be holomorphic (also called an analytic function).

DEFINITION OF THE CONVERGENCE AND DIVERGENCE CRITERIA OF THE SERIES

He played a fundamental role in defining the criteria of convergence and divergence of series in mathematics. His contributions in this field helped establish solid foundations in mathematical analysis. One of Cauchy's most notable contributions was his formulation of the "Cauchy Criteria" for the convergence of series and in the solution of modular equations.

DESCRIPTION

The elaboration of this research work is based on a requirement to opt for the degree of Bachelor of Mathematics from the National University of Panama and was prepared with the collaboration of Professor Alcibiades Medina, Professor Eliecer Cedeño and Professor Narciso Galástica, professors of the University of Panama. They are elaborated in chapters that represent the most relevant aspects of Augustyn Cauchy's legacy, such as his historical evolution, decipherment of mathematical contributions made and a wide relevance to the great scientific and cultural contribution to our society.

The limitations presented in the research of the topic presented was the verification of the research source, since some of them were very scarce in information.

FINAL THOUGHTS

Augustin-Louis Cauchy was an exceptional mathematician whose contributions profoundly impacted mathematics and physics, becoming a pillar of the development of modern mathematics. His rigorous approach based on mathematical analysis laid the foundations for greater coherence and precision in various branches of mathematics.

Cauchy excelled especially in function theory and complex analysis, with fundamental theorems such as the Cauchy–Riemann theorem and the Residue Theorem, which remain essential in the study of complex variable functions. In calculus, he formulated clear definitions of key concepts such as limits, continuity, and derivability, thus consolidating the discipline in its current form.

His influence transcended pure mathematics, as his work on elasticity theory and partial differential equations had practical applications in engineering and physics.

In addition, his contributions in number theory and functional analysis laid the foundation for future advances in theoretical physics.

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HEALTH NEEDS OF ELDERLY RESIDENTS IN MONTEVIDEO HOUSING COMPLEXES

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ABSTRACT

Population aging impacts social and health services. Objective: To understand the perception of the health needs of elderly people living in Social Security banking complexes. Methodology: Qualitative study. 27 people over 65 years of age participated, Montevideo. Information collection technique: semi-structured, individual interviews. Targeted content analysis. Results: Family Relationship and Social Support Category, a protective factor in old age, perceived as weak or almost non-existent. Loneliness and Depression Category, 14 experience loneliness. Category Need for good living conditions, need for family financial support or cash loans. Access to Health Category, belong to the National Integrated Health System, with multimorbidity. Category Autonomy Physical limitations, some independent in daily activities, others need help. Final thoughts: The health system for the elderly requires effective policies to improve care.

Keywords: Aged. Need for health. Barriers to access to health services. Qualitative research.

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INTRODUCTION

One of the major challenges worldwide is the sustained increase in the proportion of older people. In the Region of the Americas, by 2025 they will represent 18.6% of the total population, doubling this amount in the next 25 years.1

There are several ways to measure health needs, from individuals' perception, to objective measurements of physical and mental function and other determinants. There are those who define it as the degree of health-disease where there is a relationship between the basic needs that an individual may have, and the intermediate needs such as nutrition, education, housing, work, economy, among others.2 To understand the broad concept and complexity of health needs, Matsumoto (1999) uses a taxonomy that divides them into 4 major groups: Good living conditions, Access to health technologies and prolongation of life, Bond with health professionals and team and, finally, the need for autonomy and self-care. caution.3,4

Considering these four groups, in Uruguay there are policies that aim to realize the rights and improve the living conditions, as well as the health needs of the elderly. In this sense, the Social Security Bank (BPS) is responsible for coordinating the State's social security services and organizing social security. Among the social programs it develops is Housing Solutions for Retirees and Pensioners, framed in Uruguay's housing policy. With this, the housing needs of the retired elderly or pensioner, contributors to the Agency, and who meet the conditions established in Law No. 17,217, are met.

Housing complexes for retirees and pensioners are one of the components of the Program. They are houses of the individual housing type, in buildings of one or two floors or apartment towers, they have drinking water, electricity, sanitation, most have green spaces for common use, meeting rooms, for accessibility in some ramps have been placed, elevators for those who have more than one floor. The houses have a kitchen with sink and tap, bathroom, bedroom. An average of 5,752 elderly people across the country live in these complexes.5

Another policy that is being developed is through the National Integrated Health System (SNIS), which guarantees the right to health and provides comprehensive care to the entire population of the country through Law No. 18,211 (2007).

The Ministry of Public Health, the body responsible for health issues, hosts the National Program for the Elderly, responsible for managing health programs aimed at this population group. In the context of social development, the Ministry of Social Development (MIDES) is part of the National Institute of the Elderly, responsible for actions related to old age in the country. (CIEN; 2020).24

This research aims to understand the perception of health needs by elderly people living in housing complexes of the Social Security Bank.

With this data, it is possible to support the development of public health and social assistance policies consistent with the needs of this population.

METHODOLOGY

This is a qualitative research, allowing an approach of information that cannot be quantified, used to understand the universe of meanings, beliefs, motivations and values of those who participate in the study.6

For the selection of the three housing complexes for BPS retirees and pensioners in the city of Montevideo, Uruguay, the following criteria were used: geographic location of the complex and accessibility to health services; to have developed the teaching of care for the elderly in the training of Nursing Graduates of the Faculty of Nursing of the University of the Republic continuously for 3 years, 1 year and less than 6 months.

The fieldwork was carried out between September and December 2022, starting after obtaining authorization from the Social Security Bank. The invitation was made in each of the complexes through posters in the elevator and in the spaces for common use by the residents, with the purpose of making them aware of the research and having equal opportunities to participate in it.

The interviewees were 27 elderly people. Intentional type sample. The inclusion criteria were: person aged 65 years or older, living in the BPS housing complex for more than one year. The exclusion criterion was elderly people who have difficulty communicating. To define the sample size, the saturation point methodology was used: after a certain amount, new cases repeat or saturate the content of previous knowledge.7

The technique used to obtain information was the semi-structured individual interview, coordinated day and time. The anonymity of the participants was used by the researcher with the letters CH, B, C indicating the housing complex in which they live and by number in the order in which the interview was conducted. The number of interviews conducted per complex was CH eight, in complex B ten and complex C nine. Most of the interviews took place in the participants' homes. Simple observation notes were made during the research process. It contained descriptive notes such as portraits of the participants, events or activities, feelings, impressions.

The participants gave their informed consent, it was explained to them that they could participate in the study voluntarily, anonymously, confidentially, knowing the objectives of the research, the use of the data for scientific purposes, taking into account the full

protection of the human being subjects of a research in accordance with Decree 158/019. The study was approved by the ethics committee and the research project was registered through the General Directorate of Health, Division of Health Evaluation, at the Ministry of Public Health under the number 5218709.

RESULTS

CHARACTERIZATION OF HOUSING COMPLEXES

A key was used to identify the selected complexes

Complexo CH. It is located in the central area of the capital, with a large flow of traffic and public transport to various areas of the capital, with connection to health services. Some health care providers are about 6 blocks (600 meters) away and the farthest are 35 blocks away. Complex B. It is located in the most vulnerable neighborhood of the capital. The nearest health services are 600 metres away and the farthest 12 km away. Complex C. Located in the east of the city, about 200 meters from important avenues with access to public transportation by bus, the nearest health services are 450 meters away and the farthest 13 kilometers.

The characterization of the participants was carried out with the following components: gender, age, health status, health provider, education, number of people living in the household and presence of pets, time of residence in the household.

The elderly who participated in the research were 27 years old, aged between 67 and 92 years, and of these, 9 were over 80 years old. Of the total number of interviewees, 20 were women, 6 of them over 80 years old. In complexes there is a higher proportion of women compared to men. All participants reported comorbidities, some of them with cardiovascular conditions, followed by osteoarticular, metabolic, psychological and oncological conditions. The presence of comorbidity can mean several adverse events such as functional deterioration, disability, and dependence, affecting their quality of life. Among the pathologies reported by the interviewees were arterial hypertension, metabolic, oncology, stroke, osteoarticular and depression. Suffering from non-communicable diseases has long-term consequences, involving pharmacological and nutritional treatment, periodic check-ups, among others. Several people have limitations and some are helped with mobility with walking aids. All participants have a health provider and choose which one to belong to, most are users of public health services and a smaller number of private ones.

Another characteristic is the level of education: of the 18 people who completed elementary school, only half managed to complete it. Some reported that the reason for dropping out was due to their socioeconomic situation, prioritizing work in childhood. Those

who reached the secondary level were 8 and only three completed it. Of the interviewees, 19 live alone. In the category about the length of residence in the complex was between 1 and 20 years, 9 of the participants have between 5 and 10 years.

In the directed analysis of the interviews, five categories were identified: Family and social support relationship: Loneliness and depression; Need for good living conditions; Access to health; Autonomy and physical limitations. Each of these is linked to the four components of Matsumoto's taxonomy. The first three categories mentioned are related to the Need for good living conditions; access to health with the Need for access to all technologies and the Need for bonding with health professionals and teams, with the category autonomy and physical limitations with the Need for autonomy and self-care.

Family relationships and social support

As biopsychosocial beings, people need the support and companionship of others throughout their lives. This support network changes over time, in the phase of old age its importance as support intensifies in the presence of vulnerability to economic insecurity, health problems, dependence. In the study we tried to get to know this social network with family, friends and neighbors and even for some the importance of having a pet at home.

"I have my daughter who is the only family I have... my daughter who calls me several times every day" (CH2)

"My family is my two daughters and my granddaughter and my son-in-law" "My daughters are always present" (B2)

"Perfect! Well, with (your son's name) and my daughter-in-law I go every Saturday and Sunday" (B4)

In general, for the elderly, family means a lot in life and even more so when there are children and grandchildren. Your loved ones are present in the stories, especially when there are good ties.

Note Note: In the decoration of their homes, there is usually a space where photos of their loved ones and shared moments are kept.

Close ties with the family do not happen in most cases and this is evident in non-verbal expression, lack of support in activities of daily living and even in economic issues.

"I haven't had contact for a year, I haven't seen her, the other day she was a year" (with her daughter)... My son has been 15 years since I don't know where they are, I don't know anything. He doesn't worry either, you know, I love those who love me" (B6)

"I am sad, because I have my daughters, all very far away and I heard from them and now I don't have them anymore" (C4)

There are those people who have no bond with their children, nor do they mention the presence of friends. In the stories, they reveal a relationship with family members and especially with children, poor or non-existent. Contact is lost, the need for affection is present, not being able to develop the role of grandparents or parents.

Note of observation: A change of mood is observed in his expressions when talking about this theme where sadness, pain, accompanied by crying are noted.

Friends can be chosen in life, they are bonds that are created by common interests and shared activities, resulting in support of great importance in people's lives and even more so in old age, and can even contribute to care issues, health behaviors (seeking medical help, mood, self-esteem). They are links where there are spaces to accompany each other, to laugh, to exchange support. In the stories, some expressed having friends. The people who will live in these complexes often had to give up many things when moving from their old home, neighborhood, neighbors, friends, family.

Loneliness and depression

Of the interviewees, more than 14 elderly people report loneliness. During aging, a series of experiences and changes occur that can generate a feeling of loneliness.

"When I lost my sister who lived here... and I was alone (pause) I felt alone... The truth is that I was so alone" (CH1)

“... I feel bad, emotionally I don't feel like doing anything, I do things because I'm alone, I have no one (CH3)

"There are times when I have low points... because I lived with my daughter when I came here, I have to adapt to being alone and. And take care of myself and not make it difficult for anyone" (CH6)

Several people report having lived the experience of loneliness, feeling alone. It is mostly expressed by women, which does not mean that men do not experience this feeling. Some express having suffered the loss of loved ones (siblings, spouse). In other situations, loneliness is due to the fact that your loved ones are far away and you don't have physical contact with them. The stories reflect feelings of anguish, sadness, reluctance, perhaps a sense of abandonment.

There are diseases that can accompany old age, such as depression. There are people who have been diagnosed with Depression, others have elements of this disease, characterized by persistent sadness and disinterest in carrying out activities of daily living.

"I'm going to take her, I have depression problems" (CH6)

"I had a great depression.... It's not the same thing as talking on the phone or texting (with the family), it's not the same thing as being able to hug and touch" (B8)

The depression manifested by those who have been diagnosed and are undergoing treatment has generally been in women, who in most cases live alone and who suffer from other types of health problems. In some cases, having a pet helps them stay active and be able to carry out activities of daily living.

"If it wasn't for my dog I don't know where I would be... he's my companion, it's the only thing I have" (CH3)

For those who love animals, having a pet is positive for them. In those who age, they experience a series of changes and new situations where deficiencies, new needs, loneliness, diseases, sedentary lifestyle, among others, begin to appear, and having a pet can help to face these situations.

NEED FOR GOOD LIVING CONDITIONS

Within this category are family financial support, the use of loans, help with medicines and housing. People living in the complexes have social security coverage, it is a condition they must have to be beneficiaries of a house, and this pension or BPS pension is one of the lowest. Knowing the perception of the elderly about the need for good living conditions allows us to know if their income helps them to be self-sufficient to cover their expenses, when it is known that health problems and consequently costs increase in old age. People's circumstances are different from each other, there will be those who need help in their social relationships, others who use the loan system and others who can solve with the income they receive. Some people receive financial support from family members.

"Payday was coming, but I was very short on money like almost everyone here... Then that... She brought me an assortment (referring to her daughter). It's hard for me to get to payday" (B8)

"No, if I don't have money, I have a son who is a sun, who doesn't let me lack anything. No, the income I have is not enough for me" (C1)

There are several people who depend on their social support network to cover monthly living expenses. In most cases this support is not sporadic but monthly, and in most cases it is the children who provide the help.

People who don't have a social network and need financial support take out loans or use credit cards.

"Everything is very expensive... I have to get the OCA card (credit card) because I can't afford it. And it's kind of complicated... the issue of food is tough" (CH6)

"No, I didn't have a penny and I'm alone. Nobody gives it to me and I don't get credit anywhere. What happens is that I make loans very well" (C2)

In some stories they express the increase in the cost of things, for example, food. Not having support from other people close to them, they end up resorting to monetary loans. A minority of the elderly say they are able to cover their expenses with the income they receive. In some situations, the economic income of that household is higher than that of a person. It should be taken into account that the economic budget of each household is different due to various health factors, the health provider to which they belong, their morbidity and, therefore, the treatment they must carry out, among others.

From the above, the people interviewed suffer from pathologies and several of them have more than two. This is accompanied by pharmacological treatments and, therefore, has its cost.

"… They help me with the medication. It doesn't work for me, it's not enough for me because there are several medications that I take" (B2)

"... He is involved with loans... medicines are deadly" (CH5)

"Yes, because sometimes we don't receive it, we have half of it there, so sometimes I prolong the trip to the hospital to get the medication. Because without money you won't go anywhere" (CH8)

In the stories, there are those who, due to their pathologies, have continuous drug treatment, giving rise to the existence of a geriatric syndrome such as polypharmacy. In the stories they express how expensive access to medicines is and some express the postponement of their purchase due to lack of money. Depending on the health operator, it may or may not have a lower cost. Other difficulties are that there are professionals who prescribe medicines that are not available at your doctor and must be obtained abroad, at a different price.

Within the Need for good living conditions is housing, recognized as a right and an aspect considered according to the socioeconomic situation of the person. The housing has the purpose of contributing to your quality of life, knowing what the participants think about it is important.

"Yes, because I lived on a farm, it rained like outside. I'm right here (C2)

"I never had my own house or anything. This well-being that I have, I never had. It's the first time (B4)

"But I like it, because I've always dreamed of my apartment and I've always liked to be organized" (CH8)

The vast majority of people like to be able to have a house and feel that it is theirs, it dignifies them, it gives them a space of privacy, they feel like owners of their house, even though they know that it is for use. For some, moving meant a challenge, having to adapt to a new place, leaving environments of trust, support from family and friends, and relearning how to live with strangers.

Access to health

The elderly are part of the National Integrated Health System (SNIS), and it is up to them to choose to stay with a private or public provider. In the stories, they refer to 17 participants who are part of the public health network. All interviewees suffer from some type of disease and often live with more than one person. Health care is divided into specialties. The stories allow us to know how the elderly perceive this theme.

"There aren't so many specialists, I really need to do the queue thing, that's annoying because the truth is that, because sometimes you have to wait and sometimes you can't stand it so much, it's no use" (C8)

"I'm all deformed, in October last year I went to the rheumatologist who sent me a CT X-ray and until now I'm waiting to see the result" (CH3)

"... always in the long term and even more so the specialists, they are giving me specialists almost 3 by 3, for 3 months" (CH7)

"I respect medical care like this, like now we would need this, I would need to go to the doctor many times and sometimes I'm lucky, sometimes not... Now I've been waiting for the Ophthalmologist for four months" (B3)

Health care is fragmented, depending on the pathology and the specialist treating it. A person may need consultation with several specialists. Some express the need for more specialized medical professionals. The waiting time exceeds two months. Consultations are not always for monitoring or control of the health problem, but for some decompensation, for the appearance of new symptoms, requiring timely care. They see no other way out than to wait months for the appointment. The waiting time at the health service is reiterated in the stories of the different elderly people.

"You have to wait, what are you going to do, there's no other way" (CH5)

"I wanted my doctor to treat me... But she doesn't come here. That they attended to me, faster. Wait, wait, no, no one likes to wait, it seems to me" (CH6)

"I say this, to take care of an elderly person, so similar to us... not so much waiting. You go and stay for an hour, two hours, 3 hours suddenly and waiting for the doctor to attend you stay more than an hour every time" (B10)

The scheduling program continues to be used in most services. Everyone agrees that they have a waiting time and that it is excessive. Some are resigned to the fact that they have to wait, others say that sometimes they have to wait in conditions that their health does not allow.

Autonomy and physical limitations

There are several factors that can lead a person to dependence. This category is linked to the need for autonomy and self-care. In addition to suffering from illness, it is important to know if there are limitations to maintaining this physical autonomy and to the ability to carry out activities that allow them to take care of themselves and continue to live independently. There may be increased physical frailty, mobility problems, and deterioration, which generate respiratory, cardiovascular, and osteoarticular problems. Of those who manage to carry out the activities independently, they report the following in their stories.

“… I go to Gimnasia downstairs, I have a club that I go to... And well, I dance and do gymnastics." (C2)

“… I do it, I am alone, I take a shower alone and I do everything myself, I cook and I do everything myself." "I'm painting, I'm painting because I love it" "I love reading" (B4)

"I like to organize everything. I do my things, I go out to run errands, I go for a walk, I go to the gym" (CH6)

Of the interviewees, some people are able to perform basic and instrumental activities independently and even in an advanced way. But there are those who manage to carry out the activities but who manifest difficulty when performing them.

“… I can do everything without any problem... I do it slower... it takes me a little longer to do it, before I did a task that I did in half an hour, now in forty minutes, I have tremendous osteoarthritis in my knees, that I can barely walk" │laughs│" (CH2)

“... I do my best to clean up, it's hard... when my son arrives he goes" (to do something) (Ch4)

“... I come from the supermarket, then I get tired... I have to stop because I get a little tired... I have difficulty bending down too much... Washing the floor, bending over, something is difficult for me. Or I get tired, for example, sometimes putting on my sneakers, I get agitated" (B1)

"I fell and, um, I broke + and now I have a prosthetic femur... It's been 7 years since I've been out on the street. There's one thing I can't do, ..., which is to raise my arms" (CH1)

In the stories, they express limitations in the performance of basic and even instrumental activities. There are those who have the support of a child to clean and run

errands. These limitations, in some cases, limited them to instrumental activities. Those who are dependent or who need other people to carry out these activities, some have to do with those related to self-care and others with instrumental ones.

"For me it is very difficult to walk alone, I always walk with one of my daughters because I get tired. I have to walk slowly... I pay a girl..., eh I washed the floor because it makes me sick" "I don't like dirty houses." (B2)

"Exactly, they gave me a bath and everything now, with the therapy I started to shower alone, but my head can't always hurt" "I'm afraid of falling... I'm not going anywhere (B6)

"I take a shower" "So I don't have stability" "No, I don't run errands or cook... there are times when I lose the mobility of my fingers" (C9)

Some have the possibility of the help of another person to collaborate in these activities. Limitation in the satisfaction of activities that allow you to live independently and autonomously may be at risk. These situations generate fear in people, of feeling insecure, of losing stability, of reducing their mobility, of feeling limited.

Many people stated in their stories that they have limitations when traveling on public transport, such as buses, having to use a taxi to perform procedures and go to the health service. The complexes are geographically located in neighborhoods where there is public transportation, but not everyone can use it, even if it means a lower cost for having the benefit of being retired. People express the following.

"By taxi, because I can't take the bus, I can't do it" (CH5, uses a walker)

"And I ride a taxi... it doesn't make me feel safe... It's not safe for a big person. To avoid these things I prefer to take a taxi" (B7)

Despite having a higher cost, they use taxis to travel long distances. Their stories reflect that they feel limited in their use of the bus.

DISCUSSION

In Uruguay, for decades there has been a constant growth of the over-60s and in facing the social determinants that condition health and well-being due to socioeconomic, political, cultural and environmental factors. Ending situations of poverty, ensuring a healthy life, promoting the well-being of all, at all ages, is part of the Sustainable Development Goals of the 2030 Agenda.[8]

The results of this survey show some characteristics common to the elderly population of the country. There is a feminization of aging in the residents of housing complexes, with more women than men, at advanced ages. In other countries in the region,

ageing is also a process marked by gender, as is the case in Chile, where the proportion of women is higher than that of men.[9]

In the country, a universal right to have decent and adequate housing is recognized, as is the situation of the elderly who are part of the research. , among others.

The allocation of housing through the BPS Housing Solutions Program seeks to contribute to the improvement of the quality of life of the elderly who have elements of social vulnerability before entering. The aim of the research is not to focus on whether housing conditions meet the needs for autonomy and independence, as contributors to the well-being of the elderly, to the promotion of health and quality of life. An attempt was made to find out how they felt when living in these houses; The expressions of the participants were mostly positive. For the elderly it is of great value to have their own space, to feel like they own their home, where it provides them with privacy, autonomy and peace.[10]

When analyzing the education and occupation of the participants, a large number of elderly people with little education were verified, perhaps due to the difficulties in accessing school when they were children and due to the precarious socioeconomic conditions, therefore, of low income. Similar data were found in a study carried out in a Long-Term Care Institution for the Elderly in Rio Grande do Sul-Brazil: low education, low professional qualification and income, in addition to chronic health conditions.[11.12]

Research indicates that those with low levels of education have a higher proportion of chronic diseases, use health services more and need support in their daily activities. This also affects the degree of understanding and assimilation of health care.[13]

For the analysis of health needs, we started from the need for good living conditions with the family category and social support relationship. In the lives of individuals, a network is created, the result of interpersonal relationships of reciprocity between the elderly, family members and members of the community. These networks are considered protective sources of health and well-being for this population, being essential when there are elements of vulnerability such as the interviewees. What is extracted from the stories reflects networks that are limited and weak in many cases, in some cases non-existent. Similar results are found in another study that refers to social support for the elderly, where old age is accompanied by deterioration in health, the economy and the weakening of social networks.[14]

In relation to the family, there are stories that express that they are present in their lives, but in others they say that they lost contact a long time ago. The cause that generated this distancing is unknown; There are those who claim that there were conflicts that were not resolved. Other causes that may have affected this network are the need to move from

a neighborhood to live in a complex, that is, people having to learn and accept the changes, live alone, be retired and what this implies (loss of roles and bonds).), overcoming the loss of loved ones due to death, affecting the size and strength of the support network. The situations that these people had to live are in line with a study that mentions these factors or causes for the dissolution of the family, loss of friends, colleagues.[14]

The value of a social support network in old age is mentioned by a study that highlights the advantages. It refers to the fact that, in the old age of men and women, having a support network provides economic security, protection, support in daily domestic and personal activities, care and affection.[15] Not having it leaves the person without support, without protection, generating the question of who cares for these elderly people with elements of vulnerability when their informal support network is weakened or absent.

In the different complexes there are those who have pets, and express in their expressions the affection they feel for it, resulting in a stimulus, generating in people the responsibility of taking care of the other, favoring the feeling of feeling useful and of being accompanied. What was found here is similar to a study that deals with elderly people in poverty, with limitations in family support and support networks. The objective was to understand the bond between the elderly and the pet in everyday life and its implications for health, concluding that this bond had its effect on health promotion.[16]

Living alone may have been a choice of the elderly. In some people's history, this was not an option and they had to accept having to live alone due to various circumstances in life. In several stories they express the feeling of loneliness, accompanied by words and expressions of sadness, longing, anguish, demotivation. Those who most express this feeling in their stories are women. These stories coincide with the study carried out on Loneliness in the Elderly, where it says that there are risk factors that can lead to the feeling of loneliness, being of advanced age, being a single woman, divorced or widowed, having a lower level of education, with a lower socioeconomic level, low, good quality of life.[12.17]

Among the participants, there are those who expressed a diagnosis of Depression, some reported that the beginning was during the COVID-19 pandemic due to the circumstances experienced in that emergency process and the health recommendations entrusted to the population and especially to the elderly. Depression is a common mental health problem in older people. One study showed that it is more common in women, with a low level of education. It points out that studying in youth can be a protective factor against cognitive deterioration in the elderly, but there is no consensus between schooling and emotional deterioration in this population.[18]

Another condition that may be linked to the Need for good living conditions is the category that includes income, the subcategory is family financial support, loans, help with medicines, and housing. People who live in the complexes to be beneficiaries of the houses must receive a minimum retirement or pension (12 Adjustable Units = $U 1,596.82, Central Bank of Uruguay, June 2023). The income that a person has affects in most cases their ability to meet their basic needs, access services and products that contribute to a better quality of life.

In the stories, most people express their situation of vulnerability, dependence, and subordination by needing the help of others, in most cases, their children. This coincides with a study that states that the need for support from their social network makes them dependent, having in common that the reason is the low social security coverage for the elderly living in poverty.[19]

For those who do not have enough income and do not have a family support network to help them, they resort to credit. The economic and debt-generating issue is one of the factors that causes the most stress and anguish to a person, especially when their situation and the system do not allow them to obtain higher income through, for example, work. The loan option that might seem like a solution exposes them to receive, during the period in which they must repay the loan, a smaller amount of their retirement or pension. There are situations in which a snowball is generated, when the person wants to pay off the debt and continues to make new loans and so on.[20]

The Need for Access to all technologies could be linked to the Category-Access to health. Access to health services, the costs of medical care, consultations, medications, treatments and hospitalizations would be considered, conditions that can affect their health.

The values of the National Integrated Health System are the right to health, universality, equity, solidarity, and dignity. All participants are integrated into the country's health system like the rest of the population (URUGUAY, 2007). Within the 2030 National Health Goals, in third place is the improvement of the quality of health processes and in fourth place is the creation of conditions for those who take care of their health to have a positive experience.[21]

Of the health problems identified, the 15 most critical were prioritized, with the difficulty of access to services for people with disabilities and care for vulnerable elderly people in thirteenth place. Five strategic objectives have been proposed, the third refers to Improving access to and health care throughout life, the fifth expresses Moving towards a care system centred on people's health needs. It was intended to promote an

approximation with Primary Health Care (PHC) strategies, with emphasis on the first level of care (MSP, 2015).

Participants mention self-perception of the health care provided by the system, regardless of whether the provider is public or private. In the stories, they express accessibility difficulties, there are barriers when they need the health service. There is a long wait for a medical appointment and even longer with a specialist of up to two months, waiting for the day of the medical appointment in conditions that are not comfortable and this also happens to get the medication. The person has geographical and economic difficulties.

In the stories, most must use some means of transport, having to choose the one that gives them security, even if it is more expensive. Another attribute that must identify people's health needs and provide answers through the system is called comprehensiveness. The old paradigm of care persists in which the individual is passive and focused on the disease and the cure. A study carried out in Brazil mentions that health systems based on PHC obtain better results. The existence of access barriers limits other attributes such as longitudinality, exhaustiveness and coordination. These frail elderly, whose way of organizing health services, may find it difficult to get medical appointments and achieve satisfactory longitudinal and comprehensive care.[11]

All the people interviewed suffer from chronic diseases and in most cases more than one. Chronic diseases are characterized by a longer duration, do not resolve spontaneously, and once they appear, they rarely disappear completely. The main conditions are hypertension, arthritis and other musculoskeletal system problems, heart disease, and diabetes, some of which can lead to disability. The health situation of these elderly people and their difficulties are also found in other studies, which indicate that many do not undergo medical examinations at the established times and are seen when they are sick. The study also mentions the lack of personnel and the overload in certain professions, which can affect the quality of care, negatively affecting the health situation of the elderly. The elderly do not have priority care in the services and home visits are not carried out.[22]

Currently there is a paradigm shift in relation to the issues of old age and aging, the Healthy Aging Program of the Pan American Health Organization states that the specific health needs of the elderly must be known.1 Respecting these people as subjects of rights implies that health services must be evaluated so that they are adapted to them and sensitive to their needs, considering their particularities, risks and circumstances.[9]

The last category is Autonomy and Physical Limitations, it is linked to the Need for Autonomy and Self-Care.

The health of the elderly should be measured in terms of function and not disease. Frailty is one of the geriatric syndromes that may be present and is a relevant clinical condition, a state of great vulnerability, which generates difficulties in the functional and homeostatic reserve, leading to adverse consequences for the health of the elderly.23 Incorporating the concept of frailty in the care of the elderly would facilitate the understanding and analysis of health inequalities in relation to the elderly population.[11]

The elderly interviewed have risk factors that can lead them to develop the frailty syndrome or already have it. There are biological factors such as being 80 years old or older or being a woman; the presence of relevant multimorbidity; psychosocial factors, socioeconomic deficit, widowhood for less than a year, social isolation, poverty; hospitalization in the last year, recent institutionalization; functional decline. The latter has to do with the person's ability to carry out activities of daily living and maintain their autonomy.[23]

Aging is a heterogeneous process and has an impact on the planning and delivery of health services. A system is expected to ensure that it does not generate health inequalities for those who are in a state of great vulnerability, that does not allow them to suffer systematic disadvantages in access and quality of care. In a study on frailty in the elderly and perception of problems in PHC attribute indicators, he talks about the importance that this level of care must be well structured to offer adequate care to the frail elderly, optimizing health resources. [11]

These are people who live old age, one of the longest phases of life, in which deterioration and health problems coexist. The elderly studied have little or no participation in community activities, impairing their social bonds, generating difficulties in the development of social and occupational roles, which will help them generate feelings of belonging to the community, identity and value. Stories show that not everyone is fragile to the same extent. They are people who mostly practice little physical activity, some with mobility restrictions, risk factors that increase frailty. The conditions observed in the interviewees coincide with the elements found in a study that also considers the social relationships of the elderly and their effects on health through psychosocial mechanisms, which influence their psychological or cognitive state.[14]

People living in housing estates are not exempt from suffering the same problems as the rest of the elderly population; There are factors that increase their vulnerability, according to the stories told to the interviewees, and their social support networks, their economic situation, access to health through a system that does not recognize their needs

and how they are conditioned by the existence of physical limitations and elements of fragility that can affect their autonomy and self-care.

FINAL CONSIDERATIONS

The results obtained in this study aimed to understand the perception of the health needs of the elderly living in housing projects of the Social Security Bank in Montevideo, Uruguay.

Knowing the health needs from their perception allowed us to understand their concerns, interests and difficulties, how the various factors interact at this stage of life, highlighting the need for changes to have preventive measures, identification and treatment of diseases or chronic conditions, direct attention to a comprehensive approach and not to their division as it continues to be done, This makes it clear that more resources are being allocated to meet current needs. They are people with vulnerabilities of all kinds and who lack or are weak in their social network of family, friends, neighbors and community.

There are policies that comprehensively target ageing, but the situation shows that they work separately in institutions linked to economic security and health.

The approach to care must be personalized, to provide appropriate care, prevent diseases, treat chronic conditions and improve your quality of life. It is necessary to rethink that care programmes for the elderly and health methods must address the challenges of old age and the deficiencies that they must face in their health problems.

Knowing health needs and recognizing their rights implies taking into account access to education, adequate understanding of their needs and participation. Public policies for elderly people and environments should promote physical environments within the home, complex and community, public, social and health services, mobility, autonomy, independence, safety and care, avoiding their isolation, contributing to the construction of stronger and more lasting social relationships. hammocks in old age.

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DEVELOPMENT OF SKILLS ADOPTED IN THE FORMATIVE ASSESSMENT PROCESS IN THE STUDENTS OF THE 9TH GRADE OF COLÉGIO BG 1115 "10 DE FEVEREIRO"- BENGUELA

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ABSTRACT

This scientific research project has as its theme, development of skills adopted in the formative assessment process in the students of the 9th grade of the BG 1115 "10 de Fevereiro" school - Benguela. It started from the following research problem: how do teachers carry out formative assessment in the students of the 9th grade of the BG 1115 school "10 de Fevereiro"- Benguela? The general objective was to analyze how formative assessment contributes to the development of skills in 9th grade students of the BG 1115 "10 de Fevereiro" school - Benguela. The research is descriptive, with a mixed approach, qualitative and quantitative, to achieve the objectives we used methods of theoretical level such as bibliographic, analytical-synthetic and inductive-deductive research and empirical level, observation, interview, questionnaire, for data treatment, the mathematical-statistical procedure was used. The results reveal that the formative assessment process carried out by the teachers contributes in a reasonable way to the development of skills in the students of the 9th grade of the school under study. Teachers know some formative assessment techniques, but they assess students' learning with some insufficiencies, they do not comply with all assessment procedures, the student responds by reading in the notebook without arguing, which prevents the development of skills. The formative assessment technique (PMI) and the assessment tool (MAF) enable teachers to check and record the strengths and weaknesses of students during classes, helps the student to understand the content and thus results in meaningful learning and develops skills.

Keywords: Formative evaluation. Learning and skills.

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INTRODUCTION

Today's world demands an active, transformative, participatory, creative subject endowed with a wide range of knowledge. In recent years, the quality of education in Angola has been questioned. One of the criticisms made is the lack of skills in the students.

According to Perrenoud, cited by Estanqueiro (2010, p. 83), it is the evaluation that "helps the student to learn and the teacher to teach. Teachers do not teach to evaluate, but they evaluate to teach better and ensure the quality of learning."

The evaluation done successfully, following all its procedures, will be able to detect the weaknesses and positives of each student and teach according to their particularities for better learning, developing skills in it.

The elaboration of this project is justified by the fact that I note as a teacher of the aforementioned school, that some teachers evaluate the learning of students with some insufficiencies in a way that does not adequately follow their evolution. Teachers have carried out few evaluations, there is no correspondence between the number of classes and the number of evaluations, not only that, some student participation in class and other evaluation aspects are not recorded, it was noted a lack of school knowledge in the students, they end up without the skills that should be acquired in this cycle.

Therefore, some teachers have not adequately applied formative assessment, thus, it does not contribute to the development of students' skills, with these aspects and not only, based on professional experience, there is a need to deal with the process of assessing student learning.

Research problem: how do teachers carry out formative assessment in 9th grade students of the BG 1115 "10 de Fevereiro" - Benguela school? The object of study is the teaching-learning process of the 9th grade and the field of action is limited to the analysis of the formative assessment process for the development of skills in the students of the 9th grade of the BG 1115 "10 de Fevereiro" - Benguela.

General objective: to analyze how the formative assessment process contributes to the development of skills in the students of the 9th grade of the BG 1115 "10 de Fevereiro" - Benguela school.

Specific: (i) Systematize theoretical foundations that support the evaluation of student learning. **(ii)** To identify the formative assessment techniques used by the teachers of the 9th grade students of the BG 1115 "10 de Fevereiro" school in Benguela. **(iii)** To characterize the formative assessment procedures in the students of the 9th grade of the BG 1115 "10 de Fevereiro" school in Benguela. **(iv)** To propose a technique and the respective formative assessment instrument that aims to develop skills in the students of

the 9th grade of the BG 1115 "10 de Fevereiro" school in Benguela. **Scientific questions: (i)** What theoretical foundations support the assessment of student learning? **(ii)** What are the formative assessment techniques used by the teachers of the 9th grade students of the BG 1115 "10 de Fevereiro" school in Benguela? **(iii)** How are the formative assessment procedures characterized in the 9th grade students of the BG 1115 "10 de Fevereiro" school in Benguela? **(iv)** What is the technique and instrument of formative assessment that aims to develop skills in the students of the 9th grade of the BG 1115 "10 de Fevereiro" school in Benguela?

THEORETICAL FOUNDATION

THE ASSESSMENT OF LEARNING

Learning is not just a process of acquiring knowledge, content or information. "Information is important, but it needs to go through a very complex processing in order to become meaningful to people's lives" (Piletti, 2004, p. 31).

According to Perrenoud (1999), cited by Afonso and Agostinho (2008, p. 6), the evaluation of learning in the new paradigm "is a mediating process in the construction of the curriculum and is closely related to the management of student learning". Learning assessment is one of the components of teaching that has the function of controlling the teaching objectives whether they have been achieved or not.

FORMATIVE ASSESSMENT (CONTINUOUS OR SYSTEMATIC)

According to Afonso and Agostinho (2001, p. 17), formative assessment "is an activity of permanent monitoring that provides the student, the teacher and the guardian with the immediate results of the pedagogical action, since it is done during classes. This evaluation is carried out throughout the teaching-learning process and has a controlling function". Formative assessment is the one that helps the teacher to follow the evolution of their students, record the strengths and weaknesses and try to correct them.

FORMATIVE ASSESSMENT TECHNIQUES

There are several techniques through which the evaluation of students' learning can be carried out.

Lopes & Silva, (2012) highlight 50 techniques of formative assessment, among which we will deal with the TAF-PMI (Technique of Formative Assessment - Most Important Point).

The choice of this technique results from the fact that it allows the inclusion of students in the process of knowledge construction in the classroom, which will contribute to a large extent to the development of significant learning in students.

HOW TO BUILD COMPETENCIES IN STUDENTS

Competence: for Perrenoud (1999), cited by Silva, 2008, p.87 competence is understood as "an ability to act effectively in a given type of situation, supported by knowledge, but not limited to it".

Based on the idea of the author mentioned above, teaching aimed at the development of skills cannot be summarized in the pure and simple transmission of knowledge, but implies exercising the transfer of knowledge from one situation to another.

"Assessment is actually at the heart of all learning. School success largely determines the future life of students and this success depends on evaluations made by teachers" (Lopes & Silva 2012, p. 7).

"Students are considered to have achieved success or failure in school because they are evaluated according to the demands expressed by teachers or other evaluators who follow the programs and other guidelines determined by the educational system" (Perrenoud, 2008, p. 25).

According to Silva (2008, p. 99) "it would be the school's function, then, to exercise the transfer and mobilization of capacities and knowledge, through disciplines".

Evaluation is what determines the success and failure of the student, he goes to school to acquire knowledge in the various disciplines, it is the task of the teachers to help him to achieve the objectives of each discipline and thus develop his skills.

3 RESEARCH METHODOLOGIES

3.1 TYPE OF RESEARCH

We opted for a descriptive investigation, with a mixed or qualitative-quantitative approach. According to Cervo, Bervian and Silva (2013, p. 61), descriptive research is that which "proposes to observe, record, analyze and correlate facts or phenomena without manipulating them, seeks to discover as accurately as possible, the frequency with which a phenomenon occurs, its relationship and connection with others, its nature and its characteristics." Thus, we sought to analyze the way teachers perform formative assessment in the students of the 9th grade of the school under study. For Quissua (2019, p. 21) the qualitative approach "explores the particularities and subjective traits considering

the personal experience of the interviewee. Quantitative approach uses different statistical techniques to quantify opinions and information".

RESEARCH METHODS

For Ramos and Naranjo (2014, p. 55) the theoretical and empirical methods "form a dialectical unit in which one and the other complement each other. Theoretical methods enable us to interpret the various relevant concepts of the work". Therefore, we used methods of theoretical level, bibliographic research, analytical-synthetic, deductive-inductive and empirical level, observation, interview and questionnaire.

CHARACTERIZATION OF THE POPULATION AND SAMPLE

The school has 26 teachers who teach the different subjects of the 9th grade and 658 students of the 9th grade in the morning and afternoon periods. We intentionally selected 9 (nine) teachers and randomly selected 69 students, making up 11.4% of the population.

PROJECT RESULTS

The project data were collected through class observation, student survey, teacher interviews, as mentioned above.

OBSERVATION OF CLASSES

Two classes were observed for each teacher, totaling 18 classes, of which it showed us that teachers carry out formative assessment through tasks, class consolidation, teacher's test and other assessments (written or oral exercises, group work), but in a very small way.

Of the 18 classes observed, 16 the correction of the task and the consolidation is done collectively and the work or the answers of the other students are not carefully observed, they respond by reading in the notebook, without the student's argument. Teachers use reproductive consolidation more. In the 2 (two) classes, the teacher had a student answer the task with the notebook closed and the student answered the task correctly and other oral questions during the class, other students only read what was written in the notebook and on the board.

As for the registration of grades, of the 9 (nine) teachers only 1 (one) recorded the evaluations during class. The rest limited themselves to listening to the students' answers. We noticed insufficiencies in the formative assessment process, in fact teachers use some

assessment techniques, but in a very reduced way, they opt for reproductive consolidation, the student responds by reading in the material without argumentation, all this worries us because formative assessment is to identify potentialities and difficulties throughout the student's teaching-learning process, so the teacher uses procedures that help the student to understand and argue what learned along the way. Reproductive consolidation does not help the student to produce school knowledge. There must always be feedback in this process and preferably immediately for the student to understand where he went wrong and correct it with the help of the teacher, and accompanied to check how he improved his learning process in relation to a previous one to be able to understand him how he builds and rebuilds knowledge, this will allow the strengthening of the student's autonomy and his co-responsibility for the success of learning. Some teachers do not record evaluations, they are only concerned with recording some evaluations related to the cognitive domain, especially written evaluations. Evaluations must be recorded and analyzed in order to follow the student's learning process.

SURVEY BY QUESTIONNAIRE ADDRESSED TO STUDENTS

A total of 69 students from the 9th grade were interviewed and for the treatment of the quantitative data we resorted to the Mathematical-Statistical procedure, which allowed the percentage count, the frequencies of the data obtained through the previously elaborated instruments.

What are the formative assessment techniques that teachers use?

Options	Frequency	Percentage
Tasks	7	10,2%
Group work	6	8,6%
Individual work	8	11,5%
Oral questions	12	17,2%
Written tests	36	52,2%
Exercises on the board	0	0
He cites others	0	0

The indicated options show that teachers use written tests more frequently to evaluate student learning and diversify with other techniques such as assignments, group work, individual work, oral questions. These techniques, when well applied, help the teacher to detect the strengths and weaknesses of the students. Therefore, it is necessary to diversify the evaluation techniques and apply them appropriately to achieve the intended objectives.

How do you characterize the way your teachers are evaluated?

Options	Frequency	Percentage
Helps to understand the material	0	0
Encourages students to study	0	0
Helps to analyze and interpret the contents	14	20,2%
Develops students' skills	3	4,4%
It discourages the student from studying	0	0
Shows students' weaknesses and strengths	27	39,2%
It forces the student to copy	25	36,2%

The options indicate that the evaluation procedures used by teachers help to detect the weaknesses and strengths of students, to analyze and interpret contents, develop skills, but we can see that these procedures need to be improved, as 36.2% claim that the way they evaluate forces the student to copy, which means that they lead students to reproduce what teachers sign, as we see when observing the classes.

Do teachers disclose the results of the evaluations?

Options	Frequency	Percentage
Yes	10	14,5%
Sometimes	34	49,3%
No	25	36,2%

Regarding the dissemination of results, 49.3% of students claim that teachers do not always disclose the results of evaluations and 36.2% said they do not disclose them. This situation is worrying for us. The results should be immediately disseminated, as the objective is to obtain a double feedback, for the student to indicate the stages of his learning process and the difficulties he encounters and for the teacher to indicate how to develop his pedagogical practice.

INTERVIEW AND DISCUSSION WITH TEACHERS

Wanting to interview those teachers we observed in class and explain the functioning of the proposal of the technique and instrument of formative assessment, we opted for a group interview and discussion on how teachers should carry out formative assessment.

What are the formative assessment techniques that you know?

The teachers answered, group work, individual work, tasks, oral and written test, exercises on the board, practical work.

The answer is satisfactory, but we have to say that there are several techniques of formative assessment: according to Keeley, cited by Lopes & Silva (2012, pp. 127-128), it is necessary for teachers to know several techniques to assess students' learning.

What techniques of formative assessment have you used?

The teachers answered: the tasks, class consolidation, teacher's test and other evaluations (written or oral exercises), group work. During the discussion, the teachers claimed that these are the evaluation techniques to be used at this level of education and recognize their insufficiencies and that some factors are due to: excess of students per class, lack of didactic resources, excess of content, lack of knowledge about the evaluation procedures.

In the interview and group discussion, the teachers show that they have carried out formative assessment based on some techniques, which when well applied help to verify the weaknesses and strengths of the students, but we were concerned about these insufficiencies during this assessment process, because formative assessment is a continuous process that helps the student in the process of assimilating knowledge and acquiring skills. Despite some factors that interfere in this process, the teacher must outline strategies that help to correctly assess student learning.

In your opinion, does the way you evaluate develop skills in students? Justifies

Teachers claim that students do not have the ability to argue, solve tasks and other assessments, only by reproducing.

Teachers must follow the appropriate procedures of this process to be able to seek favorable paths for the acquisition of students' school knowledge. It is necessary to evaluate the student appropriately and in its entirety, the values, knowledge and skills so that he develops skills.

Have you ever heard of the PMI formative assessment technique (most important point)?

All teachers were unanimous in their answers, they had never heard of this formative assessment technique-PMI, and they claim to have always evaluated students' learning based on other techniques, despite each one having a technique that they use the most during school time.

There are several formative assessment techniques, all of which when applied properly help in understanding and verifying students' strengths and weaknesses. It is necessary for teachers to have knowledge of various techniques and diversify during the evaluation process.

Asked if they record the results of the formative assessments.

Seven teachers answered that they do not always record the results of the assessments, they are more concerned with recording the cognitive domain, the teacher's test, quarterly and written assessments. *Two teachers answered that they always record and have a notebook.*

All student evaluation requires a qualitative or quantitative assessment, and it is necessary to record these evaluations for better monitoring of the evaluation process and control if there is evolution or regression to redefine the evaluation procedures. That is why we have developed an evaluation instrument (map) for its purpose. (Annex 1)

At the end of the interview and discussion with the teachers, we present the proposal of the formative assessment technique – PMI that aims to develop skills in students and the respective map for the registration of all assessments.

CONCLUSIONS

- The evaluation of learning done in an appropriate way aims at the cognitive and social development of the student, in turn will allow for quality teaching. Formative assessment helps to know and identify failures in learning in order to seek pedagogical techniques to correct them, it is the guide of the teaching-learning process.
- The teachers of the BG 1115 "10 de Fevereiro" school in Benguela use some formative assessment techniques in 9th grade students, which are tasks, group work, written tests and oral questions.
- The procedures used by the teachers of the 9th grade of the BG 1115 "10 de Fevereiro" school in Benguela are characterized as reasonable, as they present some insufficiencies, do not comply with all the assumptions of the evaluation process, do not lead the student to argue what he has learned, are limited to reproductive consolidation, there is no immediate feedback on the results of the evaluations, partial recording of the results of the evaluations, this practice needs to be improved; because through formative assessment the teacher leads the student to a significant learning by producing competencies;
- The formative assessment technique, which aims to develop skills in the students of the 9th grade of the BG 1115 "10 de Fevereiro" school in Benguela is the most important point (PMI), is a technique that allows the verification of the understanding of the given content and gives *feedback* to the teacher in relation to the objectives of the class and contributes to learning.

PROPOSAL OF THE FORMATIVE ASSESSMENT TECHNIQUE (MOST IMPORTANT POINT) TAF - PMI

For Keeley, quoted by Lopes & Silva (2012, p. 127), the most important point (PMI) "is a formative assessment technique (TAF) that is easy and quick to apply, in which students are asked to identify the most important learning or idea of the class. It is the opposite of TAF – muddy point or stone in the way".

How does the PMI-Formative Assessment Technique work?

At the end of the class, students describe orally or in writing, the most important or significant aspect of the class, which contributed most to their learning.

Purposes of the formative assessment technique - PMI

This technique allows for the verification of comprehension. It is used at the end of a lesson to give feedback to the teacher on how students have achieved objectives or learning goals. It enables the involvement of students in the self-assessment of their learning.

PMI is a technique used to collect information about what students think were the most significant or important points of the class for their learning. If students' PMI differ from the main points of the lesson, the teacher can use this information to clarify and emphasize.

Advantages of the Formative Assessment Technique - PMI

Students reflect on the lesson and identify the key points that contributed to their learning. They thus have a metacognitive strategy that helps them focus on the important objectives of a lesson. This reflection on the most important aspects of the class, made by the students, can contribute greatly to the development of meaningful learning in the students.

According to Lemos (1994), the object of formative assessment is of a broad and comprehensive character: it should not be restricted only to the domain of knowledge, but should also encompass the socio-affective area of the student. It is advisable to use structured records of use. Therefore, we have prepared a map of the formative evaluations (see annex).

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ANNEX 1 - FORMATIVE ASSESSMENT MAP

NAME _____

No. ___ **DWELLING** _____ PHOTO

DATE	FEBRUARY				MARCH				APRIL				MAY				JUNE				JULY				AUGUST				SEPTEMBER				OCTOBER				NOVEMBER				DECEMBER			
	F/PT	ASS	INT/RT	TO	F/PT	ASS	INT/RT	TO	F/PT	ASS	INT/RT	TO	F/PT	ASS	INT/RT	TO	F/PT	ASS	INT/RT	TO	F/PT	ASS	INT/RT	TO	F/PT	ASS	INT/RT	TO	F/PT	ASS	INT/RT	TO	F/PT	ASS	INT/RT	TO	F/PT	ASS	INT/RT	TO	F/PT	ASS	INT/RT	TO
M.A.F Monthly																																													
BEHAVIOUR																																													

MAF1 -------- PP1 -------- MT1 --------

MAF2 -------- PP2 - ------- MT2 --------

MAF3 -------- PP3 - ------- MT3 --------

MF = 0,4 X MA + 0,6 X PE

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PHILOSOPHY AND SCIENCE IN EDUCATION: BETWEEN FRAGMENTATION AND COMPLEXITY

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ABSTRACT

This article aims to critically analyze the fragmentation of scientific and human knowledge, often confined to school disciplines and university departments, in the light of the history of the relationship between philosophy and science. To do so, we used the Cartesian paradigm and the emergence of the complexity paradigm as a reference. We investigate, in particular, the pedagogical models derived from the Cartesian paradigm, with emphasis on the pedagogy of competencies and skills that, with the reform of High School promoted by Mendonça Filho, became the official guideline of the school curriculum in Brazil. In this context, we question to what extent this curricular and pedagogical change can overcome the Cartesian model and whether the roles attributed to philosophy and science in these legal documents contribute to the articulation of knowledge from a perspective of complex thinking.

Keywords: Cartesian paradigm. Paradigm of complexity. Education.

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INTRODUCTION

Since the last decades of the twentieth century, a central theme of debate has presented itself as a pressing challenge, namely: what is the most appropriate way to train the new generations? This questioning gains relevance in a context where the historical process of education has resulted in the fragmentation of knowledge into methodological and epistemological compartments that interact and collaborate very little with each other. Philosophy, traditionally recognized for its interdisciplinary nature and for its capacity for dialogue with other fields of knowledge, has also been impacted by this fragmentation that characterizes the contemporary panorama of knowledge. To structure our analysis, we organized this work into three parts: in the first, we addressed how science, by moving away from philosophy, caused an epistemological rupture between the human sciences and the natural sciences; in the second, we examine the pedagogical implications of this Cartesian paradigm; and, finally, in the third part, we analyze the Brazilian educational reform that adopts the model based on competencies and skills.

THE DIALOGUE BETWEEN THE HUMANITIES AND SCIENCE

Philosophical knowledge, which should be the epistemological instance for the meeting of the various knowledges and a pedagogical instrument for reflection and understanding of human formation, also suffers from the modern fragmentation of reality in various areas. As a result, philosophical-pedagogical work ends up being organized in a way that is contradictory to its own open and transdisciplinary nature and assumes the methodological posture of determining specific contents and traditional pedagogical ways of dealing with knowledge. Such an anti-philosophical attitude - brought to the environment of reflection and pedagogical practice of professional philosophers, philosophy teachers and teachers in general - generates systems that disintegrate the entire range of knowledge produced and that goes against the complexity of reality that cannot be understood in an atomized way without serious damage to human formation and social life.

> These systems cause the disjunction between the humanities and the sciences, as well as the sciences in hyperspecialized disciplines, closed in on themselves. In this way, global and complex realities are fragmented; the human moves; its biological dimension, including the brain, is enclosed in the departments of biology; its psychic, social, religious, and economic dimensions are at the same time relegated and separated from each other in the departments of human sciences; Its subjective, existential, poetic characters are confined to the departments of literature and poetry. Philosophy, which is by nature the reflection on any human thought, has in its turn become a field closed in on itself. Fundamental problems and global problems are absent from the disciplinary sciences. They are safeguarded only in philosophy, but are no longer nourished by the contributions of the sciences (Morin, 2007, p. 40).

The fragmentation of knowledge inappropriately called human and scientific (wouldn't all knowledge be human?) and the consequent mischaracterization of philosophy brings an impoverishment from the epistemological point of view both for the natural sciences and for philosophy. Furthermore, without a philosophical conception that is capable of integrating the various knowledges between the parts and the whole without simplification, there is no way to develop a pedagogy that is favorable to the formation of individuals capable of understanding and dealing with reality in a global and solidary way.

For the natural sciences, hyperspecialization removes the possibility of bringing to their research the central and more general aspects that give meaning to human life. They produce a cold discourse in which the imaginative, mythical, and subjective aspects of culture are set aside as an obstacle to true knowledge. And so, such scientific knowledge is restricted to the descriptive aspect of reality to the extent that it is capable of being translated into technological productions to be somehow consumed. For philosophy, on the other hand, the division of areas distances researchers from the physical, chemical and biological knowledge produced about man and the universe. This situation is at odds with the history of thought itself, which, until the emergence of modern physics with Newton (1643-1727), treated bodies, movements and energies present in nature as philosophical problems.

In fact, Newton called his inaugural work of modern physics Mathematical Principles of the Philosophy of Nature. The founder of modern science himself still understood his research as philosophical or as an integral part of various other integrated knowledges, which in the seventeenth century had not yet been atomized. However, in the title the Cartesian element of mathematics already appears as the language of a knowledge that is intended to be distinct and clear to the detriment of the other metaphysical discourses of nature that have mythical aspects as a language of expression: to the Judeo-Christian Scriptures as a source of knowledge and language of nature, the Cartesian science henceforth opposes mathematics as a model of pure knowledge, certain and verifiable.

Newton synthesizes the scientific knowledge of his time and offers them a system based on simple principles that would account for all the mechanics of bodies, from the smallest elements of the world to everything that constitutes the universe. From Galileo Galilei, he inherits the conception that the Aristotelian view of the division of the celestial spheres into supra and infralunar spheres is inadequate, especially because through empirical observations of the sun (with a spyglass), the moon and the stars, he can perceive that there were "holes" in the moon and "faults" in the sun and planets, that is, the thesis that everything above the moon lived in a state of perfection that only did not it would

be absolute because they revolved around the earth. The movement of the stars would be the only imperfection within this ancient and medieval conception that understood mutation as negative.

From Galileo, Newton also absorbs the conception of a world written with mathematical characters. A harmonious, perfectly symmetrical universe that would form a web of Euclidean geometric relationships, in which all the behaviors of bodies could be described with geometric shapes and in a quantifiable way with numbers and proportions. The clear and distinct language here of mathematics would possess an ontological status of equivalence with reality and would make the world not only known but also possible to investigate.

There is already a drawing here of a physical science that will be improved in the Principia from the cosmology presented by Copernicus. Thus, the earth ceases to be the center of the universe and becomes a dwarf star that orbits like a satellite around the sun. Furthermore, the movement of our planet would follow a fixed and elliptical trajectory within a mechanics that would obey an immutable order. For the Catholic priest and scientist, there would be plenty of evidence that the earth would have no edge or cosmic centrality, but it was necessary for Newton to develop this thesis, which had already been defended by Galileo within a work in the form of a dialogue called "On the Two Great Systems". However, here the defense was made in an apologetic way within a style of writing in which the author could advocate his (Copernican) ideas without compromising his life that could be set on fire by the fires of the Catholic Inquisition.

The scientific basis of these revolutionary ideas for the time only really came in Newton's greatest work. No doubt, Johannes Kepler had already presented the three laws of motion that explained why the planets revolve around the sun. However, the understanding of the fact that they moved the way they did had remained open. The Newtonian answer to this unknown was the law of attraction between bodies, which states that the force of gravity between two bodies is inversely proportional to the square of the distance (Hawking, 2005, p. 154), that is, the elliptical movement of the orbits of the stars around the sun is the result of the massiveness of the sun and the distance in relation to the planets that function as its satellites.

The formulation of the law of universal gravitation unified what would be inconceivable in Aristotelian optics, namely, the same force that attracts objects to the center of the earth causing an apple to fall on someone's head is the same that attracts and keeps the planets in their orbits. Based on this theory, which unified all terrestrial and celestial phenomena, linking the tiny infinite to the cosmic infinite, science followed in the

nineteenth century a dogmatic path of determinism, which was expressed very well in the pretensions of the French scientist Marquis de Laplace, who stated that the universe and all physical processes in it would obey a set of fixed laws. These would determine the state and behavior of bodies, movements and energies existing in nature (Hawking, 2015, p. 75). Within this view, it would be conceived that if we knew the current state of the universe or the position and velocity of the sun, we could predict everything that would happen to this star and its celestial system, from the macro to the micro elements.

Within this deterministic paradigm of the nineteenth century, in which uncertainty is overcome by the illusion of the causal linearity of a supposed universal legislative order, a fissure has emerged through which an epistemic hemorrhage has erupted. "A hemorrhagic principle of degradation and disorder (second principle of thermodynamics) has been discovered in the physical universe [...]" (Morin, 2015, p. 14). The macro analysis of the behavior of steam engines has led scientists to observe that, in the production of work or movement through the use of hot springs, the yield of the machines can never be one hundred percent, because it is impossible for there to be full use or transformation of the heat received into work. Therefore, a part of the heat is rejected by the thermal system within a phenomenon of entropy, namely, from a principle of disorder and spontaneity. In other words, the greater the degree of disorder within the system, the greater the functionality and spontaneous organization of the phenomenon.

The phenomenon of entropy deconstructs the idea of a nature that comes out of a disorder and necessarily goes to an order and brings the understanding that disorder is an inherent part of systems, including being the factor that provides organization and spontaneity. It was understood from this that "[...]the cosmos is not a perfect machine, but a process in the process of disintegration and organization at the same time" (Morin, 2015b, p. 14). The same constitutivity of chaos understood by thermodynamics in the macro context is also found in the dimension of microphysics. “[...] then, in what was supposed to be the place of physical and logical simplicity, extreme complexity was discovered [...]; the particle is not a first brick, but a frontier on a perhaps inconceivable complexity" (Morin, 2015, p. 14).

Deterministic science, which had been shaken by the experiments that technologies such as steam engines provided to thermodynamics, from the twentieth century onwards will see its world collapse again. This time, the infinity in question is the minuscule, which cannot be seen with the naked eye. The mechanics in question here is not that of the functioning of large bodies and masses, but of particles. From photovoltaic experiments and the observation of energy emission, paradoxes arose that led to the emergence of quantum

mechanics. The name of this branch of physics comes from Max Planck who suggested that the idea prevalent until 1900 that from a hot body (such as a star) radiates an infinite rate of heat – which could be extended to any emission of light that would produce electromagnetic waves – was absurd. Therefore, he stated "[...] that light, X-rays and other waves could not be emitted at an arbitrary rate, but only in certain packets that he called quanta" (Hawking, 2015, p.76).

The postulation of the *quantum* became a coup de grace in scientific determinism when Wener Heisenberg formulated the uncertainty principle in 1926. Contrary to what Laplace expected, it was proven that at the micro level of the universe there is no way to predict the future behavior of a particle from the determination of the position and current motion of the observed object. This is precisely due to the uncertainty caused in the investigator's own act of observation. The German scientist realized that to predict the future speed and position of a particle it would be necessary to accurately measure the current position and speed. The point is that for this to be possible, the observer needs to shine light on the object in a very small amount equivalent to a wave crest.

The problem is that, according to Planck's conclusions, this emission cannot be done arbitrarily, but using at least one quantum of light. "This quantum will disturb the particle and change its velocity in a way that cannot be predicted" (Hawking, 2015, p. 77). With this, the uncertainty principle shows that the more accurately we can determine the position of a particle, the less we can determine its velocity, and the opposite is also true. This conclusion is the beginning of the reformulation of mechanics that is then called quantum mechanics and which basically postulates that it is not possible to measure and define precisely (or separately) the position and velocity of microphysical objects.

The role of science then becomes to establish the quantum state, that is, to predict the various possible outcomes of an experiment, showing the probability of each of the outcomes. Hence, instead of being deterministic, the role of the investigator of nature becomes probabilistic insofar as when analyzing varied and similar systems, he can only predict that the result is one in certain conditions, another in others, and so on, predicting only an approximate number of how many times each effect can occur. As a result, science begins to admit randomness and unpredictability as constitutive of its work.

Of course, here we refer to physical and cosmological works considering studies on the macro and the micro separately, so that we have to understand that the understanding of science of some is not yet accepted by others. Albert Einstein is one of these scientists who revolutionized the understanding of macro knowledge and, together with the Dane Niehls Bohr, sought to unify the understanding into a single theory (just as Newton had

done in the seventeenth century) that explained both the behavior of particles (quantum mechanics) and that of the stars (Hawking, 2005, p. 201). Regarding the mechanics of bodies, Einstein at the beginning of the twentieth century made a paradigmatic change in relation to the Newtonian system from the introduction of the Theory of Special Relativity and the Theory of General Relativity.

Special relativity revolutionized the understanding of reality by modifying the Newtonian understanding of time and matter. For classical physics, time is mathematical and absolute, that is, it flows infinitely and continuously, regardless of any factor external to its reality. Mass would also be something of an algebraic nature, but relative to gravity that would be absolute within the definable and calculable relationship between bodies. In Einsteinian theory, the speed of light is the reference constant for thinking and establishing other quantities, so that for observers who are in varied movements, the measurement of the time of the displacement of light does not vary. "Einstein held that all observers should measure the same speed of light" (Hawking, 2005, p. 200). However, for the same observers, their time is measured from their own speed in relation to the speed of light. If we do not perceive this difference with the clock, it is due to the fact that we make speed experiments that are infinitesimally smaller than in light, which has repercussions on a difference in time between subjects that are imperceptible without technological mediation.

As far as matter is concerned, Einstein associated mass with speed and energy production. According to his postulate, later demonstrated experimentally, the mass of a body changes as its velocity changes. Thus, the acceleration of a particle to a speed equivalent to eighty-six percent of the speed of light doubles the mass of the corpuscle. Hence, from this it was understood that, symmetrically to the massive increase of the particle by the velocity, there is an increase in the energy generated. From this realization came the famous formula described as the equality between energy (E) and mass (m) times the square of the speed of light (c), which indicates that with a minimum amount of matter (such as an atom) an enormous amount of energy can be produced. This encouraged the world of science and technology to work on the fissure of atoms producing a (nuclear) weapon, the result of which would be a great atomic explosion of colossal proportions and very damaging.

If special relativity modified the Newtonian understanding of time and matter, general relativity altered the meaning of the conception of space. For classical physics, space is unlimited, geometric, and does not suffer any influence from matter: bodies act for each other in proportion to their mass and in the inverse ratio of distance, and space is only the stage where this web of attraction between celestial or terrestrial bodies occurs. Gravity is

the very force of attraction. The problem with this conception is to disregard that it is not only matter that is responsible for the relations of forces of the celestial bodies. Space is a complex system that can only be understood in its relationship with time, in such a way that space is actually a structure called space-time by contemporary science. And gravity is not the simple force of attraction between bodies that gravitate to each other. That's also it, but not only... it is the influence that mass exerts on space-time, causing a curvature in it and producing an effect of movement on bodies.

Both Einstein's physics and quantum mechanics (Borh's, for example) are proven by scientific experience. The theory of general relativity was observed on May 29, 1919 by a scientific expedition in Sobral, in the interior of Ceará: they realized that the position of a star during the solar eclipse was in a different position from the one it occupied at night, and this showed that the light of the star when passing through the sun suffered a curve. Quantum physics, on the other hand, is present in modern technologies "it governs the behavior of transistors and integrated circuits, essential components of electronic devices such as televisions and computers." (Hawking, 2015, p. 78).

Both theories[2] brought new elements to think about science, thought itself, reality and, as a consequence, also education. Now, how to think about the organization of knowledge within school curricula while maintaining a rigid separation between philosophy and science or between human sciences and natural and exact sciences arising from the determinism of the nineteenth century? It seems to us that the separation between philosophy of nature and natural science, in the twentieth and twenty-first centuries, begins to be rethought within the urgency of overcoming a Cartesian-Newtonian paradigm that no longer explains reality so well.[3]

THE CARTESIAN PARADIGM AND PEDAGOGICAL MODELS

And so, what was not possible to occur in the seventeenth century because of the persistence of the philosophy of nature in the physical conception of bodies, from the nineteenth century onwards will become the rule in the world of sciences, creating an abyss

[2] Edgar Morin does not hide his preference for Niels Bohr over Einstein, but in both he finds elements that show the emergence of a complex paradigm (2015, p.14). In Bohr's quantum mechanics, he sees the relationship of opposites that become complementary, that is, he brings the contradictory into logic. In Einstein, he perceives the inseparability of the separable and the separation of the inseparable (space-time). "Although Einstein's genius did not influence me as Bohr's, his conceptions revealed that time and space, which, for us, are two separate entities, to a certain cosmic degree of observation, are inseparable entities. I was quite fascinated by the immense paradox of inseparability in separation and separability in the inseparable" (2020b, p. 146).

[3] "What from an interpretative perspective can be considered a crisis of contemporary scientific thought, from our point of view, is a manifestation of a powerful rupture with old ideals, norms and values" (Morin, 2016, p. 42).

between philosophy and the natural sciences. And also between philosophy and the other sciences, given the birth of sociology and psychology, whose model of epistemological organization was that of Newtonian physics. It is worth remembering that the founders of sociology defined this knowledge in direct reference to the science of nature, see Auguste Comte (1798-1857) who called sociology "social physics" and Émile Durkheim (1858-1917) who defined its object as being the "social fact" or that which can be quantifiable and analyzed empirically. The Cartesian epistemological-paradigmatic background of this movement of sciences in modernity will be responsible for this fragmentation and hyperspecialization, according to Edgar Morin.

> It is necessary to evoke here the "great paradigm of the West" formulated by Descartes and imposed by the unfolding of European history from the seventeenth century onwards.
> It is certainly a paradigm: it determines the sovereign concepts and prescribes the logical relation: disjunction. Failure to obey this disjunction can only be clandestine, marginal, deviant. This paradigm determines a double vision of the world - in fact, the unfolding of the same world: on the one hand, the world of objects subjected to observations, experiments, manipulations; on the other hand, the world of subjects who question themselves about existence, communication, consciousness, destiny. Thus, a paradigm can at the same time elucidate and blind, reveal and conceal. It is within it that the key problem of the game of truth and error is hidden (Morin, 2007, p. 27).

As can be seen, the Cartesian paradigm of knowledge is the great guide for the formation of knowledge that has become too specialized in search of clarity and distinction within a cold rigor and disconnected from the problems of life. In fact, the sciences alone cannot deal with ethical, epistemological and meaningful questions. In fact, the question of the meaning of life as the primary engine of our existence and of the entire universe does not even arise, since what matters is the deciphering of the constant laws that govern the causalities of phenomena. In this way, we proceed to the simplification of reality that occurs by disjunction in the case of the separation of the human world from the world of nature or by the reduction of the human to the natural.

The Cartesian paradigm prevents one from thinking about reality in the way that Morin calls uniduality in which there is no simplification of the processes of man's relationship with the world, but a concomitant separation and implication. In this case, reality is thought of in a complex way in which the game of truth is found in an apprehension of reality in which subject and object are interrelated without the superimposition of one over the other. The truth in this case is not absolute and linear, but open to criticism and transformations of the world as well as to the processes of reformulation, unlike several other formative models that are founders of different pedagogical knowledge.

In the case of the hyper-specialized modern paradigm – in which truth is thought of as a mirror of nature within what the Scholastics said was an *adequatio mens et res* (adequacy of the mind to things) – the predominant formative model is the traditional one. Paulo Freire (1921-1997), in his famous Pedagogy of the Oppressed (2015), calls this practice banking education, because knowledge is seen as something merely objective which the holders of knowledge transmit in a verbose way to the students, who in this case are not subjects of the process, but objects of training. As in a bank, teachers, after depositing knowledge in students, demand a return on investments through tests that aim to punish those who did not retain the information and repay/recognize/promote the merit of those who proved capable of answering the questions and problems proposed in the same way they were taught.

In opposition to this Cartesian model of truth and the corresponding traditional pedagogy, numerous alternatives and epistemological conceptions have appeared, which have been put into practice in various school experiences and in many cases have been adopted as normative in various pedagogical policies of various educational systems. We highlight here, by way of example, some models that we consider to be of great relevance given the influence they exert on our teaching practices and on the organization of the curricular structure of our schools and our teacher training courses, namely: progressive model; pragmatic model; technical/business model/competencies and skills; and complexity model.

Progressive pedagogy is founded on a conception of dynamic and historical truth in which the movement of knowledge production is not linear. Contradiction, conflict and socioeconomic issues are the aspects in which reality presents itself. And the school is seen sometimes as reproducers of the dominant ideology, sometimes as an opportunity to free themselves from the shackles that imprison individuals in alienation. The most radical, the reproductionists, argue that there is no way out of the situation of exclusion and oppression through state institutions, as these were created to reproduce the *status quo ante* through symbolic violence and as an ideological apparatus of the state. Others, such as Paulo Freire, preserve the hope that education can be liberating when it is taught to read the world in an ontological, ethical and aesthetic commitment to be more (2011). In this model, students are subjects of their knowledge, which is conceived as something historically and socially constructed.

The pragmatic model understands truth within an aspect of utility. True is that which is capable of solving a problem or producing a meaningful experience. Concepts are understood as tools that provide thought and aesthetic experiences. From the pedagogical

point of view, knowledge is seen as an experience mediated by concepts or affections and the role of students is seen in an active way and the classroom as a research laboratory guided by the teacher. This orientation served as a basis for the New School reformers and influenced Paulo Freire, although he was not a liberal.

In the case of technicist/business pedagogy, we perceive the influence in Brazil from the period of the military dictatorship in which the MEC-USAID agreements took place. In this orientation, what counts is the preparation of individuals for the world of work. The school is a kind of citizens' industry. These are understood as specialized professionals and ready to meet the demands of the market. From the point of view of the conception of truth and pedagogical practice, there is no innovation, as it follows the same traditional epistemology added to behaviorist practices of conditioning and adapting individuals to the expected corporate results.

Although with a different epistemological conception, we understand that the model of competencies and ability follows the same purpose as technicist pedagogy. Created for the training of workers in the 1970s in the corporate world, it was promoted by large international organizations such as the World Bank and the OECD (Zabala; Arnau, 2014, position 178). In the 90s, it was also promoted by UNESCO when it encouraged work on what education in the twenty-first century should be like, given Philippe Perrenoud's Ten Skills: Invitation to Travel (2014). For us Brazilians, this pedagogical model is very important since it received from our public authorities the normative and legal character of a parameter for the design of our school curricula. It remains to be seen whether this pedagogy responds to the demands of complex thinking.

FINAL CONSIDERATIONS

In this same context promoted by UNESCO, we have The Seven Necessary Knowledges for the Education of the Future (2007) by Edgar Morin, which brings a reflection on what education in the twenty-first century should be like. The proposal is transdisciplinary and involves not contents, but basic issues, such as: 1 - the blindness of knowledge: error and illusion; 2 - the principles of pertinent knowledge; 3 - teach the human condition; 4 - To teach earthly identity; 5 - face uncertainties; 6 - teach understanding; 7 - The ethics of the human race.[4]

These seven knowledges are central problems that have a dynamic conception of truth, not simplifying, which propose to see reality in a complex and unidual way, that is, in a

[4] These themes are also found in the work Ensina a viver: manifesto para mudar a educação (Teach to live: manifesto to change education) (Morin, 2015).

relationship of disjunction-implication in which the whole and the parts are organized in such a way that the former cannot be seen as the sum of these, but in a systemic-organizational movement in which the whole is already found in the part (as in the hologram or in the cell), which recursively is composed of the parties in a process of interdependence (Moraes, 2015). That is why one could not determine the truth absolutely, but one could determine the principles of true knowledge that would be able to approach complex reality in an adequate way, namely: the context; the global; the multidimensional; and the complex. And based on the work A cabeça bem-feito (Morin, 2020a, p. 93-96) we could add some others of which we highlight: the systemic-organizational; the hologrammic and the recursive.

The context is the place where information or knowledge is found. The global and the systemic-organizational refer to the relationship between the whole and the parts in an organizational and inter-retroactive dynamic. Multidimensional is the perception that there are complex units that must be seen from many perspectives. The hologrammic principle states that in each part is the whole (e.g., society in the individual; all the genetic material in a cell). The recursive presupposes that all things are at the same time products and producers, effects and causes within the same process, so individuals produce society, but society produces humanity and individuality in each one. The complex means that all things are together in a unity of multiplicity. These principles serve as hermeneutical lenses to read reality in a believable way.

With regard to training, complex thinking is an approach that does not exclude the advantages of others, but brings the contributions of this knowledge to an epistemological conception that does not simplify reality and that seeks to overcome the fragmentation of knowledge. We understand that it is a philosophical conception capable of shedding light on the formative work of teachers (especially those of philosophy), regardless of their theoretical orientation. In this sense, we could ask: does what is in the pedagogy of competencies and skills and in the Brazilian educational reform correspond to the education necessary for the twenty-first century according to the principles set by Edgar Morin?

At first glance at these problems, it seems to us that it is, since the BNCC raises the issue of interdisciplinarity and makes the curriculum more flexible with the alleged purpose of making the learning process more attractive to the student. However, when we observe that the only thing that is really guaranteed (regardless of the choices of the systems and schools) is to learn to read and write and count in isolation, we suspect that it is a modern model in its pedagogical proposal, but not very effective in the results. In fact, within the five training itineraries, there is only Languages and Mathematics as a generous workload.

It seems to us that this model, by leaving components such as philosophy and sociology for negotiation, does not guarantee equal learning rights for all so much. Will the child of the worker and of poorer regions not feel pressured to give a pragmatic character to his curriculum at a time when he should be developing his general intelligence with philosophy, sociology and the arts? Is it not a way to continue reinforcing the school duality and preparing most students to become cheap labor?

When the spokespersons of the BNCC say that there is a huge possibility of negotiating the workload for other curricular components in the flexible part of the itineraries, do they take into account that teachers of Philosophy and sociology only began to be demanded by the education systems recently (2008) and that now they are no longer considered necessary? Not to mention Arts which, although it has always been in the curricular designs, only receives a status of filling the teacher's workload and animating civic moments at school. What negotiating power do these professionals have in the face of the imperative of the business mentality brought about in the midst of this reform? In our understanding, almost nothing!

In this sense, our answer to the question of whether the model of competencies and skills responds to the demands of complex thinking is categorical: no! We understand that the requirement to develop general intelligence in line with specialized thinking by putting complex principles into practice does not find a favorable environment in a model that does not recognize science as philosophical and philosophy as science. It is not possible to reform a "well-made mind" if those epistemological instances that caused the fragmentation continue to operate in this split: counting and reading obligatorily on the one hand and philosophizing, artisting, investigating, finally thinking, on the other hand and without curricular weight.

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CADMIUM REMOVAL FROM WASTEWATER: A COMPARATIVE STUDY BETWEEN ELECTROLYTIC AND MEMBRANE SEPARATION PROCESSES

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ABSTRACT

To minimize the effects of pollution caused by toxic metals, the environmental laws of the various countries of the world have become increasingly restrictive with regard to the emission of industrial waste. On the other hand, technological development has driven the creation of new processes and techniques that are extremely efficient in the removal of toxic metal contaminants from wastewater. In the literature review, several techniques for removing toxic metals such as cadmium are evaluated. The main objective of this work is to carry out a comparative laboratory study between electrolytic and membrane separation techniques (reverse osmosis) for the removal of cadmium ions (Cd2+) from wastewater. The electrolytic process, because it is simple and does not require chemical additives, has the advantage of enabling the recovery of cadmium in its metallic form and in high concentrations present in wastewater. However, at low concentrations of Cd2+ ions, the process is not efficient. Finally, it can be proposed to use the two processes in a complementary way. At first, the electrolytic process is applied to remove the highest concentration of cadmium, followed by reverse osmosis to reach values acceptable by environmental legislation.

Keywords: Cadmium. Electroplating. Reverse osmosis. Contamination. Environment.

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INTRODUCTION

The pollution of water bodies is a chronic problem for society, which has been progressively aggravated by urban, agricultural and industrial growth. If, on the one hand, there is a growing demand for water, on the other hand, the increase in the pollutant load discarded in rivers, lakes and seas reduces their quality, often making them unavailable to the noblest uses, reducing the supply of water.

As a way to minimize the effects of pollution, the environmental laws of the various nations have become increasingly restrictive with regard to the launching of dumps. In parallel, technological development has been driving the emergence of new processes and extremely efficient techniques for the removal of contaminants from water.

Among the main contaminants associated with the pollution of natural waters, toxic metals stand out, a class of compounds of high toxicity and that are bioaccumulated in organisms. Because they are not biodegradable, the traditional process of biological treatment of wastewater (activated sludge) is not efficient in removing these contaminants, which requires investments in the development of physical-chemical processes, with emphasis on electrolytic processes and membrane separation processes.

Electrolytic processes are based on the use of electrical energy for the occurrence of chemical reactions. In the case of an aqueous phase, heavy metals are dissolved in the form of cations. When the electric current is applied in the aqueous phase, in the cathode of the electrolytic reactor, these cations will react with electrons, reducing their metallic form. The metallic form is deposited in a solid phase on the surface of the cathode, thus being removed from the aqueous phase.

The use of membrane separation processes has shown extremely satisfactory results in the removal of heavy metals from aqueous solution. From the second half of the twentieth century, the use of membranes in separation processes was incorporated in different areas, which include the desalination of brackish and salt waters, hemodialysis and various industrial applications, such as gas separation and beverage clarification. Recently, these processes have also started to be used in the environmental area, providing the removal of contaminants from industrial effluents, in order to meet the limits of effluent disposal imposed by environmental legislation and provide water reuse.

The main objective of this book chapter is to carry out a comparative study between electrolytic and membrane separation techniques for the removal of cadmium ions from wastewater.

LITERATURE REVIEW

DISPOSAL OF HEAVY METALS IN WATER BODIES

Metals play important roles in the metabolism of living beings. Its properties are fundamental in maintaining the three-dimensional structure of biomolecules. Some metals are necessary in minimal amounts for the maintenance of cellular metabolism, while others have no relevant biological function, which can cause damage to metabolism. From a physiological point of view, metals can be classified into three categories: essential (calcium and magnesium), essential metals that can become harmful in high concentrations (iron, manganese, zinc, copper, cobalt, nickel and molybdenum) and toxic (mercury, lead and cadmium). However, it is important to highlight that the interactions of the organism with the metal do not depend only on the element, but on its chemical speciation [1].

The most toxic form of a metal is not free, but when it is found as a cation or bound in carbon chains. The main mechanism of toxic action of these elements derives from their affinity for sulfur. Thus, they react with the sulfhydryl radical (-SH) present in protein molecules, altering their properties, which can result in harmful consequences to the metabolism of living beings [2, 3].

Within this context, a group of metals has taken a particular position in relation to their impacts on the environment: heavy metals. According to Hawkes [4], in general, the literature classifies as a toxic metal that has a specific mass greater than 5 g/cm3. However, this author highlighted the importance of defining these elements in relation to their chemical properties and cites them as elements that form insoluble sulfides and hydroxides, whose salts form colored aqueous solutions and originate colored complexes.

All metals, to a greater or lesser extent, in the form of soluble salts or hydroxides are solubilized in water, and can affect aquatic ecosystems in two basic ways: the metal can be toxic to the body or it can be bioaccumulated, having its effect enhanced along the food chain. Thus, even at low concentrations, a dump with toxic metals can be dangerous.

Toxic metals correspond to a class of compounds commonly present in dumps from different types of industries, such as mining, electroplating, tanneries, and electronics manufacturing. Table 1 presents the limits established by Brazilian legislation for the discharge of effluents and the potability of water for the main toxic metals.

Table 1 – Limits of effluent discharge and water potability.

Inorganic contaminants	Effluent discharge, mg/L	Limits for potability of water, mg/L
Arsenic, As3+	0,5	0,01
Barium, Ba2+	5,0	0,7
Cadmium, CD2+	0,2	0,005
Lead, Pb2+	0,5	0,01
Copper, Cu2+	1,0	2,0
Mercury, Hg2+	0,01	0,001
Manganese, Mn2+	0,5	0.05
Nickel, Ni2+	2,0	-
Zinc, Zn2+	5,0	-

CADMIUM

Cadmium was discovered in 1817 by chemist Friedrich Strohmeyer, professor of chemistry and pharmacy at the University of Göttingen, Germany, while working with zinc carbonate (ZnCO3), this scientist noticed the presence of an unexpected substance. Later, he concluded that it was a new element, still unknown. The element was baptized as cadmium because it was extracted from cadmium, the designation used for the ore rich in zinc carbonate [5, 6].

Cadmium is a transition metal of light gray color. Its most stable ion is the divalent species. This element occupies the 67th place in the order of abundance of chemical elements that make up the Earth's crust, having no biological function and being highly toxic to men, plants and animals, however the natural levels of cadmium found do not cause acute toxicity.

Cadmium is a rare element and does not occur in nature in pure form. The common concentration of this element in the earth's crust is approximately 0.15 - 0.2 mg/kg. The main cadmium mineral is greenochite, the cadmium sulfide that is found in small amounts in the soil, usually associated with zinc ores, especially sphalerite and galena [7, 8].

Cadmium is found in mines for zinc (constituting more than 1% of the metal content of such mines), lead and copper. The anthropogenic origin of cadmium contamination is typically 3 to 10 times higher than natural contamination.

Due to its low boiling point and high vapor pressure in relation to the metals with which it is found, cadmium volatilizes during fusion and condenses into fine particles that react immediately with oxygen, transforming into cadmium oxide, an inhalable and extremely toxic form. This element emits vapors even when at temperatures below its boiling point. In its solid state it is insoluble in water and in the usual organic solvents, undergoing oxidation in the presence of air and humidity [9].

Cadmium is not normally present in the environment as a pure metal, but as a mineral combined with other elements, such as oxygen in the form of oxide, chlorine in the

form of chlorides, and sulfur in the form of sulfates and sulfides. It also comes in complexed form, with oxides, sulfides and carbonates of zinc, lead and copper. The most soluble structures found are sulfates and chlorides [10].

Natural sources of contamination of this element are the emissions of gases from volcanic activities, burning of forests and wind transport of soot particles and soil [11]. The main sources of contamination are due to anthropogenic activities, such as: burning of coal, improper disposal of industrial and domestic waste, mining processes and metal refining. Another important source of contamination is the incorporation of fertilizers that contain cadmium as an impurity. Studies on cadmium tailings show that about 30 thousand tons of the element are released into the environment per year [10].

Cadmium consumption and use have varied greatly, especially in recent years. Its use in batteries has surpassed more traditional uses, such as pigments, stabilizers and coatings. One of the main industrial uses of cadmium is due to its low melting point (320.9 ºC), being used in metal alloys that require this characteristic, offering low melting point, low coefficient of friction and high fatigue resistance. It is also used in electroplating and battery construction, along with nickel. It is in the battery sector that most of the cadmium used in the industry is used. However, changes are being noticed in this field [11-13].

Nickel-cadmium (Ni/Cd) batteries are gradually being replaced by nickel metal hydride (NiHM) batteries, mainly due to the high toxicity of cadmium and the risk presented in the final disposal, which, being within the reach of the majority of the population, ends up not having an adequate destination, being placed most of the time in household garbage [11-13].

Because it is considered a persistent element, cadmium can accumulate in plants and animals, reaching humans and, similar to what happens in the food chain, accumulate in the human body for a long time, mainly in the kidneys and liver, where it has been detected that its biological half-life is approximately 10 years. Other studies show that the half-life of this element can vary even more, reaching 40 years in organisms [14-19].

REMOVAL OF HEAVY METALS FROM WASTEWATER

Because they are not biodegradable, heavy metals are not removed in conventional biological treatments, so that in the treatment of effluents containing these contaminants, physicochemical processes are used, the most common being: chemical precipitation, coagulation-flocculation, flotation, ion exchange, electrochemical processes and membrane processes.

Physicochemical processes have operational advantages over conventional effluent treatment processes, such as: low residence time, ease of operation and control, the systems are compact, the possibility of associating two or more techniques and the ability to operate in different temperature ranges. However, there are still limitations, mainly the high operating costs resulting from the use of additives and energy expenditure and the need to dispose of the formed sludge [20-22].

In addition to these factors, each technique has its particularities, so that the choice of the process to be employed depends on operational parameters (contaminant concentration, desired removal efficiency, pH, etc.) and economic parameters. The main techniques for the removal of heavy metals from wastewater are: chemical precipitation, coagulation-flocculation, flotation, ion exchange, adsorption, biosorption, electrochemical techniques and membrane processes.

Chemical precipitation is a widely used technique in the removal of heavy metals from industrial effluents. The principle of this technique consists of raising the pH of the medium, around 11, which leads to the precipitation of metal hydroxides. This technique is suitable for the removal of metals in concentrations in the range between 100 and 1000 mg/L. The main advantages provided are the simplicity of the process and the low operating costs involved. However, the total removal of the dissolved metal species in the aqueous phase is not achieved. Consequently, in certain cases, the residual concentration of metal may be higher than the limits imposed by environmental legislation, which would require further complementary treatment [20].

Although they have different principles, because they are complementary, coagulation and flocculation techniques are usually addressed together. Coagulation consists of the destabilization of charged colloidal particles, through the use of coagulating agents, causing their coalescence and formation of flakes. In turn, in flocculation, with the help of flocculating agents, there is the growth of these flocs and their consequent sedimentation. Depending on the system, a single compound can be used that will play the role of coagulant and flocculant, or different compounds for each of the stages.

Compared to chemical precipitation, coagulation-flocculation allows the removal of metals at concentrations lower than 100 mg/L or higher than 1000mg/L. In addition, there is better stability and decantability of the particulate matter, with the formation of sludge with lower water content. However, coagulation-flocculation has disadvantages, such as higher operating costs, due to the use of chemical additives [20].

Depending on the characteristics of the effluent, flotation can be used after the coagulation-flocculation process, so that, in contact with the air, the formed flocs ascend to

the surface of the liquid. Another possibility is the use of adsorbent materials, on the surface of which the adsorption of metals occurs. Among the adsorbents used, there are zeolites, biosurfactants and activated carbon. The main advantages of using flotation are: low cost of adsorbent material, high efficiency of removal in effluents with initial concentrations of metals in the range between 50 and 500 mg/L, possibility of separation at pH lower than that of chemical precipitation, low hydraulic retention time and low operational cost [20-22].

In the ion exchange process, there is a reversible exchange of ions between a solid phase and a liquid phase. In this way, as heavy metal ions are removed to the solid phase, other cations such as H+ and Na+ are transferred to the effluent [23]. In general, ion exchange is efficient in removing metals at concentrations below 10 mg/L, and can extend this efficiency to concentrations above 100 mg/L.

When compared to other heavy metal removal techniques, ion exchange has the following advantages: there is no sludge (solid waste) production, shorter operating times and the systems are compact. However, this process has some limitations, such as: the importance of efficient effluent pretreatment for particulate matter removal and the high costs of resins and operating costs. In view of the high costs of ion exchange resins, an alternative lies in the use of low-cost, high-availability natural ion exchangers [23, 24].

Adsorption is a mass transfer process in which the species to be removed is transferred from the liquid phase (effluent) to the surface of a solid, to which it is bound by physical and/or chemical interactions. Due to its high surface area and high adsorption capacity, activated carbon is the most used adsorbent in the removal of heavy metals. However, activated carbon is a relatively high-cost material, especially the best quality types, a characteristic that does not make it attractive for industrial use. In addition, the techniques of regeneration of activated carbon (chemical and thermal) are costly, cause a considerable loss of adsorbent capacity and generate effluents [20, 25, 26].

In order to develop processes with high efficiency and low cost, in the removal of heavy metals, the use of agricultural waste (orange, hazelnut and soybean peels), industrial by-products (lees, sludge and furnace slag) and clays have already been reported. so that large quantities of these are needed in the treatment of effluents [20, 25, 26].

Biosorption consists of adsorption on biomass (live or dead) and uses everything from microorganisms to aquatic plants. In a generic way, the term biosorption encompasses different independent metabolic processes that occur in the cell wall, such as: physical and chemical adsorption, electrostatic interactions, ion exchange, complexation, chelation and microprecipitation. Thus, these processes differ from oxidative metabolism

(biodegradation). The main advantages of biosorption are high selectivity and efficiency and low cost [26].

Electrochemical techniques, such as electrolysis and electrochemical precipitation, also deserve the attention of researchers. Despite the high energy costs involved, these techniques emerge as alternatives for the removal of heavy metals, especially in view of the large volume of sludge generated with a significant toxic load in the processes of chemical precipitation and coagulation-flocculation. Electrolysis is a process that uses electric current for the occurrence of oxy-reduction reactions, so that in the cathodic region there is a reduction of metal ions in solution. Despite the energy expenditure, an advantage of this process is the possibility of removing metals in a wide concentration range, from values below 10 mg/L to concentrations greater than 2000 mg/L [27-29].

Electroflocculation combines the application of electric potential and chemical precipitation. The advantage of this process lies in the fact that heavy metals are removed through oxy-reduction reactions in an electrochemical cell without the need for continuous addition of chemical reagents, minimizing reagent costs. Depending on the characteristics of the electrodes, electrochemical precipitation can be performed in acidic medium or in basic medium [30-32].

MEMBRANE SEPARATION PROCESSES FOR CADMIUM REMOVAL FROM WASTEWATER

A membrane can be defined as a selective barrier, solid or liquid, that separates two phases and restricts the transport of one or several chemical species in a specific way. This transport can occur either by diffusion or convection, induced by a gradient of pressure, concentration, temperature or electric potential [33].

According to Londsdale [34] the first studies using membranes date from 1748, having been carried out by Nollet and Dutrochet. Since then, several other researchers have contributed to the development of these processes. As a result, at the beginning of the twentieth century, the production of microporous cellulose nitrate membranes began on a commercial scale, but with initial use limited to laboratory applications.

The main advantages associated with these processes are: low energy consumption, absence of chemical additives, the systems are compact, easy scale expansion, use in continuous or batch systems and the possibility of combining with other processes. However, this technology still has some drawbacks to be overcome, such as: low permeate flow, short membrane life and low selectivity for certain separations. In this sense, there is a large investment in research and development of new membrane-forming materials.

On a commercial scale, the most commonly used membranes are made up of synthetic polymers, which are called polymeric membranes. These can be classified in numerous ways, and the classification according to their structure (morphology) is the most used, since the separation mechanism and, consequently, its application are a function of morphology. According to this classification, membranes are subdivided into: porous and dense. In porous membranes, the transport of substances takes place through the pores. These can be classified as symmetrical and asymmetric. Symmetrical membranes do not show significant variation in pore size over the thickness of the membrane. In turn, asymmetric membranes have a porosity gradient throughout their thickness.

Dense membranes have no pores. The transport of substances through the polymeric matrix is carried out by a sorption-diffusion mechanism, and its selectivity is a function of the mobility of the permeants and their chemical affinity with the membrane-forming material. These can be classified as: homogeneous (the membrane is made up of the same material), integral (a thin dense layer that is responsible for the selectivity supported on the porous structure that gives mechanical resistance to the membrane) and composite (formed by a porous membrane covered by a dense film of another polymer).

Table 2 presents the main processes with membranes, the respective morphological structures of the membranes employed and the basic separation mechanisms. Of these processes, three are used in the removal of heavy metals from wastewater: electrodialysis, nanofiltration and reverse osmosis.

Table 2 - Characteristics of the main membrane separation processes.

Process	Membrane structure	Driving force	Separation factor
Microfiltration	Porous	Pressure difference (0.5 – 2 atm)	Retention by size
Ultrafiltration	Porous	Pressure difference (1 – 7 atm)	Retention by size
Nanofiltration	Porous	Pressure difference (5 – 25 atm)	Retention by size
Reverse Osmose	Dense	Pressure difference (15 - 80 atm)	Sorption-diffusion
Dialysis	Porous	Concentration difference	Diffusion in pores
Electrodialysis	Porous	Electric Potential Difference	Electric Charge
Gas permeation	Dense	Partial pressure difference	Sorption-diffusion
Pervaporation	Dense	Partial pressure difference	Sorption-diffusion

Electrodialysis is a membrane technique in which species ionized in solution permeate ion exchange membranes (cationic and anionic) under the action of an electric field. The main advantage of this process lies in the production of an aqueous stream that is

virtually free of heavy metals and an extremely concentrated disposal stream. However, this technique has limitations, such as the need for a supply stream without the presence of particulate matter, equipment and operational costs, and low efficiency for solutions with concentrations higher than 100 mg/L [35].

Nanofiltration is a process that employs porous membranes, in which separation occurs basically by the rejection of the heavy metal cation due to its size. The diameter of the ion is larger than the average diameter of the pores. In reverse osmosis, the separation occurs by a mechanism of sorption-diffusion of the solvent through the membrane and rejection of the metal cation. Operationally, the only difference between these processes is in the applied pressure range. According to Qdais and Moussa [36], research has indicated that the application of reverse osmosis and nanofiltration in the treatment of effluents is extremely promising in terms of reducing operating costs, conserving natural resources and increasing the efficiency of pollutant removal.

In addition, it should be noted that reverse osmosis and nanofiltration processes do not require the use of chemical additives, which end up becoming a source of secondary contaminants [37]. In the same way, the sludge generated, in processes such as chemical precipitation, requires the investment of resources for its treatment and final disposal. Another advantage associated with nanofiltration and reverse osmosis is the possibility of recovering the metals at the end of the process.

Qdais & Moussa [36] conducted a comparative study with solutions of cadmium sulfate, copper sulfate and the mixture of cadmium sulfate and copper sulfate, using reverse osmosis and nanofiltration membranes. The results showed that both membranes were efficient in removing cadmium and copper. The average percentage of copper removal was around 97% in the reverse osmosis system and the rejection in the nanofiltration system was 84% and 96%.

Zuo *et al.* [38] studied multiple processes with membranes combined with physicochemical pretreatment in the galvanizing industry with the objective of selectively separating the heavy metals present in the effluent and reducing costs, in addition to reducing the effects caused by the presence of these contaminants in the environment. The processes were divided into three stages: the microfiltration and ultrafiltration processes were applied to separate possible organic suspensions, then the electrodialysis process was used to remove the salts, and finally the nanofiltration and reverse osmosis processes, carried out separately to increase the water recovery rate. Electrodialysis demonstrated excellent performance, achieving rejections above 97%. The permeate obtained from electrodialysis was used as feed in the nanofiltration and reverse osmosis processes. The

results showed that nanofiltration was more effective in terms of selective separation between univalent and bivalent ions, with greater flow at lower pressures. In general, reverse osmosis showed better performance on salt rejection.

Table 3 presents more research relating the removal of some toxic metals from wastewater in relation to the processes mentioned above.

Table 3 – Removal of toxic metals using membrane processes

Referenced authors	Processes	Metals removed
Lohokare *et. al*., 2008 [39]	Ultrafiltration	AS3+
Huang *et al*., 2019 [40]	Ultrafiltration	CD2+
Garba *et al*., 2019 [41]	Ultrafiltration	Cd2+, Cu2+
Koli & Singh, 2023 [42]	Ultrafiltration/nanofiltration	Cd2+, Cu2+
Wang *et al*., 2020 [43].	Nanofiltration	Cu2+
Trus *et al*., 2020 [44]	Nanofiltration	Cu2+,
Pezeshki *et al*., 2023 [45]	Nanofiltration/Reverse Osmosis	AS3+
Caprarescu *et al*.,2014 [46]	Electrodialysis	Cu2+
Omran *et al*., 2024 [47]	Electrodialysis	Cu2+
Nthwane *et al*, 2024 [48]	Reverse Osmose	Ni2+, Cu2+, Nd2+
Kheriji *et al*., 2015 [49]	Reverse Osmose	CD2+
Sahebjamee *et al*. 2019 [50]	Reverse Osmose	Ni2+, Cu2+ ,Nd2+
Momtazan *et al*., 2018 [51]	Reverse Osmose	CD2+
Lumani Kapepula *et al*., 2022 [52]	Reverse Osmose	Cr3+, Pb2+, Cd2+, As3+ Ni2+, Sb+3

ELECTROLYTIC PROCESSES IN THE REMOVAL OF CADMIUM FROM WASTEWATER

An electrochemical cell is a device that uses oxide-reduction reactions to produce the interconversion of chemical and electrical energy. It is called an electrolytic cell when electrical energy from an external source is used to produce chemical reactions. Electrochemical processes are widely used for metal removal. The electrochemical cell is the basis of the process, consisting of an anode and a cathode, immersed in a solution. When the current is applied to the cell, the metals are deposited on the cathode, thus obtaining separation. Electrochemical recovery of metals basically involves two steps: electrodeposition of the metal, followed by some form of re-extraction to remove them from the cathode. The reextraction process can be carried out by chemical or electrochemical dissolution, by extractive electrolysis or reversal of the polarity of the electrode [53].

Dutra *et al*. [54] used a cross-linked vitreous carbon cathode in flux for the treatment of aqueous solutions containing cadmium at the usual concentration found in wastewater from metallurgical industries (15 to 100 ppm). It was possible to treat 2 liters of solution with an initial concentration of 210 mg/L, reaching a final concentration of 0.1 mg/L. Elsherief [28] describes the removal of cadmium from synthetic liquid residues by electrodeposition of cadmium on three-dimensional spiral steel electrodes. In this work, a cadmium removal of 30% of a dilute acidic solution was achieved.

Grau and Bisang [55] conducted a study on cadmium removal in dilute aqueous solutions. The authors cite three factors for the efficiency of metal removal: good mass transfer condition of the rotating cylinder electrode; large surface area of expanded structures; promotion of turbulence, however, as a disadvantage of the process is the high energy consumption.

MATERIALS AND METHODS

MATERIAL

The synthetic effluents evaluated consisted of aqueous solutions of cadmium chloride (CdCl2) for the electrodeposition tests and cadmium sulfate (CdSO4) for the reverse osmosis tests.

TANGENTIAL FILTRATION SYSTEM

The commercial membrane used is composed of polyamide, model 4040-X201-TSA, manufactured by TriSep Corporation. The manufacturer's recommended operating conditions are: operating pressure from 7 to 21 bar, operating temperature from 2 to 45 ºC, and operating pH from 2 to 11. Figure 1 shows the tangential filtration system used in the experiments. The system has a tangential filtration module for a flat membrane, and the effective permeation area is 77.2 cm2.

Figure 1 – Tangential filtration system used

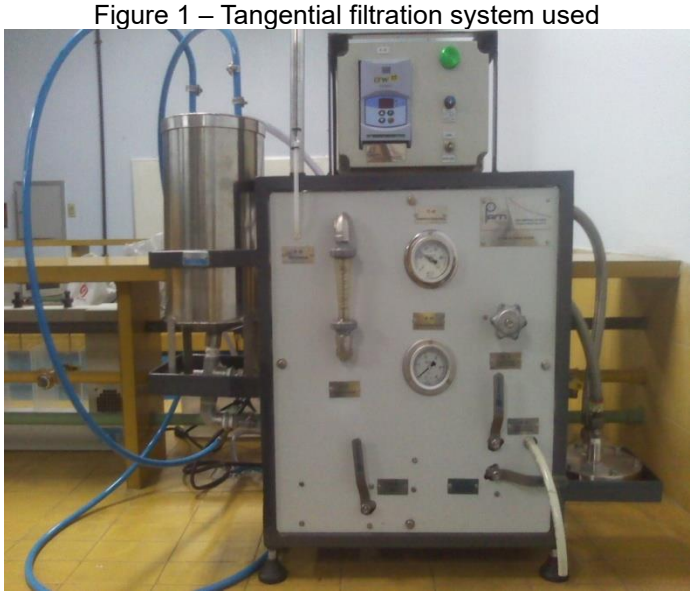
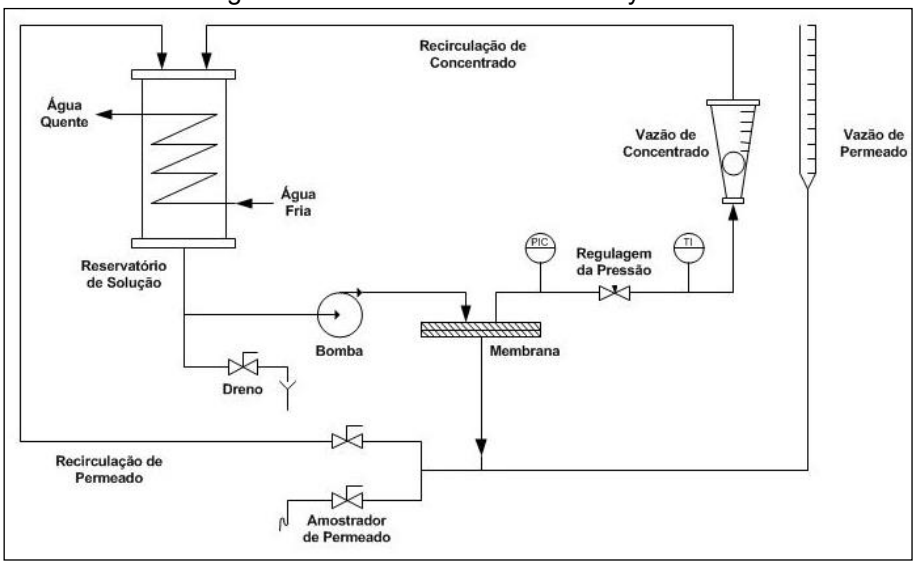


Figure 2 shows the flow chart of the filtration system, which consists of a feeding tank (capacity of five liters), current rectifier, rotameter, pressure gauge, thermometer, permeate flow indicator and centrifugal pump.

During the operation of the system, the system is pressurized gradually. The rotation speed of the pump is adjusted by the current rectifier. With the help of a back pressure valve, the pressure is regulated in the system. From the control of the current rectifier and the back pressure valve, it is possible to regulate the supply flow rate and the operating pressure.

Figure 2 - Flowchart of membrane systems



The maintenance of the temperature of the system was done through water circulation and during the operation, it was sought to control the temperature increase, which occurs due to pumping and friction, so there is cooling with water flow in a stainless steel coil in the feeding tank, thus preventing temperature fluctuations from interfering with the separation process. The system allows batch operation (with recirculation of the concentrate current) and continuous (with disposal of the concentrate current). In the operation of the system, it is possible to collect a permeate sample and measure its flow.

The analytical methods for determining the concentrations of metals both in the feed and in the permeate and concentrate were conductivity measurements, pH and atomic absorption and ion chromatography analyses.

The membrane performance effect was evaluated through metal rejection calculations and permeate flow determination. Rejection was calculated according to the following equation, which indicates the percentage of solute retained by the membrane.

$$R(\%) = \left[1 - \frac{C_p}{C_f}\right].100$$

Where:

R(%) = percentage solute rejection (%),

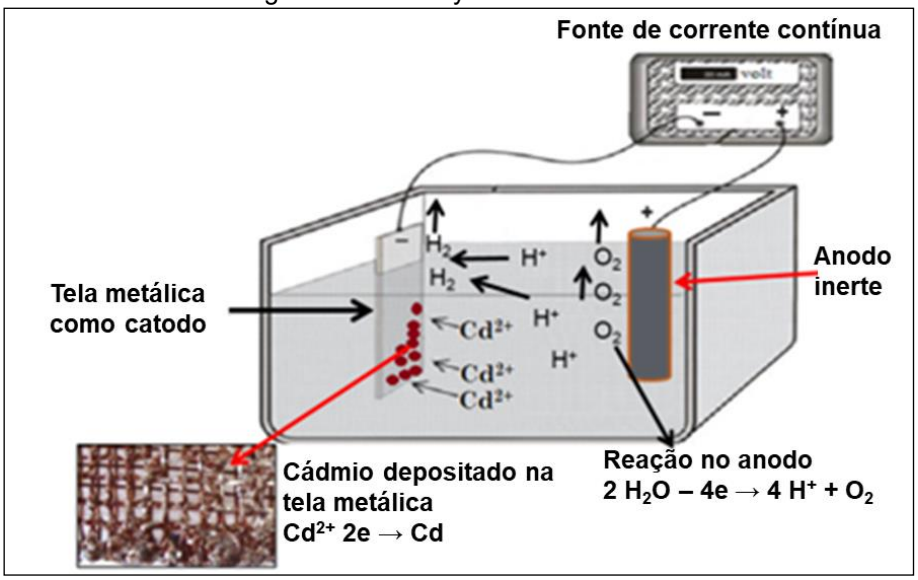
Cf = solute concentration in the feed (mg/L),

Cp = the concentration of solute in the permeate (mg/L).

ELECTROLYTIC SYSTEM

The electrolytic cell assembled in this study is formed by a platinum anode and a carbon steel cathode in the form of a wire mesh. Agitation was used in this process, for which a magnetic stirrer was used. For the application of voltage in the cell, a direct current power supply was used. The procedure was performed at room temperature and pressure, and no temperature or pH control of the solutions was performed during the removal process. The container where the electrochemical process took place has a volume of 280 mL, and the volumes of solution used were 250 mL. The cell schema is shown in Figure 3.

Figure 3 - Electrolytic cell schematic.



RESULTS AND DISCUSSION

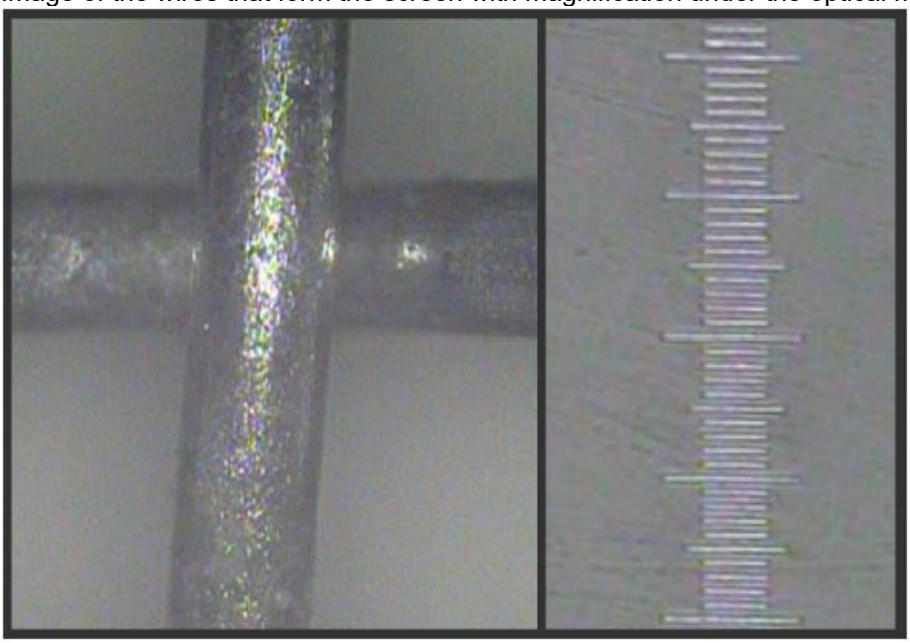
CADMIUM REMOVAL BY ELECTRODEPOSITION

In the electrodeposition experiments, solutions with a volume of 250 mL and cadmium concentrations equal to 500, 250 and 50 mg/L were tested. The experimental results used in this item were obtained through a previous study carried out by Fernandes [6, 56].

The electrolytic system used a platinum plate with a surface area of 7 cm2 as anode. Carbon steel electrodes were used as cathodes, which corresponded to screens with braided wires, whose diameters varied between 0.10 and 0.15 mm. Figure 4 shows the

image of the wires that make up the screen with microscopic magnification. In all experiments, the potential difference applied was 20 V.

Figure 4 - Image of the wires that form the screen with magnification under the optical microscope.



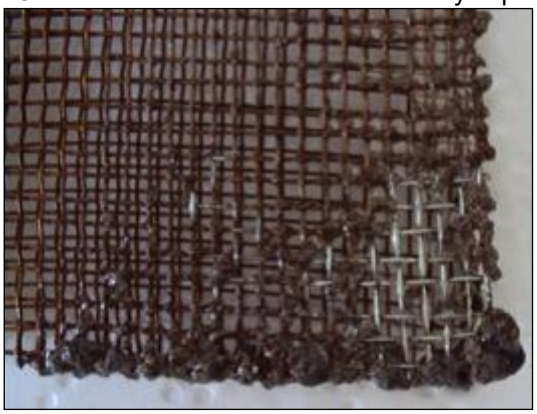
The main electrochemical reactions involved in electrodeposition are:

Anodic reaction: $H2O\ (l) \rightarrow 1/2\ O2\ (g) + 2\ H+\ (aq) + 2\ e$;

Cathodic reaction: $Cd2+\ (aq) + 2\ e^{-} \rightarrow Cd\ (s)$

In Figure 5 it is possible to observe the results of the electrochemical process the deposition of cadmium in the cathode.

Figure 5 - Visual observations of the electrolytic process.

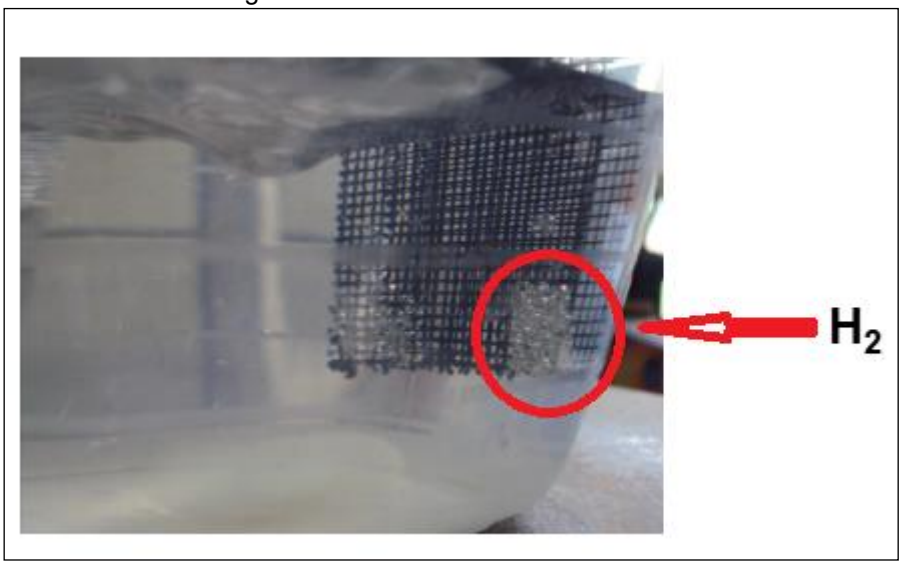


In addition to the main reactions, during the electrolytic process the formation of hydrogen gas is also observed in the cathode, according to the chemical reaction:

$2\ H_2O\ (l) + 2\ e^- \rightarrow H_2\ (g) + 2\ OH^-\ (aq)$.

This reaction, although secondary, occurred due to the low concentration of ions in solution, which led to a low electrodeposition speed, thus allowing the electrodeposition of the metal. In Figure 6, the formation of hydrogen gas in the cathode can be seen.

Figure 6 - H2 formation in the cathode.



In the experiments, the difference in applied potential (20 V) was fixed. Thus, as a function of the concentrations of the solutions, different values of electric current intensity are observed. This fact was due to the presence of ions in solution, since the intensity of electric current is a function of the electrical conductivity of the medium. The experiments aimed to analyze the influences of the applied current intensity, the electrodeposition time and the cathode area for the different cadmium ion solutions.

Table 4 presents the results obtained for the solution with an initial concentration of 500 mg/L. When comparing the results obtained in experiments 1 to 4, it is observed that the increase in the surface area of the cathode led to an increase in cadmium deposition, keeping the other parameters constant. These results can be seen in the graph in Figure 7.

When comparing the results obtained between the pairs of experiments 1-5 and 2-6, it is verified that the increase in the intensity of the electric current applied led to an increase in the percentage removal of cadmium. Likewise, when comparing the results obtained between experiments 5 and 7, it was observed that the increase in the deposition time led to a greater cadmium deposition. The results of the influence of time and intensity of applied electric current are in accordance with those predicted by Faraday's Law, from which the mass of metal deposited is directly proportional to the applied current and the electrodeposition time.

Table 4 - Results obtained for the initial concentration of CD2+ equal to 500 mg/L.

Tests	Area cm^2	Time Min	Tension V	Current A	Final concentration, mg/L	Removal, %
1	36,44	90	20	0,08	159,83	69,1
2	27,33	90	20	0,08	180,15	65,1
3	21,86	90	20	0,08	184,29	63,5
4	16,78	90	20	0,08	197,47	60,9
5	36,44	95	30	0,15	16,52	96,7
6	27,33	95	30	0,15	67,05	86,5
7	36,44	120	30	0,15	10,03	98,0

Figure 7 - Influence of cathode area on the percentage removal of cadmium ions in solution.

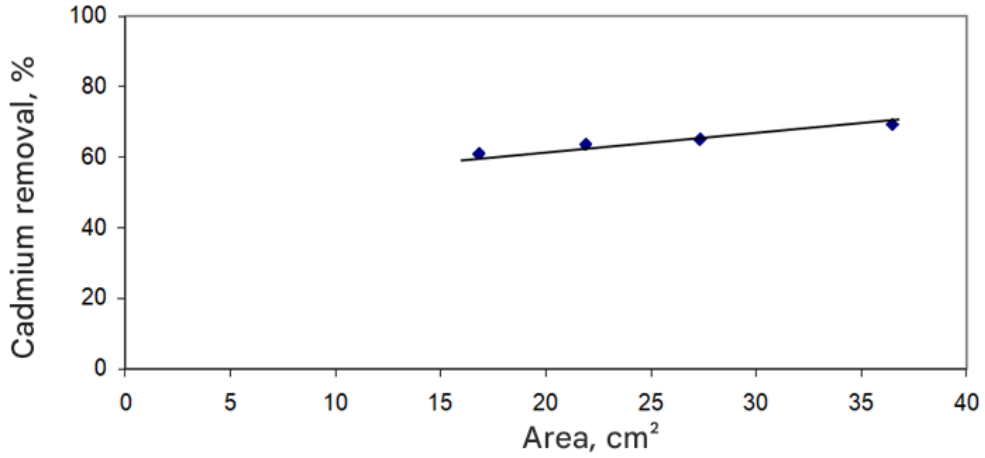


Table 5 presents the results obtained for the initial concentration solution of 250 mg/L. When comparing the results obtained in the pairs of experiments 1-2 and 3-4, it is observed that the increase in the cathode area led to a greater electrodeposition of cadmium, keeping the time and intensity of the current constant. The influence of time can be seen when comparing experiments 3 and 5, in which the increase in time led to the greater formation of cadmium metal.

Table 5 - Results obtained for the initial concentration of Cd2+ equal to 250mg/L.

Tests	Area cm2	Time min	Tension V	Current A	Final concentration, mg/L	Removal, %
1	36,44	90	20	0,06	45,00	82,5
2	27,33	90	20	0,06	65,27	74,6
3	36,44	80	30	0,09	69,26	71,1
4	27,33	80	30	0,09	74,96	68,7
5	36,44	120	30	0,09	48,15	79,9

Table 6 presents the results obtained for the solution with an initial concentration of 50 mg/L. When comparing the results obtained, it is observed that the increase in the cathode area led to a greater electrodeposition of cadmium, keeping the time and intensity of the current constant.

Table 6 - Results obtained for the initial concentration of Cd2+ equal to 50mg/L.

Tests	Area cm2	Time min	Tension V	Current A	Final concentration, mg/L	Removal, %
1	36,44	90	20	0,04	15,57	66,3
2	27,33	90	20	0,04	20,73	55,1

Due to the limitations of the experimental apparatus used and the concentration of the solution, it is observed that as the concentration of cadmium in solution is reduced, there is a reduction in the removal achieved. Thus, the electrolytic system allowed better results for the tests with a concentration of 500 mg/L, in which it was possible to achieve the highest values of current intensity (0.15 A) and removal, reaching 98%. The experiment with a concentration of 50 mg/L, on the other hand, led to the lowest values of applied current intensity (0.04 A) and a maximum removal of 66.3%.

CADMIUM REMOVAL BY REVERSE OSMOSIS

The reverse osmosis experiments were carried out in the tangential filtration system. In this system, three liters of the feed solution were processed in batch, with recycle of the concentrate and collection of the permeate. The aim was to evaluate a range of initial concentrations from 5 to 1500 mg/L. In all experiments, the system was operated with a feed flow rate of 1 L/min and a pressure of 10 bar.

Table 7 presents the results of permeate current concentration and rejection (removal) for the different initial concentrations evaluated.

Table 7 - Results obtained in the reverse osmosis experiments.

Initial concentration (mg/L)	Permeate concentration (mg/L)	Rejection (%)
4,49	0,17	96,1
15,77	0,39	97,5
153,6	0,70	99,5
490	1,43	99,7
680	2,25	99,6
1430	5,30	99,7

In the graphs of Figures 8 and 9, the permeate concentration and rejection profiles are observed as a function of the initial concentration. From the analysis of these graphs, it can be seen that the concentration of the permeate increases as a function of the increase in the concentration of feed. However, when observing the rejection profile, it is verified that for feed concentrations lower than 100 mg/L, the rejection increases as a function of the feed concentration. From 100 mg/L, rejection remains practically constant, ranging from 99.5 to 99.7.

Figure 8 - Permeate concentration as a function of feed concentration.

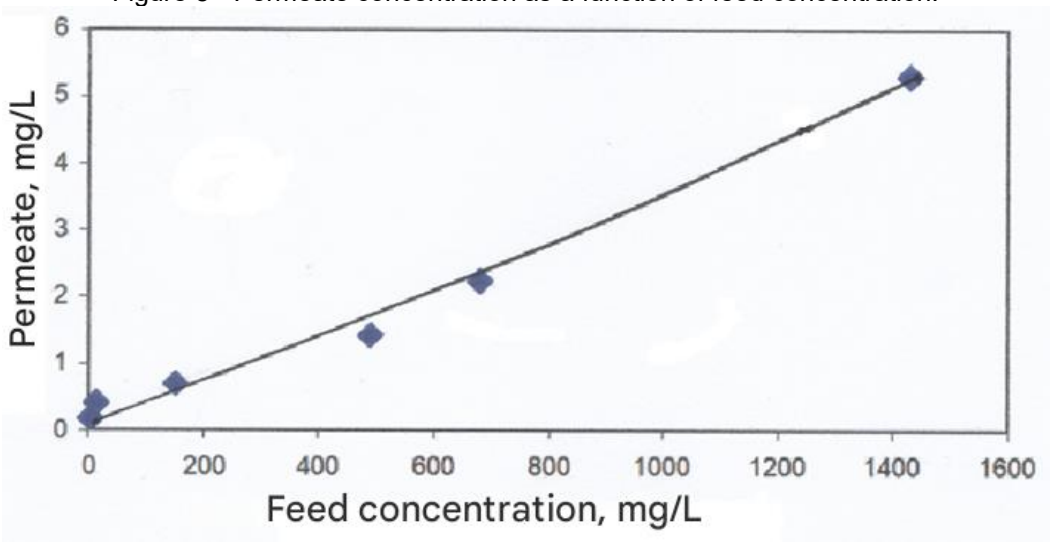
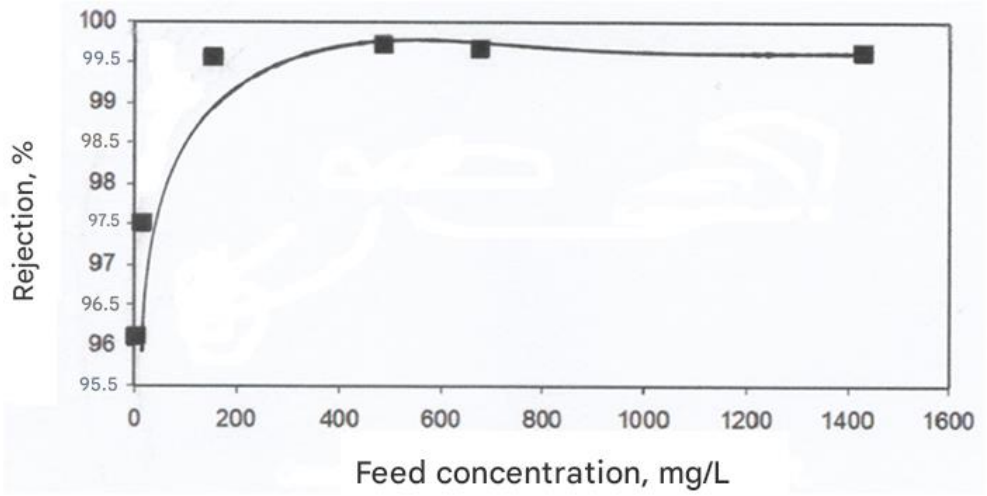


Figure 9 - Rejection as a function of feeding concentration.



CONCLUSIONS

From the analysis of the results obtained, it can be seen that the electrolytic process allowed high values of cadmium removal for concentrations of around 500 mg/L. This process, in addition to being simple and not requiring the use of chemical additives, has the advantage of enabling the recovery of cadmium in its metallic form. The biggest drawback is that its efficiency is directly proportional to the electrical conductivity of the medium and for solutions of low concentrations of metals, the reduced conductivity proves to be an impediment.

The reverse osmosis process proved to be extremely efficient for low concentrations of cadmium in solution, reaching removals above 96% for concentrations of the order of 5 mg/L. The main advantage of this process is to obtain a treated stream with concentrations lower than 0.2 mg/L, thus adapting to the disposal limits required by environmental legislation.

By analyzing the two processes, it is possible to propose their use in a complementary way. In a first step, the electrolytic process to remove the highest concentration of cadmium, followed by reverse osmosis to reach values acceptable by legislation.

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WHEN AFFECTION IS SILENT: MOURNING FOR ABANDONMENT IN THE LIFE OF THE ELDERLY WOMAN

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ABSTRACT

Aging is a natural phenomenon, initiated from birth, evidenced by functional, physical and psychological changes that become noticeable in old age. In the female dimension, menopause can be characterized as the initial milestone of the aforementioned process, and aging is commonly marked by situations of affective abandonment, absence of emotional support and emergence of emotional reactions such as grief, a scenario explored in this chapter. The objective is to categorize and explore the physical, emotional and social manifestations of affective abandonment and grief in elderly women. The methodology adopted for this work is based on a narrative review of the literature, with the objective of exploring the dynamics of affective abandonment and grief in the health of elderly women. Searches were carried out in scientific databases such as PubMed, Scielo, LILACS and gray literature Google Scholar, using the descriptors "elderly women's health", "affective abandonment", "mourning" and their English correspondents, according to the DeCS/MeSH criteria. Among the main results, it can be highlighted that grief triggers implications in the physical, emotional and social spheres, and the State should devise and execute public policies concerning the theme. It is concluded that the health of elderly women requires multidisciplinary attention and action, especially with regard to the scenarios in which affective abandonment and grief are present, given that such phenomena alter and intensely affect the quality of life of the population.

Keywords: Mourning. Affective abandonment. Elderly Women's Health.

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INTRODUCTION

Aging is a natural and gradual process, started from birth, in which both men and women undergo functional, physical, and psychological changes. It is a multifaceted process that affects not only the body, but also the emotional and social dimensions of life. Although there is no universal definition that determines the beginning of old age, for women, the arrival of menopause is considered the starting point, even if they are not yet in old age (Pereira and Derzi, 2021).

In old age, the experience of aging is predominantly female, a phenomenon known as the 'feminization of old age'. Older women face specific biological, psychological, and social challenges, which may intensify as they watch their now-independent children build their own families and homes. This change often generates a feeling of loneliness, often associated with the image of a lonely bird in its empty nest (Miani & Cordeiro, 2023).

For many elderly women, this phase is marked by situations of affective abandonment, a worrying reality that is manifested by the reduction or absence of emotional and affective care by family, friends and even society. This type of negligence can have serious consequences for physical, psychological, and social well-being, compromising the quality of life and dignity of these women (Leão, 2023).

The experience of affective abandonment can trigger an adaptive emotional reaction to significant losses, often characterized by grief and emotional protest, i.e., grief. When associated with isolation, loneliness, and the absence of support, this process can intensify feelings of helplessness, negatively impacting the mental and physical health of older women (Morais et al., 2019).

Grief is a deep and natural response to any significant loss, and it is an essential process so that the void left can gradually be resignified. Although it is a universal experience, it is particularly intense among the elderly, who often face losses more frequently at this stage of life (Silveira & André, 2024).

In the social imaginary, old age is often perceived as a period marked by increasing limitations, physical losses, and a sense of despair in the face of the proximity of death. As they age, older people experience the sense of finitude as a kind of grief—for time that runs out, for past experiences, and for relationships that change. In this context, in addition to the pain of losing friends and acquaintances, many face grief due to the emotional or physical absence of loved ones who are still alive, an experience that is especially impactful for women (Miani & Cordeiro, 2023).

In view of this scenario, the present study aims to identify the biopsychosocial aspects related to grief due to abandonment in elderly women, contributing to the understanding of this reality and providing subsidies to minimize its impacts.

METHODOLOGY

The methodology adopted for this work is based on a narrative review of the literature, with the objective of exploring the dynamics of affective abandonment and grief in the health of elderly women. Searches were carried out in scientific databases such as PubMed, Scielo, LILACS and gray literature Google Scholar, using the descriptors "elderly women's health", "affective abandonment", "mourning" and their English correspondents, according to the DeCS/MeSH criteria. The inclusion criteria included articles published in the last 5 years, available in Portuguese, English and Spanish, which addressed psychological, social and emotional aspects related to the theme. Studies that did not present a specific discussion about elderly women or did not relate affective abandonment and grief to health were excluded. Data analysis was carried out qualitatively, organizing the information into thematic categories that supported the critical discussion of the findings.

RESULTS AND DISCUSSION

In Brazil, the Statute of the Elderly (Law No. 10,741/2003) guarantees the elderly fundamental rights, such as protection, respect, dignity, social inclusion and guarantee of healthy aging, in addition to the preservation of their physical, moral and mental integrity (BRASIL, 2003). However, affective abandonment remains a phenomenon present in our society and still little debated, representing a significant challenge for the realization of these rights.

This reality highlights the need to understand the biopsychosocial factors involved, since affective abandonment and its consequences directly affect the integral well-being of the elderly, especially women at this stage of life.

PHYSICAL RESPONSES

Grief resulting from affective abandonment can trigger or intensify physical responses to stress, manifesting itself through physiological changes such as increased blood pressure, insomnia, muscle pain, persistent fatigue, and a predisposition to untreated health problems. Additionally, conditions such as malnutrition, dehydration, and other medical complications become more common, especially among vulnerable individuals such as the elderly. These manifestations highlight the deep interrelationship between

emotional and physical health, highlighting the need for integrated interventions and a careful look at the consequences of affective abandonment on general health (Leão, 2023).

EMOTIONAL IMPACT

Studies show that the emotional impact of affective abandonment can also manifest itself as homesickness, depressive symptoms, anxiety and loneliness, sadness and hopelessness. The results suggest that the absence of a social and affective support network contributes to the decline of mental health in old age (Santos and Andrade 2024). As a result of these negative feelings, physical and mental illnesses arise that reduce the quality of life and can reduce the life expectancy of these women. Especially in elderly women, the lack of recognition or the reduction of responsibilities can result in existential crises (Júnior and Fonseca, 2022).

SOCIAL CONSEQUENCES

In capitalist society, older women face a double burden of invisibility and devaluation, being often considered "useless" to the productive system and relegated to secondary social roles. This perception reflects and reinforces prejudices and stigmas related to age and gender, resulting in neglect and abandonment in various contexts. In addition, these women are often excluded from decision-making and representation spaces, which deepens social marginalization. The lack of effective public policies to meet the specific needs of this population, such as emotional support, access to integrated health services, and social inclusion programs, further aggravates their vulnerability, perpetuating cycles of exclusion and inequality (Parvin, 2020). This reality requires a closer look and concrete actions to promote the dignity, recognition and integration of older women in society.

PUBLIC POLICIES

It is the duty of the State to guarantee the protection of life and health to the elderly, ensuring their rights through effective public policies. However, it is observed that the current model in the country has significant gaps, failing to comprehensively and satisfactorily meet the diverse needs of this population. Among the challenges identified are the insufficiency of resources for public health, the lack of specific programs for healthy aging, and the absence of integrated actions that consider the physical, psychological, and social dimensions of old age, Souza and Silva (2020).

In addition, the overload on health and social care systems, compounded by inadequate infrastructure and a shortage of trained professionals, contributes to neglect

and precariousness in care for the elderly. This scenario highlights not only the need to expand and restructure public policies, but also a more inclusive and humanized approach, which prioritizes aging with dignity and quality of life. The implementation of intersectoral policies, which integrate health, education, housing and social assistance, is crucial to respond to the challenges imposed by population aging and ensure the rights of older people, as provided for in the Statute of the Elderly and in international legal frameworks, Brazil (2003).

FINAL CONSIDERATIONS

The health of elderly women is a topic that requires urgent and multidisciplinary attention, especially when contextualized by affective abandonment and grief, phenomena that profoundly affect the quality of life of this population. Aging, already marked by biopsychosocial transformations, becomes even more challenging in the face of the impact of loneliness, invisibility, and social exclusion faced by many women at this stage of life. Affective abandonment not only harms emotional well-being, but also generates significant physical consequences, intensifying preexisting vulnerabilities and exposing the fragility of social and family support networks.

The analysis presented in this chapter reinforces the interdependence between emotional, mental, and physical health, highlighting the need for integrated and specific public policies to meet the demands of older women. It is essential to promote actions that value these women, guaranteeing them access to health, continuing education, social inclusion, and emotional support. The invisibility and devaluation faced by them reflect structural issues of our capitalist and patriarchal society, which must be combated with concrete initiatives, such as expanding access to quality services, training professionals, and implementing programs that strengthen family and community bonds.

Finally, understanding the biopsychosocial aspects related to affective abandonment and grief is essential to support more humanized and effective interventions, contributing to elderly women being able to experience this stage of life with dignity, recognition and quality. May this study inspire transformative actions and expand the debate on such a relevant, but still neglected, topic in our society.

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GALENA RADIO IN GEOGRAPHY AS A DIDACTIC-PEDAGOGICAL RESOURCE IN TEACHING-LEARNING – LISTEN BEFORE IT DISAPPEARS

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ABSTRACT

This report is from an experiment with Radio Galena in the classroom with students from the initial grades of technical courses at the Federal Center for Technological Education of Minas Gerais (CEFET-MG) in Belo Horizonte. The theoretical foundation was based on a constructivist practice that proposes the articulation of knowledge from the curriculum and the ability of students to elaborate their own concepts, exercising their skills and competences. The contents of Physics (waves, resonant circuit, electromagnetism and others) and Geography (location of transmission, distance of propagation, interference of geographical features, analysis of maps, mineral resources present in the components...) were involved. During the tests, the students were able to listen to the programming of an AM radio station and correlate their listening with the contents of Geography (scale, globalization, communications, areas of influence, scope, culture, wave propagation and interference – relief, vegetation, atmospheric conditions). The prototypes were subjected to different locations to analyze the interference of geographical elements. To the geographical contents, geopolitical, physical, economic discussions etc. were added. It was found that the various contents discussed were understood in the ways in which they are articulated both for the functioning of radio, the geographical limitations, as well as for the propagation of ideas or possibilities given by technological advancement in the present day and its intercurrences of all kinds.

Keywords: Geography Teaching. Technology. Multidisciplinarity. Radio Galena. Globalization.

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INTRODUCTION

This work deals with the use of a simple pedagogical material: the galena radio – an AM modulation radio receiver that can be elaborated with a few parts. It was worked in the classroom with the students of the Integrated High School of the Federal Center for Technological Education of Minas Gerais (CEFET-MG), Campus I, in Belo Horizonte.The predicates semiconductors of the mineral galena are used, hence its name, one of the non-metallic bodies that conduct electricity before in radiofusion.

Here, Galena radio is used as an educational resource for a greater altercation, its own obsolescence (?) and/or "radiomorphosis" as a[3] vehicle of popular communication and of what has historically been broadcast on its airwaves over the last decades, in the midst of the globalizing course, especially the cultural one.

In the face of today's overwhelming technologies of communication and information based on contemporary living, intrinsic apparatuses of this capitalist processing that imposes new ways of thinking that disaggregate others in the name of a brave new world, we ask ourselves: what will happen to radio as a tool for dialogue and democratic freedom of part of the Brazilian population?

Milton Santos (2001, p. 9) discusses a world seen by a deceptive perception: "We live in a confused and confusedly perceived world. (...) It is the way in which, on this material basis, human history is produced that is truly responsible for the creation of the tower of Babel in which our globalized era lives." We yearn to escape from this illusory "certainty", since: "Its foundations are information and its empire, which are based on the production of images and the imaginary, and are placed at the service of the empire of money, which is founded on the economization and monetization of social and personal life" (SANTOS, 2001, p. 9).

In Castells (2000), using Calderon and Lasema, in the universe in which globalization and fragmentation are concomitant, the heart of the question is: "How to combine new technologies and collective memory, universal science and community cultures, passion and reason? How, indeed! And why do we observe the opposite trend all over the world, that is, the growing distance between globalization and identity, between the Network and the Being?" (CALDERON and LASEMA *apud* CASTELLS, 2000, p. 58).

In any case, according to Kischinhevsky (2012, p. 421-422):

[3]"By radiomorphosis, radio radio is reconfigured in webradio and this means that the various formats will coexist for a long time to come, even if in different supports. But we have no doubt that the future of radio is digital, with transmission through the computer network that integrates the whole world" (PRATA, 2008, p. 220).

> Radio, increasingly, is integrated into a process of media convergence, (...) on a planetary scale, in a period of transition to a post-Fordist economy. On the one hand, this convergence intensifies the business concentration around a handful of industrial conglomerates with interests in communication and culture, and on the other hand, it opens access to the market of symbolic goods to new actors, from small innovative companies to individuals, including social movements, non-governmental organizations, universities and other social actors previously deprived of their own means of communication.

There is no consensus among communication researchers regarding the use of certain meanings and approaches in studies of media development as a whole and radiophonics, sometimes they see the medium as an object, sometimes they discuss its specific characteristics: convergence, interaction, mediation, remediation (GARSON, 2019), (BOLTER and GRUSIN, 1999), radiomorphosis (PRATA, 2008), mediamorphosis (FIDLER, 1997), hypermedia...

Cebrián Herreros, in advance in 2001, referred to by Kischinhevsky (2012), exposed the demand for a new categorization.

> The Internet opens the way to a new radio of oral and sound intercommunication between users in which the "emirec" model (sender-receiver) is developed with its complexity in which the hegemony of the sender is lost over the receiver and a situation of equality is generated between the speakers [...]. Hyperphonic and hypertextual idiomatic radio navigators are born. These are users who move from one station to another, who interrelate the sounds and who try to associate the broadcast texts with each other and with other sounds. (CEBRIÁN HERREROS apud KISCHINHEVSKY, 2012, p. 426)

It is a controversial subject, we will not have the answers immediately, because we are living in this historical time of great transformations and we do not have impartiality in opinions precisely because we live it now, but we can intuit about it. Despite this, the magnitude of radio in the past and in the present moment is undeniable, its social role since then and its ability to transmit music and all kinds of information in the globalized era, as well as its valuable connections with social networks and communities.

When the first radio experience took place in our country more than 100 years ago (in 1922), on the centenary of Brazil's Independence, the president at the time, Epitácio Pessoa, made an inaugural statement and his speech was heard by few receivers installed in Rio de Janeiro, the federal capital. Since that time, a lot has changed.

McLuhan (1972, p. 335), when relating art, expression and technology, speaks of "reversal and the 'current of consciousness' and the perception of the open 'field', which subverts all aspects of the discovery of the assembly line or the 'technique of invention' of the nineteenth century". To use G. H. Bantock in this regard:

> In a world of increasing socialization, standardization, and uniformity, the goal was to accentuate the uniqueness, the purely personal in experience; in a world of "mechanical" rationality, the goal is to accentuate other ways in which human beings can express themselves, to see life as a series of emotional intensities, importing in a logic different from that of the rational world, and which can only be apprehended among dissociated images or in a stream of reflective states of consciousness. (BANTOCK apud MCLUHAN, 1972, p. 336)

We believe in the survival of radio because it is a communication equipment with resilience, facing different media for generations (TV, internet) and maintaining its public esteem and versatility, allowing one to see "life as a series of emotional intensities", rather than "mechanical rationality" (BANTOCK apud MCLUHAN, 1972, p. 336).

In fact, on the world wide web there is a type of radio with hertzian waves with a presence on the web and another type of radio with specific effectiveness on the internet called "webradios" (PRATA, 2008). But, still in agreement with Prata (2008, p. 29): "The most sensible thing is to realize that the convergent model is in the construction phase, with the old elements reconfiguring themselves in search of a framework in an absolutely new way of making radio".

Nowadays, this malleability is perceived since radios (FM) move together with other means of mass communication, notably the internet, promptly taking entertainment to anywhere in the globe, in addition to the technological translation from AM to FM radios, in displacement. That is:

> on the internet, radio continues to be oral and the mental dialogue with the listener remains, but it is also textual and imagetic; It continues to be broadcast in the user's real-life time, but now has a worldwide reach and allows subsequent access to the streamed content. (...) WebRadio will gain autonomy, mobility and low cost. (PRATA, 2008, p. 223)

However, the choice of the manufacture of a galena radio and its implementation by the students within a well-placed planning and attached to other didactic devices have, as their primary purpose, the critical analysis of the current paradoxes of the neoliberal society through the contextualization of the radio as a means of communication in the planetary acculturation in succession, learning not only about its musical programming/news and its peculiarities, but also its area of achievement and its deterritorialization/reterritorialization, the expanding technological advancement, among other aspects.

> In this multiplatform media environment, ML technology has aged and lost its ability to adapt to digital. Starting with the deterioration of mono sound quality, subject to interference and electrical noise during the transmission and reception process, making it difficult to tune in to desktop and mobile devices. Added to this is the decision of the cell phone industry to exclude the capture of the AM frequency from mobile devices since 2009, giving preference to FM. (SILVER; BIANCO, 2020, p. 26)

Thus, the didactic-pedagogical perspectives on radio and its functionality in the teaching-learning of Geography are copious, awakening the inclination and involvement of students in the geographic contents of High School in classes of the 1st year Integrated of CEFET-MG, in Belo Horizonte, in a transversal unfolding of reality, since the complexity of the world calls for an interdisciplinary approach of knowledge.

Based on Morin's comments on the relationship between complexity, reality and culture:

> If homo sapiens has "surpassed" the strictly biological order by jointly developing culture, language, thought, consciousness, at the same time he has widened the sphere of life to culture, to language, to thought, to consciousness. What we need to understand is not culture excluding nature, it is not the spirit excluding the brain; on the contrary, we cannot understand our nature if we exclude our culture, our brain if we exclude our spirit; We need to conceive of the complex "uniduality" of our natural-cultural being, of our brain-spirit, our reality at once natural and metanatural, that is: cosmo-physical-bio-anthropo-sociological. (MORIN, 1995, p. 17-18)

THEORETICAL FRAMEWORK

These domains alluded to early and structured with the curriculum, and a planning with well-agreed pedagogical intentions, contributed to the addition of abundant ingenuity demonstrated by the students in the prolongation of the activities, such as: disentanglement, commitment, help to the other colleague(s), organization, exchanges and ownership in what was shared, geographical and world syllogism, quality of argumentation in the face of what was investigated, analysis of the songs and information conveyed by the AM and FM of the Metropolitan Region of Belo Horizonte (RMBH) researched, the ways of representing knowledge (discourses, symbols, scales and maps), the subtlety of listening, etc.

The teaching-learning follow-up allowed the insertion of theory with practice and the interplay of various fields of knowledge. With Physics and Electrotechnics, for example, radio waves were discussed as a type of electromagnetic radiation that transmits energy with the characteristic of being non-ionizing, with high wave length, but of low frequency, and why they are used, especially in telecommunications. In addition to its attributes – amplitude, wavelength, frequency and speed – the differences between its most common forms were also highlighted: AM (amplitude modulation) and FM (frequency modulation).

Thus, AM radio has the benefits of propagating information to more stations in a marked frequency range and being readily distinguished by receivers. However, its signals are more subject to inconstancies of noise and static (when the electric charge present in a body has its atoms unstable in its neutrality), as during a thunderstorm. In this circumstance, noise peaks occur due to lightning strikes and this is immediately signaled by the AM tuners. Another factor to consider is that AM radio also has, unfortunately, a very circumscribed

audio coverage (from 200 Hz to 5 kHz) and, in terms of hearing, its signals have a lower quality than FM.

FM radio operates in a much wider frequency range than AM radio, although its range in terms of distance for its transmissions is less extensive than AM. However, in terms of vehicle for music, because it has a higher bandwidth range (from 30 Hz to 15 kHz), FM radio has excellent sound quality, however, due to these specificities, to cover a larger coverage surface, it needs additive transmitters to conduct its signals.

Therefore, multiple themes were articulated in this educational process, namely: principle of construction and purposes of telecommunications equipment, in particular radio; forms of generation, sensitization/calibration and adjustments of the devices; quality and scope/scale of transmissions; internal and external instrumental/technological factors (analog and digital systems, analog-to-digital converters – ADCs...); political and socio-environmental factors (interference of geographical features and natural phenomena/atmospheric conditions; use of mineral deposits – control and transformation of these resources and their use in communications systems; target audience reached by this medium – radio, the definitions of what is transmitted by each broadcaster, strategies and interests) etc.

Regarding the discipline of Geography, in addition to the topics mentioned above, radio was worked as a propagator of culture and maintenance of identities in history since its beginnings in the country (early twentieth century); the influences of the capitalist system through globalization on telecommunications and ways of life in contemporary times; the homogenization of a pseudo-individuality; the flexibility of radio in the face of technologies in historical time and its moment of transition in the present.

The educational practice presented, resulting from research on what education is and what is its meaning among peers, within a Basic Education research group of which we are part (Geopossible Research Group – CEFET-MG), arose from the authors' pressing conviction regarding the need to renew the daily exercise as educators, continuously questioning themselves in terms of curriculum, planning, practices, methodologies and possible results.

For this purpose, the philosopher Edgar Morin (1999) advocates a distended method, "without strings attached" and without certain answers, a space that will become visible only at the end, which, in turn, in view of the natural indeterminacies of this path, will provide a pedagogical emancipation of the teacher subsequent to his free will.

> It should be remembered here that the word "method" does not mean methodology at all. Methodologies are a priori guides that program research, while the method derived from our path will be an aid to strategy [which will encompass, in a utilitarian way, programmed segments, that is, "methodologies", but will necessarily involve discovery and innovation]. (MORIN, 1999, p. 39)

Knowing that, historically, the school is exclusionary and elitist, because instead of welcoming the student it expels him, and that it is easier to blame the student, already marginalized, for his failure/evasion than for the system to courageously assume its responsibility (a system of which we are a part), we swim against the tide. And we ask ourselves: Aren't we part of this same oppressive and manipulative system with which we disagree so much? How do we position ourselves, then?

Consider, with Freire (1967, p. 21), that "no one in a democracy is excluded", because:

> It is not enough for the people immersed in their secular silence to emerge giving voice to their demands. It must also become capable of elaborating its awareness in a critical and prospective way in order to overcome a behavior of rebellion for a responsible and active integration in a democracy to be made, in a collective and national development project. (FURTER In: FREIRE, 1967, p. 3)

With the debate aligned in the educational praxis focused on the teaching-learning of the discipline Geography, in the Integrated High School (1st years) of CEFET-MG, the educators, in this context, point out that more important than the contents studied in the set of tasks accomplished – although contextualized in a qualified perspective – is what underlies the practice and what was intended, that is, a humanizing view of what education is and the meaning of learning and teaching Geography.

There is an implicit social commitment to education, configured beyond the deceptive perspective of an instructionist education, with the stealthy propagation of knowledge that generates the alienation of the individual/student; Geography is not or should not be "a telephone directory".

Célestin Freinet, a French pedagogue, warns us when defining the difference between handlers and educators:

> I am sorry for the educators who are only keepers and pretend to treat students methodically and scientifically, locked up in rooms where, fortunately, they spend only a few hours a day. Its great concern is to swallow the mass of knowledge that will fill engorged heads to indigestion and nausea. Their art is that of stuffing and conditioning, and also of medication capable of making the ingested notions assimilable. Preserve in your pupils the natural appetite. Let them choose the foods in the rich and propitious environment that you prepare for them. Then, you will be an educator. (FREINET, 2004, p. 39)

He further reasons about the value of an education in which:

> Life is prepared by life. If you are afraid that your child will break his head, tear his clothes, get his hands dirty (...), lock him up (...) or take him by the leash (...), so that he does not join the bands of children who in the street, in the gardens, in the orchards and in the bush — fearlessly seek their elementary experiences. (FREINET, 2004, p. 23)

By correspondence, we are in a consecrated conjunction in which every practice is or should be a socio-affective exercise rich in observations, tests and educational experiments (WALLON, 1989); in which we would need to "make the sun shine" like "The adventurers of Kon-Tiki , who (...) they equipped their caravel and set out alone in the mysterious Pacific, to redo an experiment, verify a hypothesis and prove to the world that man has not degenerated, they are like a symbol of this conversion" (FREINET, 2004, p. 16-17). We must, in view of this, "experience" more in the classroom for our sanity and that of the students.

This pedagogical observation inferres the return of affectivity to teaching, reinforcing, once again, what the school seems to have forgotten in recent times: that our students in Basic Education are children/young people in formation, "the study of the child is essentially the study of the phases that will make him an adult" (WALLON, 1989, p. 46). Wallon's indications in favor of education and this development, by the experimental method, go through investigations and the verification of parallelisms.

Subsequently, Wallon deepens his manifestos:

> The study of correlations is therefore a method of analysis and verification, but not of reconstruction. (...) The existence of a set is not to be confused with the affinities of its parts. What makes the different activities that constitute it contribute to the behavior of a given age is not necessarily the fact that they are conditioned to each other. The causes of an evolution go beyond the present instant. Each of its stages cannot, therefore, form a closed system, the manifestations of which would all depend strictly on each other. (WALLON, 1989, p. 47)

This affectionate gaze will allow us to carry out our educational experiments for the benefit of our students. To do so, each teacher needs to know their students, their "biographical narratives" (BRUNER, 1997a; 1997b; 2001) and, in teaching, make the association feasible as opportunities arise, with the daily life of the individual/student and their interests/abilities, because the centrality is in the student (ROGERS, 2019).

In the appreciations of Jerome Bruner (1997b, p. 46), "a narrative is composed of a singular sequence of events, mental states, occurrences, involving human beings as characters or authors". It is apprehended as a metaphorical achievement constructed from a

historical-social point of view and culturally expressed, in which the subject who forges it exposes his representation of the proximate reality, conceiving and reformulating it in his narrative and life transit.

Furthermore, Bruner ratifies the understanding that each (auto)biographical narrative stands out in a peculiar panorama and its conformation is subordinated to the singularities of the enunciator and his dialoguers, all undoubtedly consigned to the same cultural core, having as essences the encounters of values and precepts incorporated in this sociocultural scenario (BRUNER, 1997b).

Apart from the current interlocution, it is necessary for the narrator to undertake a deep and particular intellectual work that encompasses the recollection of knowledge/memories/experiences of the past, appreciating them through a prism of what is more considerable in the present, probably receiving intercessions that act as an incitement to narration. This subjectivized extension of the being says that the narratives are neither finalized nor concluded, but are repeatedly open to new contributions and reelaborations (BRUNER, 1997b). Hence Bruner's invitation for schools to be communities of mutual learning:

> In fact, based on what we have learned in recent years about human learning – that it is best if it is participatory, proactive, communal, cooperative and if it aims to construct meaning, rather than receive it – we do better in teaching science, mathematics and languages in these schools than in more traditional schools. (BRUNER, 1997a, p. 84)

Vygotsky, on the other hand, interprets the school as an environment in which students take possession of the universal heritage of humanity densified in the school curricula. Teaching-learning is a psychological mechanism that designates the psychic refinement of the young student. The teacher's conduct in this scope is to link the student's pre-existing practical knowledge with the theorizations that he will develop in school. In the Vygotskian bias, to deepen the theoretical and scientific conceptualizations in education is to place teaching in the area of proximate development, requiring relationships between the dynamics of teaching, learning and the improvement of the psyche (VYGOTSKY, 1989).

Combining the learning of the school with that of the student's life is a constant desire for every teacher, because the school is not detached from culture, on the contrary, it is one of its expressions. Immersed in a complex universality, we see the world of today through our partialities and our localities, and the gaps in knowledge are cognitively complemented through interactions, preferably. The biggest question, in our praxis, is not to let ourselves be imprisoned in the search for a range of themes, but to emphasize the deepening of what

we consider important for the student to abstract, so that he can later internalize them and, later, reinterpret them in his own way, creating his own judgments.

Our principles are based on the assumptions of Geography, on education scholars that we deeply admire and with whom we have more affinities, some of which are mentioned here and in classroom experiences; however, these studies that refer to us are not unquestionable axioms. The theoretical foundation is respectable, but the difference is in the sensitivity and intuition in relation to our students.

We believe that, thanks to quality education, we can build, in the future, a more humane and democratic society, as Santos (2001, p. 11):

> On the theoretical level, what we see is the possibility of producing a new discourse, a new metanarrative, a new grand narrative. This new discourse gains relevance due to the fact that, for the first time in the history of man, the existence of an empirical universality can be verified. Universality ceases to be just an abstract elaboration in the minds of philosophers to result from the ordinary experience of each man. In such a way, in a dated world like ours, the explanation of what happened can be made from categories of a concrete history. It is also this that allows us to know the existing possibilities and write a new story.

Therefore, the work in the classroom, in the discipline of Geography, has as an anticipated conjecture to help the student to arrive at a presumed "geographical reasoning"; by doing so with our mediation, if it happens, he will establish himself as a subject/citizen. However, there are no prerogatives.

METHODOLOGY

Access to a competent and popular school, ingrained in our cultural and massifying civilizing process, reinforces that democratization occurs/will take place with the evolution and overcoming of our intrinsic contradictions, on the part of all those involved in the educational system, thus, our work as educators is eminently political (not to be confused with "pamphleteering").

Therefore, this methodology was listed in the problematization of the focus of study (globalization) in Basic Education, collecting the theoretical elements inherent to the exposed practice and its pertinences in the concreteness of the classroom from the knowledge about the students, the generation of knowledge and assumptions elaborated by them, in a formative geographical practice.

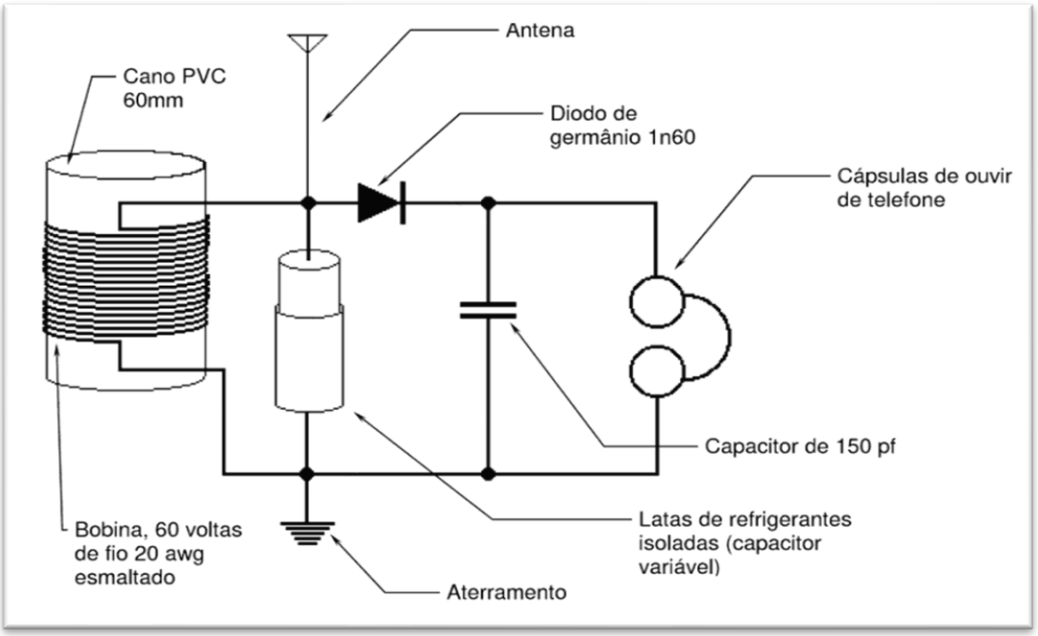
Let us see, below, the methodological steps taken (within an open method):

i. Diagnostic evaluation of primary notions (globalization, fragmentation, identity, diversity, multiculturalism, ideology, hegemonic power...), planning of activities;

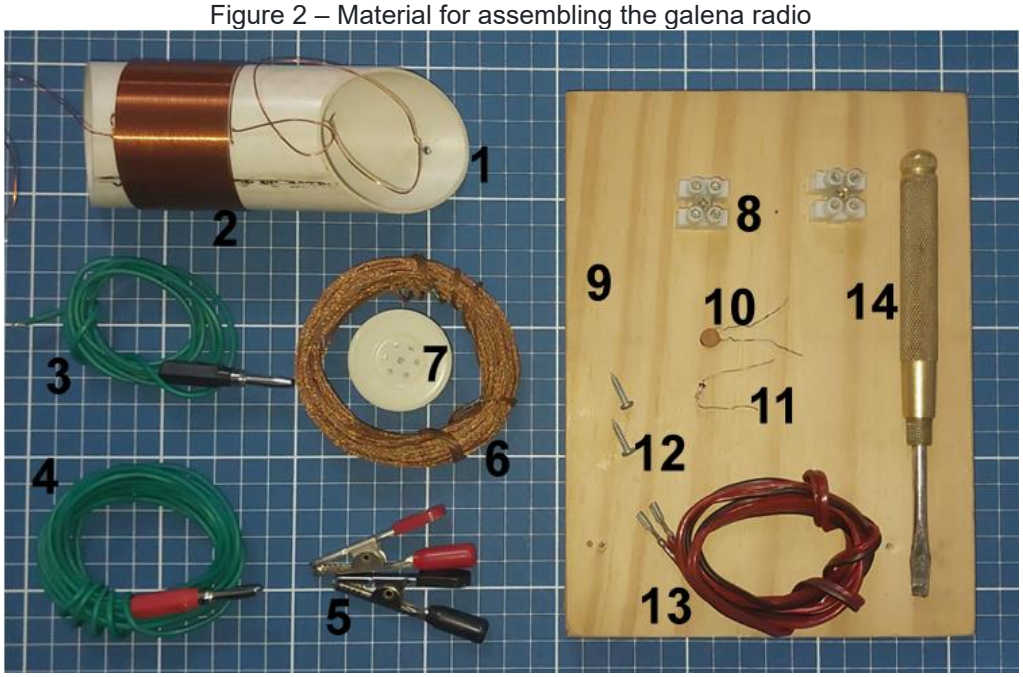
ii. Research done by students on new technologies in telecommunications, especially on radio and its history in Brazil, its new configurations;
iii. Individual survey on the main AM and FM radios in the Metropolitan Region of Belo Horizonte and their relevant characteristics (which songs/information/news they broadcast and by what means, target audience, etc.);
iv. Radios tuned by students and their families, identification and particularities;
v. Discussion in groups for the exchange of experiences and information among students with the interposition of teachers;
vi. Preliminary explanations for the manufacture of the galena radios, an electronic scheme made available to the students (Figure 1).
vii. Materials needed for the assembly of the galena radios in the room (Figure 2) were:

a. Electronic scheme; 1 board of 15cm x 20cm;
b. 1 coil of 60 turns of 20 AWG enameled wire (0.8mm diameter);
c. 4m of 24 wire (cabin) for connection with antenna and with connection for grounding;
d. 2 large alligator clips with insulation; 5m to 10m of wire rope for antenna;
e. 4 screws (1.5cm) for wood; 1 capacitor from 150pf to 470pf ceramic or stiroflex;
f. 1 germanium detector diode 1n60, AA119 or equivalent;
g. 1 variable capacitor of 410pf or 2 cans of soft drinks interspersed with plastic insulating them;
h. 1m of polarized parallel wire for speaker;
i. 1 earphone capsule (listen) of the highest possible impedance;
j. 1 small screwdriver; 2 banana plugs;
k. 2 pairs of parafuso (sindal) bar connectors from 1.5mm to 2.5mm.

Figure 1 – Electronic schematic of the galena radio



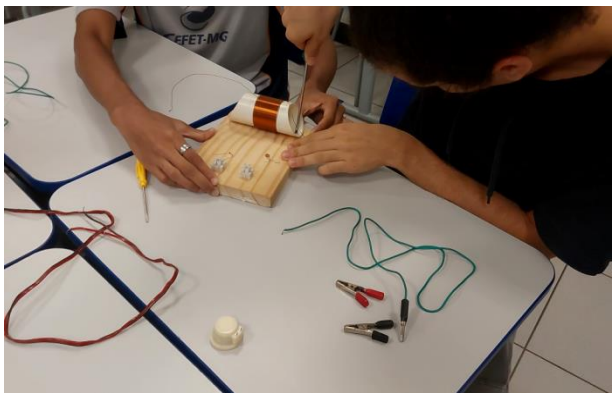
Source: Prepared by the authors.
Figure 2 – Material for assembling the galena radio



Source: Authors' collection. Description: 1 – PVC pipe, 2 – Enameled wire coil, 3 – Grounding wire, 4 – Antenna connection wire, 5 – Alligator clips, 6 – Antenna cord, 7 – Headphone capsule, 8 – Sindal connectors, 9 – Wooden plate, 10 – Ceramic capacitor, 11 – Germanium diode, 12 – Screws, 13 – Headphone cable, 14 – Screwdriver.

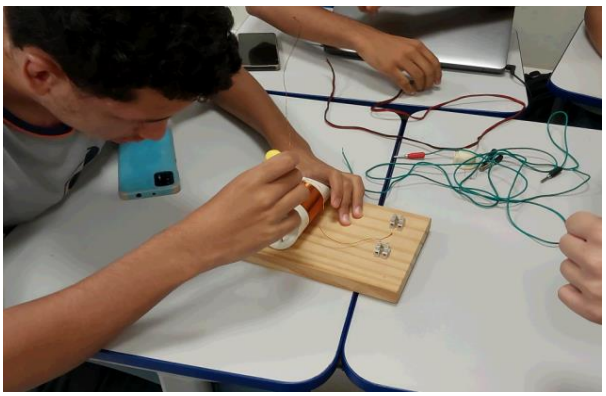
viii. Assembly of the galena radios in the classroom (Figures 3 and 4) and prototype completed with the suppression of the variable capacitor (Figure 5).

Figure 3 – Assembly of the Galena radios in the classroom



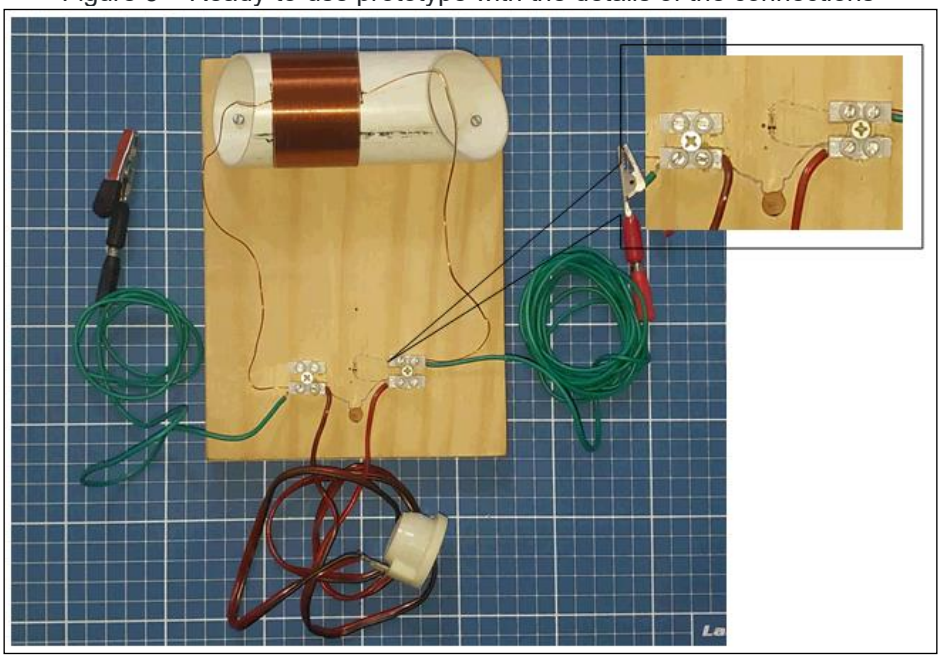
Source: Authors' collection.

Figure 4 – Assembly of the Galena radios in the classroom



Source: Authors' collection.

Figure 5 – Ready-to-use prototype with the details of the connections



Source: Authors' collection

ix. Explanation of how to use the material to assemble the radio:

For the proper functioning of the galena radio, a good grounding and a good antenna are required. To make a good grounding, we can use some metal grid or metal pole that is stuck in the ground. The black alligator clip can be used to facilitate the connection of the grounding wire to the hardware.

The antenna can be made from a long wire (about 10m) stretched outdoors and with the ends insulated so as not to touch any metallic object that is grounded. The red alligator clip should be attached to the antenna wire somewhere it is bare. The antenna should be stretched and kept as far away from the ground as possible. The strand is the best material for the construction of the antenna, but a stretched extension wire will also work very well, just by placing the alligator clip on a bare end of the extension.

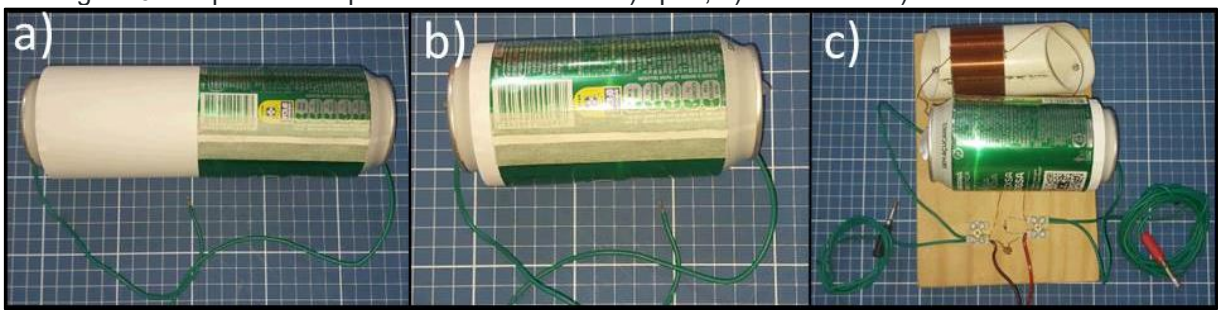
Since the variable capacitor is a more expensive part, it was suppressed from assembly. It is the capacitor that will allow the radio stations to change, but this can be achieved by reducing or increasing the amount of coil turns. Usually, the AM radio station that has a stronger signal is the one that will predominate in the auditions.

To simulate a homemade variable capacitor, we can use two aluminum soda cans assembled as follows: a can must be covered with a thick plastic such as PET bottle plastic, an X-ray sheet, plastic sheet (acetate) for transparency, or something similar to insulate it. The other can should have its bottom removed and made a longitudinal cut so that it can

wrap around the first can. The tabs (opener ring) can be connected to wires which, in turn, will each be attached to the ends of the coil.

Thus, to vary the capacitor, it is enough to pull one of the cans like a piston so that the contact area between them is changed, thus obtaining the effect of variation of a capacitor. We recommend that the second can, the one that will wrap the first, be secured by an elastic band to keep it as adjusted as possible to this first can and also so that it is the part that will be attached to the coil that will be grounded, as shown below (Figure 6).

Figure 6 – Improvised capacitor with soda can: a) open, b) closed and c) installed on the radio



Source: Authors' collection.

The open capacitor has a lower capacitance value. As it is closed, the capacitance increases. This variation of the capacitor in conjunction with the coil will change the resonance point of the assembly, which will change the equilibrium point for each radio station frequency. This effect will allow a selection of the stations. The success of this piece will depend on how much one can will be adjusted over the other and the efficiency of the insulator between them.

x. Tests inside and outside the classroom with Galena radios, conclusions from the experiments made;

xi. Listening and analysis of the song "Banda Larga cordel", by Gilberto Gil (Table 1).

Table 1 – Lyrics of the song "Banda Larga cordel"

Long Band (Gilberto Gil) He put it in his mouth, tasted it, spit it outIt's bitter, he doesn't know what he lostIt tastes like gall, bitter rootWho doesn't come in the cord of broadbandHe's going to live without knowing what world is his Everyone in the broad discussionThe neuroscientist, the economistOpinion of someone who is on the trackOpinion of someone off the listOpinion of someone who says no One band is good, it's umbandaAnother band of the band is ChristianAnother band of the band is kabalaAnother band of the band is KoranAnd	Devil of a little boy internetAlone he discovers the wayThe radio did the same with his grandfatherHighway, waterway, railwayAnd now arriving at the infoviaFor the joy of the whole countryside My Brazil, my very Brazilian BrazilYouTube coming to its grotesPaths of the hinterland, Guimarães Rosallíadas, Lusíadas, CamõesKing Solomon in the Upper SolimõesThe foot of the plant, the drool of the aloe He put it in his mouth, tasted it, spit it outIt's bitter, he doesn't know what he lostIt's bitter the mission, bitter rootWho's going to release a

then, and then, how many bands? As many as my heart asks And my heart asked like this, justBim-good, bim-bim-good, bim-good, bim-bim-goodBim-good, bim-bim-good, bim-good Either this band expands and the band movesFaster to the bands of the hinterlandOr else no, it's no useBanda goes, the band is abandonedLeft for another incarnation Rio Grande do Sul, GermaniaAfrican-Amerindian MaranhãoMore democratized broadbandOr not, it's no useThe problems will have no solution Piraí, Piraí, PiraíPiraí has gone a little widenPiraí has made it possibleThe air of the entire municipalityCertainly the measure provokedA certain whirlwind Devil of a boy now wantsAn ipod and a brand new computerWhat is certain is that the hinterland wants to become the seaWhat is certain is that the hinterland wants to navigateOn the boy's computer little internet. Grandson from Bahia, a good singerA long time ago he became a provider, an access providerTo the great network wwwThis boy still becomes a wise manHired by Google, yes sir	balloon on broadbandIt's someone who hasn't been born yet The mission is bitter, bitter rootWho will release a balloon in broadbandIt's someone who hasn't been born yet Put it in your mouth, tasted it, spit it outBitter, you don't know what you lost The whole world in the broad discussionThe neuroscientist, the economist Or this band is widened and the band moves faster to the backlands Devil of a boy now wantsAn ipod and a brand new computer Netinho from Bahia, a good singerA long time ago he became a providerTo the great network www, from the great network wwwThis boy still becomes a wise manHired by Google, yes sir Devil of a little boy internetAlone he discovers the wayThe radio did the same with his grandfatherHighway, waterway, railwayAnd now arriving at the infoviaFor the joy of the whole countryside He put it in his mouth, tasted it, spit it outIt's bitter, he doesn't know what he lostPut it in his mouth, he tasted it, he spit it outBitter, he doesn't know what he lostHe put it in his mouth, he tasted it, he spit it outBitter...

Source: Musicmatch, 2023.

xii. Debate on the ongoing globalization process, new technologies and impacts on the populations' ways of life, what are the repercussions on culture and what interests they serve.

NOTE: This radio was executed in the form of a kit so that its assembly by the students would not require a lot of time and everyone could do it calmly, regardless of preexisting skills. The coil and cables were already made, as well as the connectors that were already attached to the wooden board. Alligator clips and "banana" plugs can be suppressed. The parts are low cost, with the exception of the variable capacitor. In this case, it was decided to make a homemade capacitor with two cans of soft drinks.

The use of the galena radio inside the classroom will suffer great interference from the electrical circuits of lighting, devices and the barrier represented by the walls and ceiling with their hardware. A much stronger signal can be obtained with the galena radio operated outdoors, suffering interference from nearby buildings, vegetation, relief and other elements

of the environment. The change of galena radio in varied environments will determine the best conditions for capturing AM stations. It is also recommended that the teacher, before applying this experiment in the classroom, assemble his radio at home and do his tests preliminarily, more than once if he deems it necessary, to avoid inconvenient surprises during the classroom laboratories.

RESULTS AND DISCUSSIONS

The students' first impression was one of incredulity: how would such a simple apparatus be able to tune in to any radio? This feeling turned into a great surprise when the first tests were made with the radios already assembled. The stations were captured and the sounds came out clear on the headphones.

The didactic-pedagogical approach favored opportunities for not only individualized but also collective studies, referring to the history and constitutive data of the radio medium in general and in the country, and also to media creation and its apparatuses.

In addition to the deepening of the terms worked on in an interdisciplinary suggestion, distinctive areas of knowledge were made to assimilate what globalization and the means of communication are, the radio and its mechanics, its social/economic/political practices, the ways of structuring the medium, the value for freedom of expression and access to knowledge by the collectivity, among other approaches.

The debates and the making of Galena radios in the classroom led to greater interaction between students, helping each other, in a dialectical construction of discernments. They also provided communication with their family members from different generations by investigating the influence of radio in their lives and in other times; their preferences in the past and in the present and in what type of radio.

The students got involved in the activities and understood their purposes, issuing "tuned" opinions on the topics researched, as well as having the autonomy to investigate and interpret the media in a hypermedia world. They expanded their fields of vision, embracing argumentative positions in the face of the information collected, transforming it into knowledge.

FINAL CONSIDERATIONS

The essay on the theme of globalization as a curricular part in a teaching with the objective of presenting its more in-depth conjuncture was a nod to the simple and to a significant praxis, with the perception that the path is inconstant and flexible, since the

production of meanings happens in the very walk towards an educational practice thought of the student.

At the end of the activities, we were able to verify that they were successful. The students expressed that they liked both the theme and the way it was developed and experienced, although with some unforeseen events that were normal during the tests with the Galena radio which, in turn, generated other analyses.

The purpose of the works was the assimilation and deepening of the globalization theme through a personal and collective "laboratory", having as motivation the making of a galena radio, making the equivalences between technological advancement, acculturation and the homogenization of planetary customs, the modifications in this means of communication and the lives of the students.

Also reflecting on the network society and its flows, how these means of communication interfere in our human grouping and at what levels (personal, local, regional, global), which "is in the process of structural transformation (...). It is a multidimensional process, but it is associated with the emergence of a new technological paradigm, based on communication and information technologies" (CASTELLS, 2000, p. 16).

However, within the educational process and in our private actions as subjects, we need to understand the changes underway in contemporaneity. At this level of schooling, in Integrated High School, students have a very large maturity and access to information, but with enough discernment to carry out their own contextualizations with the help of their teachers.

One of them is that: "We know that technology does not determine society: it is society. Society is the one that shapes technology according to the needs, values and interests of the people who use the technologies" (CASTELLS, 2000, p. 16). As an example, we have Marshall McLuhan (1964) alluding to the relevance of radio with the verses of the German playwright and poet Eugen Bertholt Brecht:

> Little box I carried when on the run
> So that your valves wouldn't break down,
> That I took from home to the ship and the train
> So that my enemies would keep talking to me
> Near my bed, and to my anguish,
> The last words of the night and the first words of the morning
> About your victories and about my problems
> "Promise me not to be suddenly mute."
> (BRECHT *apud* MCLUHAN, 1964, p. 335)

That radio does not remain silent and remains diverse, and that, as subjects of a transforming social body, we are always aware of the social uses and consequences of

these technologies in our lives, with the identification of their ideological discourses and political interests, how we use them on a daily basis and how they promote integration and/or segregation among individuals where we live and around the world.

Thus, if we believe in another type of society and another type of globalization, and if we want change, the movement must begin with ourselves as educators, our praxis will be the result of this. On the other hand, that they actually contribute to the students having a voice and that the experiences are penetrated dialogical educational possibilities, as this one with the construction of the Galena radios.

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PRODUCTION AND CHARACTERIZATION OF CARBOXYMETHYL CELLULASE BY SUBMERGED FERMENTATION OF *STACHYLIDIUM BICOLOR*

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ABSTRACT

Microorganisms that are capable of degrading lignocellulolytic materials can produce extracellular cellulase complexes. Fungal are good producers of cellulolytic complex, since these microorganism sources have a high capacity of multiplication and production of various enzymes, enabling industrial production. At this work, we researched the production of the enzyme carboxymethyl cellulase (CMCase) by the fungus *Stachylidium bicolor*. The pH and temperature optimum were studied by Response surface methodology with different temperatures (30, 50, 70ºC) at different pHs, ranging from 2 to 6. The effect of substances (sodium chloride, sodium benzoate and monosodium phosphate) was studied as stabilizer CMCase using a simple-centroid mixture design. The enzyme showed optimum pH and temperature at 4.0 and 50 ˚C, respectively. Monosodium phosphate showed higher and positive EP, suggesting that the mixture with a higher proportion of this component provides a higher enzymatic activity.

Keywords: Fermentation. Fungal. Production. Response surface methodology. Characterization.

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INTRODUCTION

Microorganisms are an excellent alternative for production of cellulolytic complex, since these sources have a high speed of multiplication, are adaptable to various nutrient media few expansive, produce enzymes of commercial (Loureiro et al., 2018, Santana et al., 2023). Microorganisms that are capable of degrading lignocellulolytic materials normally produce extracellular cellulase complex. Microorganisms, including fungi, produce cellulases, an inducible biocatalyst, at different phases of their development on cellulose substrates (Sutaoney et al., 2024).

Utilization of microbial enzymes has been widely reported for centuries, but the commercial use of enzymes has been recently adopted (Ejaz et al., 2021). Cellulases has applications in various commercial sectors including agriculture, brewing, laundry, pulp and paper and textile industry. Cellulases can be used to tenderize fruits, clarify the fruit juices, reduce roughage in dough, hydrolyze the roasted coffee, extract tea polyphenols and essential oils from olives and can increase aroma and taste in food items (Ejaz et al., 2021).

The microbial conversion of cellulose to soluble products requires the action of various types of glycosidic hydrolytic enzymes, such as endoglucanases or carboxymethyl cellulase (EC 3.2.1.4), cellobiohydrolases (EC 3.2.1.91 and β-glucosidase (EC 3.2.121) (Henrrissat 1991, Lynd et al., 2002; Hua-Li et al., 2007, Santana et al., 2023). The use of cellulase-producing microorganisms and the development of new technological routes for cellulase production remain a strategic issue to be considered during the development of a sustainable process for ethanol production from biomass (dos Reis et al., 2015; Juturu and Wu, 2014, Pirota etal., 2016; Loureiro et al. 2018). Sugarcane bagasse has potential for industrial use to ethanol production due to its great abundance in countries as Brazil generating a large amount of agro-industrial waste which can be used and transformed into a value-added product employing cellulases enzymes (Santana et al., 2023).

The diversity of fungi in the Caatinga is also high, with conidial fungi being important components of the mycobiota (Cruz; Gusmão, 2009). *Stachylidium bicolor* is a fungus that is part of the class Chaetosphaeriales, phylum Ascomycota (Almeida et al., 2017).

This study describes the optimization of pH and temperature using response surface methodology and stabilization of carboxymethyl cellulase (CMCase) from *Stachylidium bicolor.*

MATERIAL AND METHODS

MICROORGANISMS

The microorganism *Stachylidium bicolor* was obtained from the Bahia Microorganism Culture Collection (CCMB) of the State University of Feira de Santana (UEFS) and reactivated in Batata-Dextrose Agar (BDA) medium for 10 days in a B.O.D. incubator at 28ºC.

FERMENTATION AND OBTAINING THE ENZYME EXTRACT

The enzyme extract was obtained according to the methodology described by Delabona et al. (2012; 2019). The composition of the pre-culture medium was adapted from Mandels and Weber (1969) using 10 g/L of glucose as a carbon source. The composition of the pre-inoculum medium was: 1 mL of Tween 80; 0.3 g/L of Urea; 2.0 g/L of KH_2PO_4; 1.4 g/L of $(NH_4)_2SO_4$; 0.4 g/L $CaCl_2.2H_2O$; 0.3 g/L of $MgSO_4.7H_2O$; 1.0 g/L of peptone; 5.0 mg/L of $FeSO_4.7H_2O$; 1.6 mg/L of $MnSO_4.4H_2O$; 1.4 mg/L of $ZnSO_4.7H_2O$; 2.0 mg/L $CoCl_2.6H_2O$. The culture medium was prepared with the same pre-culture medium.

To prepare the inoculum, a conidia suspension of the fungus was prepared by adding 20 mL of distilled water and Tween 80 (0.1%) to the cultured BDA plates until approximately 10^{-7} cells. This suspension was transferred to Erlenmeyer flasks containing 50 mL of the pre-culture medium, incubating 72 h at 29°C in a rotary shaker at 200 rpm.

To fermentation to produces CMCase enzyme a volume of 20 mL of the inoculum was then transferred to Erlenmeyer flasks containing 180 mL of the production medium containing sugarcane bagasse in natura as inducer. The assays were incubated for 10 days at 29°C and 200 rpm in a refrigerated shaker incubator. The samples were centrifuged at 10,000 rpm, 10°C for 15 min and analyzed for enzymatic activity obtained.

CARBOXYMETHYL CELLULASE (CMCASE) ENZYME ACTIVITY

The reaction tubes were prepared with 0.25 mL of the substrate carboxymethylcellulose (CMC) at 0.5% (w/v) prepared in a buffer solution citrate phosphate 50mM and 0.25 mL of enzymatic extract (crude extract). To control the reaction, 0.25 mL of buffer solution and 0.25 mL of enzymatic extract were added. The reaction white was composed of 0.25 mL of buffer solution and 0.25 mL of the substrate carboxymethyl cellulase (CMC). The samples were incubated at 50° C for 30 minutes. After incubation, the tubes were placed in an ice bath, and then 0.5 mL of the DNS reagent was added. Subsequently, the tubes were submerged in boiling water (95ºC) for 15 minutes and, after cooling, 2.5 mL of distilled water was added to the tubes. The absorbance reading was

performed at 540 nm (Santos et al., 2011). The assay was carried out in replicate. This was chosen to conduct the next essential experiments for the development of the work.

PH AND TEMPERATURE OPTIMUM

The effect of temperature on the activity of carboxymethyl cellulase was determined by assays of enzymatic activity in reactions with different temperatures (30, 50, 70ºC) at different pHs, ranging from 2 to 6. As shown in Table 3. Doehlert experimental design was used, with two variables, equivalent to 9 experiments, having its central point in experiments 4, 5 and 6 (Table 1), with tests conducted in replicate.

The enzymatic activity of the carboxymethyl cellulase obtained at each point was determined as previously described and used to plot the response surface graph using the Statistic 7.0 program.

MULTIVARIATE OPTIMIZATION FOR ACTIVITY STABILIZATION

The experimental conditions were optimized using a simplex-centroid mixture design. A total of nine experiments were performed randomly, as shown in Table 2, including repetitions of the central point to estimate the experimental error. The mixture was composed of sodium chloride, sodium benzoate and monosodium phosphate, modeled in the proportion from 0 to 100% (concentration of 1 mol L^{-1}). The enzymatic activity (U mL^{-1}) was used as an experimental response to obtain the mathematical models that were evaluated from the analysis of variance (ANOVA). The statistical significance of the regression, the coefficients of determination (R^2) and the absence of lack of fit were considered (Azcarate; Pinto; Goicoechea, 2020; Bezerra et al., 2020). Data were processed using the Statistic 12 software (StatSoft, Tulsa, United States) at a confidence level of 95% ($p = 0.05$).

STATISTICAL ANALYSIS

The data obtained were submitted to analysis of variance (ANOVA) obtained with the aid of the Statistica program, as well as a response surface graph, analysis of variance, regression index, R^2, among other statistical parameters.

RESULTS AND DISCUSSION

OBTAINING THE ENZYME EXTRACT

The results showed the use of nature (fresh) sugarcane bagasse showed an activity of 0.12 μmol $min^{-1.}$ These result evidence the utilization of sugarcane bagasse in production of carboxymethyl cellulase (CMCase) by the fungus *Stachylidium bicolor.*

PH AND TEMPERATURE OPTIMUM

pH and temperature are among the most important parameters, which directly affect the production of enzymes (Behera et al., 2017). Then, to analyze these variables, the Doehlert experimental design was applied to evaluate the effect of these parameters on the enzyme CMC obtained from *Stachylidium bicolor* (Table 1).

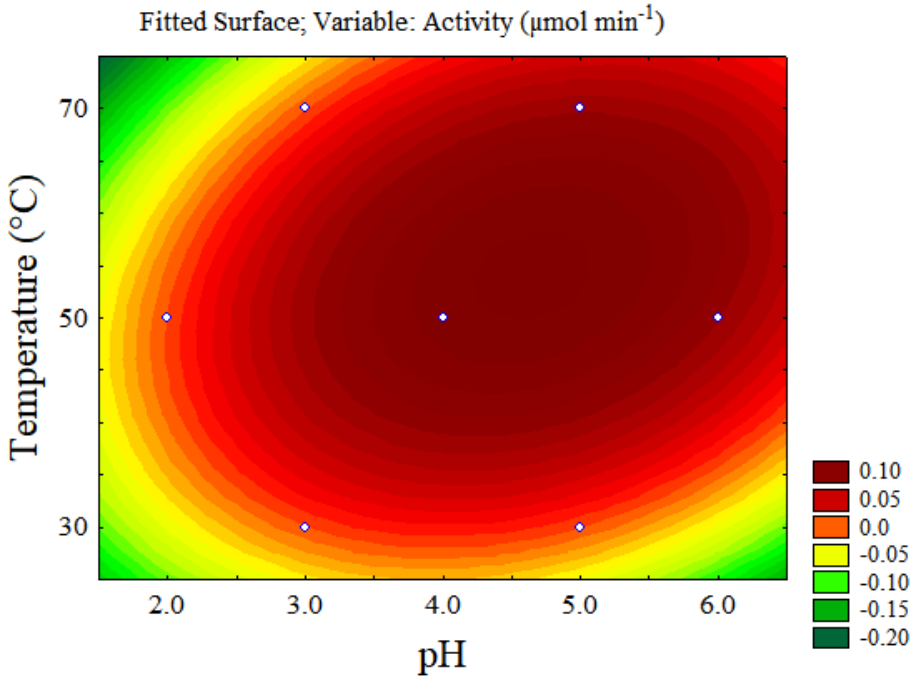
Table 1. pH and Temperature Characterization: Doehlert Experimental Design and Specific Activity

Sample	pH	Temperature (°C)	Activity (μmol min^{-1})
1	3 (-0.5)	70 (+0.866)	0
2	5 (+0.5)	70 (+0.866)	0.077
3	2 (-1.0)	50 (0.0)	0
4 (CP*)	4 (0.0)	50 (0.0)	0.1152
4 (CP*)	4 (0.0)	50 (0.0)	0.1150
4 (CP*)	4 (0.0)	50 (0.0)	0.1151
5	6 (+1.0)	50 (0.0)	0.0821
6	3 (0.0)	30 (-0.866)	0
7	5 (+0.5)	30 (-0.866)	0

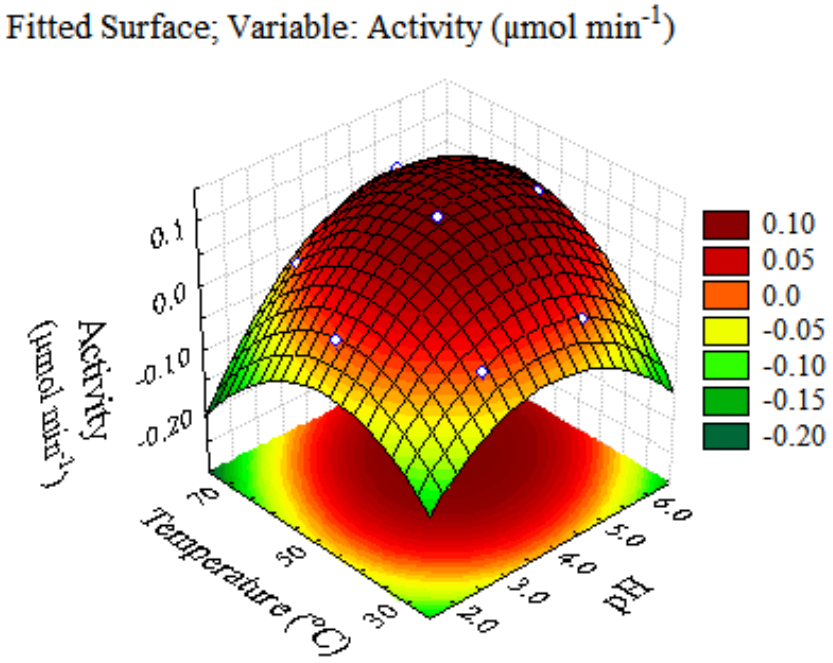
*CP = Central Point

The Statistica program was used to generate the response surface graph, which shows the influence of pH and temperature on the production of cellulase from the microorganism *Stachylidium bicolor* (Figure 1, A and B).

Figure 1. A-pH and Temperature Characterization: Area Graph. B-Response surface chart.



A



B

According to the analysis of the data obtained, the activity was higher at pH 4.0 at 50ºC, with an activity of approximately 0.115 µmol min^{-1}.

The experimental result obtained with the Doehlert design had its equation adjusted to the data obtained in the enzymatic characterization which describes the response surface, namely:

(UA) = -0.6004 + 0.1200 x (pH) – 0.0185 x (pH)² + 0.0164 x (Temperature) – 0.00019 x (Temperature)² + 0.0009625 x (pH) x (Temperature).

Table 2 shows the validity of the models obtained through experimental design can be observed by analysis of variance (ANOVA), obtaining a value of R^2 equal to 0.99. The model obtained for the activity on cellulase was validated with a calculated F of 3284.2, higher than the tabulated F (9.01), showing that the function is well adjusted to the answers obtained.

pH and temperature values influenced activity, showing higher activity at pH 4.0 and 50°C, with the critical values presented by the model in the study of 4.65 and 54.11°C. The Predicted value was 0.1236 μmol min^{-1}.

Table 2. pH and Temperature Characterization: analysis of variance (Anova)

Variation source	QS[a]	DF[b]	QM[c]	F calculated	F Tabulated (CI[d] 95 %)
Regression	0.0241	5	0.0048	3284.2517	9.01
Residual	0.0000	3	0.0000		
Lack of Fit	0.000004	1	0.000004	0.0000	0.00
Pure Error	0.000000	2	0.000000		
SQ total	0.024146	8			

a = QS, Quadratic Sum; b = DF, Degrees of Freedom; c = QM, Quadratic Mean; d = CI, Confidence Interval.

The Pareto chart was also generated, which aims to describe an order under which factors will present better results in reducing losses.

Figure 2. pH and Temperature Characterization: Pareto Graph.

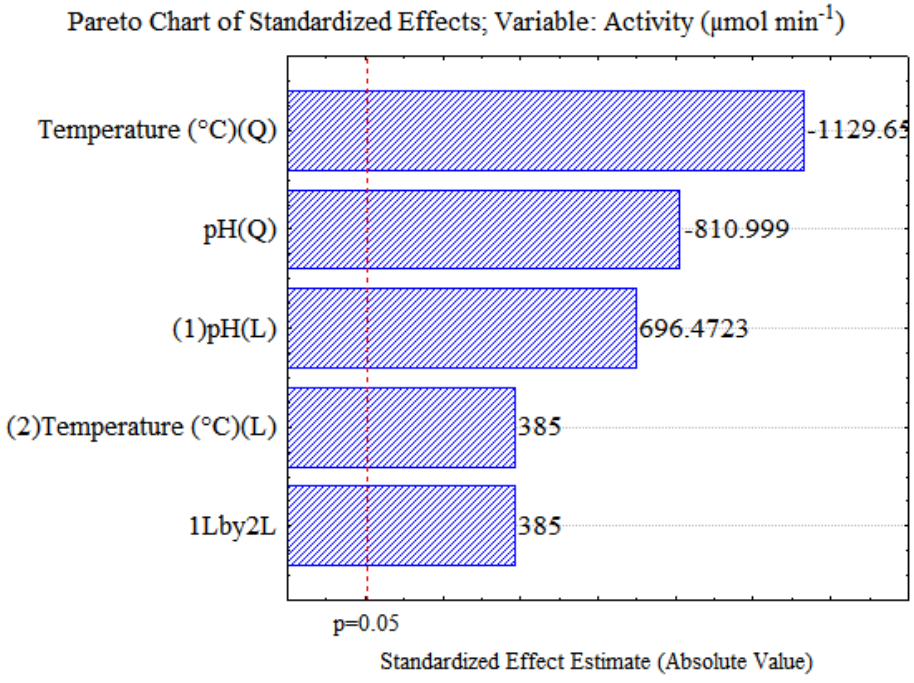


Figure 2 - Cellulase enzyme area chart – influence of temperature under pH
Source: The author himself.

In general, the cellulases produced by filamentous fungi have optimal pH values in the acid range (3.6-5.0) (Castro; Pereira JR, 2010). Para Sales et al., (2010) the pH with the best result was 5.0, according to Sohail et al., (2009). The best results for obtaining fungal cellulase occurred at pH 4.0. Buntić et al. (2016) described better results obtained at a pH ranging between 5.0 and 7.0, reaching their maximum values closer to pH 7.0 for the fungi used.

To determine the best temperature of filamentous fungi activity to obtain cellulosic enzymes, Castro; Pereira Jr. (2010) described that the best results were obtained in the temperature range was 50ºC, while Santos (2014) reports better results in the production of fungal cellulase at a temperature of 35ºC. According to Sales et al., (2010) the best results were found at a temperature of 33ºC and for Buntić et al. (2016) the best result was achieved at a temperature of 45ºC. Thus, as described in Table 1, for the present study the best result obtained for obtaining fungal cellulosic enzymes was at a temperature of 50ºC at a pH of 4.0.

The results showed similarity with several studies with endoglucanases from different organisms, which have pH 7.0 and optimum activity at temperature of 50°C (Romaniec, 1992; Saha 2004; Wen et al., 2005; Dutta et al, 2008; Heidorne et al, 2006). Results showed that in *Bacillus amyoliquefaciens* the temperature and pH optimum cellulase activity was 50°C and pH 7.0, respectively (Lynd et al., 2002). Padilha *et al* (2015) studied the production of cellulase from thermophilic strain *Bacillus* sp. C1AC5507 and found that the optimum temperature and pH for the CMCase production were 70 °C and 7.0, respectively.

Production of cellulases by *Ceriporiopsis subvermispora* cult on wood chips of *Eucalyptus grandis* and *Pinus taeda* was studied. The biochemical characteristics of cellulases produced in both wood species were almost the same. The optimum pH for these enzymes was between 4.0 and 5.0 and the optimum temperature was 60 °C (Romaniec et al., 1992).

Aspergillus niger endoglucanase activity showed an increase in activity when incubated at temperatures of 30 and 35°Cat pH 4 with a reduction in pH 5 (Sohail et al, 2009). Characterization studies of cellulase from *Phanerochaete chrysosporium* BKM-F-1767 showed values of pH 4.6 and 60°C as great to the maximum activity of cellulose (Khalil 2002). Studies show that pH and temperature of purified endoglucanase has similarity with endoglucanase of crude extract. The cellulases of *Bacillus* were optimally active in the pH range of 5-6.5. The optimum temperature was 65 and 70°C for the endoglucanase of CH43 and HR68, respectively Mawadza et al (2000).

Then, is it possible to conclude that CMC cellulase shows pH and temperature optimum that are in the range observed in the literature.

MULTIVARIATE OPTIMIZATION OF THE STABILIZING MIXTURE

To analyze the effect of substances in enzyme activity, the stabilizing mixture composed of sodium chloride (A), sodium benzoate (B) and monosodium phosphate (C) was investigated in a multivariate manner using a simple-centroid mixture design. The experimental matrix resulting from the combination of the components in proportions ranging from 0 to 1.00 mL and the experimental response (enzymatic activity) are presented in Table 9.

Table 3 - Experimental matrix with experiments with the combination of components and evaluated experimental response (Enzymatic activity).

Experiment	Sodium chloride (mL)	Sodium benzoate (mL)	Monosodium phosphate (mL)	Activity (U mL^{-1})
1	1.00	0.00	0.00	0.025
2	0.00	1.00	0.00	0.019
3	0.00	0.00	1.00	0.030
4	0.50	0.50	0.00	0.025
5	0.50	0.00	0.50	0.034
6	0.00	0.50	0.50	0.032
7 CP*	0.33	0.33	0.33	0.035
8 CP*	0.33	0.33	0.33	0.033
9 CP*	0.33	0.33	0.33	0.034

*CP = Central Point
Source: The author himself.

The mathematical models were obtained using experimental data and evaluated using ANOVA (Table 4).

Table 4 - Analysis of variance for the quadratic model

Source of variation	SS	Df	MS	Fcalculated	p-value
Regression	$2.35E^{-4}$	5	$4.69E^{-5}$	26.7	0.011
Lack of fit	$3.28E^{-6}$	1	$3.28E^{-6}$	3.3	0.212
Pure error	$2.00E^{-6}$	2	$1.00E^{-6}$		
Total	$2.40E^{-4}$	8	$3.00E^{-5}$		

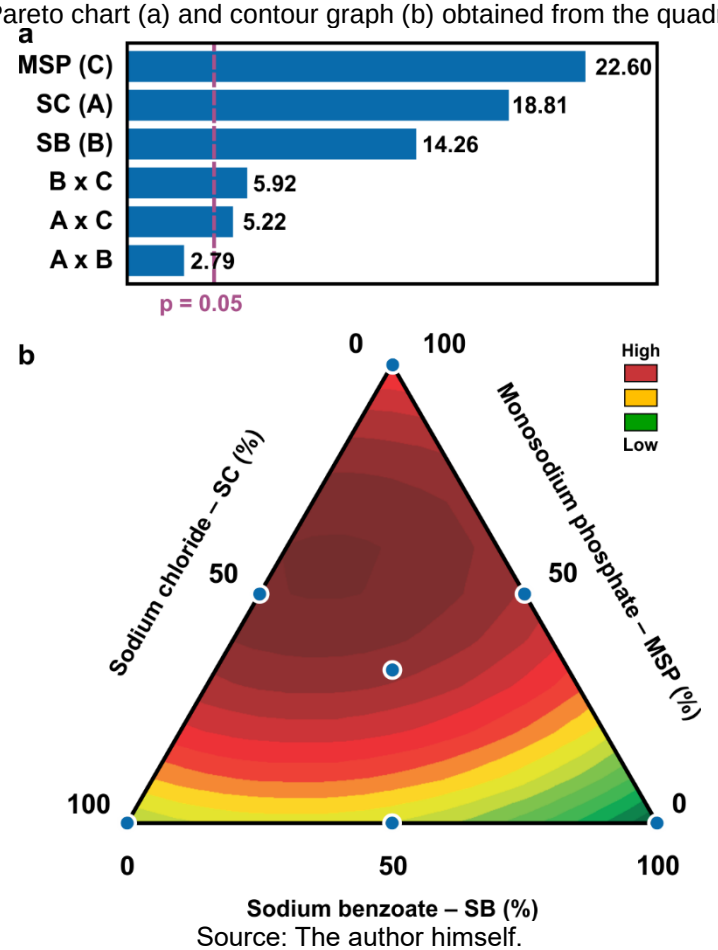
Quadratic sum (SS); degree of freedom (Df); mean square (MS); coefficient of determination (R^2).
Source: The author himself.

Considering the possible mathematical models, the quadratic had better descriptive potential. The regression was significant ($p < 0.05$), that is, it can be used consistently to describe the behavior of the experimental response as a function of the variation in the

proportion of the components of the mixture. In addition, the quadratic model did not provide evidence of misfit, indicated by the lack of statistical significance for the lack of fit (p = 0.212). Thus, a model has been obtained whose regression was significant and the lack of fit was not significant, being considered adequate for evaluating the optimal condition (Novaes et al. 2017). Also, the high descriptive capacity of the model is evidenced by the value of $R^2 = 0.978$.

The model obtained was adequate and from this, it was possible to estimate and evaluate the impact of the standardized effect (SE) of the mixture components and their interactions in the variation of the experimental response. The SE of the components and interactions are shown in the Pareto chart (Figure 3a). Monosodium phosphate presented a higher and positive EP, suggesting that the mixture with a higher proportion of this component provides a greater enzymatic activity. In addition, the other components have effects of the same magnitude and positive. Only the interaction effect between sodium chloride and sodium benzoate was not significant.

Figure 3. Pareto chart (a) and contour graph (b) obtained from the quadratic model



Source: The author himself.

Finally, considering the high predictive capacity, the mathematical equation (Equation 1) was obtained, which describes the behavior of the experimental response as a function of the proportion of components in the mixture shown by the contour graph (Figure 3b).

$$Enzymatic\ activity\ (U\ mL^{-1}) = 0.025A + 0.019B + 0.030C + 0.016AB + 0.030AC + 0.034BC \quad \textbf{(1)}$$

The model presented a maximum condition, enabling the calculation of the coordinates of the critical points, that is, the region in the contour graph that provided the greatest experimental response. Maximum enzymatic activity was obtained using a stabilizing mixture composed of 34% sodium chloride (A), 10% sodium benzoate (B), and 56% monosodium phosphate (C). Under these conditions, the enzymatic activity predicted by the model was 0.036 U mL^{-1}.

Junqueira et al. (2023) studied the effect of preservatives in the activity of CMCase enzyme produced fungus *Aspergillus niger* ATCC 1004. These authors tested sodium chloride, monosodium phosphate and sodium benzoate at various concentrations during 72 hours on the activity of the CMCase enzyme by incubating the enzyme with these salts, in citrate-phosphate buffer pH 5.0 at 50 mM, at a temperature of 50 °C. They found the substances studied show that are good options to preserve the CMCase enzyme.

Sodium chloride is used in the food industry, in the agricultural and chemical industries as chemical preservative (Ravishankar and Juneja, 2014).

Sodium benzoate is widely used in industries as a preservative, especially in the food industry (Junqueira et al. 2023). The effect of postharvest applications of sodium benzoate on physico-chemical properties and enzymatic activities of pear fruit cv was studied by Kaur et al. (2019) that found higher efficacy in maintaining less enzymatic activity of cellulase, pectin methyl esterase and polyohenol oxidase.

Monobasic sodium phosphate or monosodium phosphate is applied in food industries as an acidity regulator. In addition, it may contribute to the stabilization of some proteins (Junqueira et al. 2023). Monosodium phosphate is used as a buffer in several stages of enzyme production by fermentative processes, such as substrate preparation, enzymatic extraction, determination of enzyme activity, etc., and thus used in various studies with this approach (Junqueira et al. 2023).

FINAL CONSIDERATIONS

The results obtained showed that it is possible to produce the enzyme cellulase from the fungus *Stachylidum bicolor*, demonstrating the viability of the fungus for use, since it is possible to be acquired in some common regions of the semi-arid region of Bahia.

The enzyme cellulase produced by *S. bicolor* showed better activity at pH 4.0 at a temperature of 50ºC.

Tests were conducted, with the addition of stabilizing mixtures which should enhance or decrease the enzymatic activity. The results obtained showed that a stabilizing mixture composed of different proportions of sodium chloride, sodium benzoate and monosodium phosphate enabled an efficient enzymatic activity in the process, which can be used together or even in mixtures in pairs: monosodium phosphate + sodium benzoate or monosodium phosphate + sodium chloride.

Therefore, the feasibility of using *Stachylidiym bicolor* in obtaining and characterizing cellulase is noted, and its use as a microorganism that produces this enzyme is possible.

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PROMOTING DEVELOPMENT AND ENVIRONMENTAL AWARENESS IN CHILDREN WITH DISABILITIES: AN APPROACH WITH ADAPTED PHYSICAL EDUCATION AND FUZZY LOGIC

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ABSTRACT

This study aimed to develop a fuzzy logic model to evaluate the impact of interventions in Adapted Physical Education and Environmental Education on the development of children with disabilities, covering physical, cognitive and environmental awareness aspects. The research sought to transcend conventional assessment approaches, implementing scenario simulations that mimic real conditions and incorporating variables such as motor coordination and understanding of environmental concepts. The interventions were evaluated using fuzzy rules, in order to measure the impacts on the various dimensions of development. Although the model has not been applied in a practical context with children, validation tests suggest its future applicability in practical studies. The results indicate that integrated and balanced interventions can effectively improve both physical and cognitive development. The use of fuzzy logic proved to be a robust tool for the detailed evaluation of progress, indicating that the developed model can contribute significantly to inclusive pedagogical practices and guide educational policies aimed at the needs of children with disabilities, reinforcing the importance of sustainability in environmental education.

Keywords: Adapted Physical Education. Environmental education. Fuzzy logic. School Inclusion. Environmental Awareness.

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INTRODUCTION

Inclusive education in Brazil has made significant progress, particularly in the integration of children with disabilities, reflecting a reinforced commitment to creating school environments that support the full participation of all students. Current educational policies underscore the need to adapt these spaces to facilitate comprehensive development, highlighting the importance of environments that foster both students' physical and cognitive growth (Moraes Barth & Schmickler, 2022). However, these children still face significant challenges, especially those related to motor coordination and social interaction, which can limit their engagement in school activities. The adaptation of activities, especially in physical education, is essential to overcome these obstacles and ensure effective inclusion (França, Rocha & Oliveira, 2023).

Learning environments that support inclusion are crucial for the integral development of children, including cognitive aspects and the strengthening of socio-emotional skills. Appropriate inclusive practices can enrich everyone's educational experience, promoting collaboration and empathy (Anjos Junior & Santos, 2023). Adapted physical education, in this context, offers a safe space for motor activities that respect individual limitations and potentialities, essential for socialization and inclusion in the school environment (Nogueira, 2019). In addition, integrating elements of environmental education into these activities adds significant value, promoting not only ecological awareness, but also important social and emotional skills. Outdoor activities and contact with nature benefit physical development and promote values such as care and respect for the environment, expanding the reach of a truly inclusive education (Medeiros, 2020).

This integrative approach, which combines adapted physical education with environmental education, transcends the confines of the conventional classroom, creating a dynamic learning environment that values hands-on teaching. The inclusion of games and play activities focused on the environment offers a valuable platform for the joint development of children's motor and social skills, underlining the importance of integral development (Senhoras, 2022). To properly assess the progress of children with disabilities, assessment methods that capture the nuances of their development are key. Fuzzy logic emerges as a promising alternative, allowing for a more detailed and informative analysis of progress, suitable for informing pedagogical decisions and adapting interventions effectively (Zanata & Silva, 2021). In short, this study aims to integrate physical and environmental education interventions with fuzzy logic, exploring the complexity of the development of children with disabilities in an inclusive context, with the aim of enriching pedagogical

knowledge and contributing to the formulation of more effective and inclusive educational policies.

LITERATURE REVIEW

ADAPTED PHYSICAL EDUCATION AND SCHOOL INCLUSION

Adapted Physical Education (EFA) is essential to promote school inclusion, providing an environment where children with disabilities can develop motor, social, and emotional skills (Oliveira & Ambiental, 2021; França, Rocha & Oliveira, 2023). The practice of EFA favors social integration and the construction of a positive identity, creating safe and inclusive spaces that value diversity (Anjos Junior & Santos, 2023; Nogueira, 2019).

In addition to the impact on motor development, EFA also promotes environmental awareness by integrating outdoor activities, encouraging children to take care of the environment (Santos & Moraes, 2020). The adaptation of physical activities helps children to overcome specific challenges progressively, improving their autonomy and motor capacity (Dias & Borragine, 2020; Ladies, 2022). By incorporating environmental education, EFA not only strengthens physical and cognitive development, but also nurtures an ecological awareness among students (Medeiros, 2020).

EFA, as a school inclusion strategy, not only provides equitable participation in school activities, but also improves academic performance and socio-emotional development, highlighting the importance of a curriculum that includes inclusive and sustainable practices (Patrício, 2021; Moraes Barth & Schmickler, 2022). This transformative pedagogical approach is crucial to prepare students as conscious citizens, equipped to face environmental and social challenges of the future.

ENVIRONMENTAL EDUCATION AND COGNITIVE DEVELOPMENT

Environmental Education (EE) in the school context is an essential tool to sensitize students about the importance of sustainable practices and has a significant impact on cognitive development. By integrating theoretical learning with practical experiences, EE fosters a comprehensive understanding of natural processes and the importance of preserving the environment (Soares, 2020; Melo et al., 2020). Through cognitive games and playful activities, EE stimulates creativity, problem-solving, and critical thinking, preparing students to face and solve environmental challenges in a responsible and ethical manner (Ramos & Vieira, 2023).

In addition, EE contributes to the development of socio-emotional skills, such as empathy and cooperation, which are crucial for academic and cognitive performance.

Contact with the natural environment through outdoor activities expands reasoning capacity and attention, which are fundamental for effective and meaningful learning (Almeida, 2022; Medeiros, 2020).

EE is also a pillar for the integral formation of students, integrating ethical, social and emotional aspects in education. Activities such as school gardens and recycling projects provide a hands-on approach that facilitates the understanding of complex concepts and fosters a sense of responsibility and belonging to the natural world. This holistic approach not only enriches the school curriculum but also prepares students to be conscious and active global citizens (Kolcenti & Médici, 2020; Ramos & Vieira, 2023).

Finally, sustainable educational practices have the potential to generate positive environmental impacts by encouraging ecologically responsible behaviors among students, educators, and communities. The implementation of these practices not only strengthens environmental knowledge, but also stimulates a collective awareness of the importance of conscious consumption and sustainable management of resources (Sousa & Yoshioka, 2020; Mendes & Feitoza, 2022).

ENVIRONMENTAL IMPACTS OF EDUCATIONAL PRACTICES: FOSTERING AWARENESS AND SUSTAINABILITY

Educational practices integrated with sustainability have a significant impact on promoting environmentally responsible behaviors among students, educators, and communities, forming ecologically conscious citizens (Sousa & Yoshioka, 2020). Activities such as tree planting, composting, and the use of renewable energy illustrate how education can transcend theoretical knowledge and have direct and positive impacts on the environment, as well as teaching the importance of sustainable actions and conscious consumption (Mendes & Feitoza, 2022).

Beyond the school context, these sustainable educational practices extend to families and communities, generating significant changes through a multiplier effect. Interdisciplinary school projects that address environmental issues empower students to understand and address ecological challenges, enabling them to propose innovative solutions to local problems, such as waste management and ecosystem conservation (Rosa & Bernaldino, 2023).

Despite the challenges, the long-term benefits of sustainable practices justify the investments, preparing students to become future leaders in sustainability and influencing public policies and community practices, thus contributing to the construction of a more equitable and sustainable society.

ENVIRONMENTAL IMPLICATIONS OF EDUCATIONAL INTERVENTIONS

Educational interventions focused on environmental awareness play a crucial role in shaping sustainable behaviors, integrating theoretical knowledge with practices that foster waste reduction and recycling (Sousa & Yoshioka, 2020). The implementation of practical projects, such as school gardens and environmental monitoring, allows students to directly experience the impact of their actions on the environment, reinforcing the connection between theory and practice (Maia & Albuquerque, 2021).

In addition, the responsible use of natural resources in schools has shown effective results in reducing energy and water consumption, contributing significantly to the mitigation of adverse environmental impacts (Rosa & Bernaldino, 2023). Expanding these practices beyond schools, reaching communities and families, creates a multiplier effect, promoting sustainable practices on a broader scale (Hoernig & Júnior, 2021).

Continuous evaluation of these interventions is essential, using environmental impact indicators to ensure that the changes promoted are sustainable and adapt projects to maximize their benefits.

The inclusion of sustainable practices in the school curriculum is vital to cultivate an ecological awareness among students, combining theoretical teaching with practical activities such as composting and community gardens (Mendes & Feitoza, 2022). These initiatives not only teach about responsible waste management, but also promote cooperation and practical skills among students. Projects that include the use of renewable energy and the reduction of plastic consumption exemplify how schools can transform into living laboratories for sustainable practices (Oliveira & Andrade, 2022).

Interdisciplinarity is crucial to the success of this integration, with disciplines such as science, mathematics, and geography exploring environmental issues from diverse perspectives, while the arts and literature raise awareness about the cultural dimensions of sustainability.

The use of information and communication technologies expands the possibilities for student engagement and innovation, allowing the exploration of creative solutions to environmental problems. Implementing these practices in the curriculum prepares students to address environmental challenges in a proactive and innovative way, cultivating future environmentally conscious and responsible citizens.

FUZZY LOGIC

Fundamental Concepts of Fuzzy Logic

Fuzzy Logic, established by Lotfi A. Zadeh in 1965, extends classical binary logic to deal with values between 0 and 1, reflecting the uncertainty and subjectivity of real data. The main tool of Fuzzy Logic is pertinence functions, which quantify the degree of truth of statements on a continuum of values, rather than fixed binary values of true or false (Nogueira, 2017).

Mathematical Structure and Operations with Fuzzy Sets

Fuzzy sets allow for a more flexible representation of information through varying degrees of pertinence between 0 and 1, rather than the absolute states typical of classical sets.

- **Fuzzy Union:** The union of two fuzzy sets is defined by the maximum degree of relevance that an element has in any of the sets. Mathematically, for sets A and B with an element x, the union is expressed as (Jain, 2020):

$$\mu A \cup B(x) = max(\mu A(x), \mu B(x)) \quad (1)$$

where μ indicates the function of belonging of the set.

- **Fuzzy intersection:** The intersection of two fuzzy sets considers the lesser degree of pertinence of an element in the sets. For A and B (Li et al., 2023):

$$\mu A \cap B(x) = min(\mu A(x), \mu B(x)) \quad (2)$$

This operation is essential for modeling situations where an element must satisfy multiple conditions simultaneously.

- **Fuzzy complement**: The complement of a fuzzy set A is defined by the degree of non-relevance of an element in the set, calculated as (Martinez & Pereira, 2019):

$$\mu compl A(x) = 1 - \mu A(x) \quad (3)$$

This operation helps to understand how far an element is from satisfying the characteristics of a set.

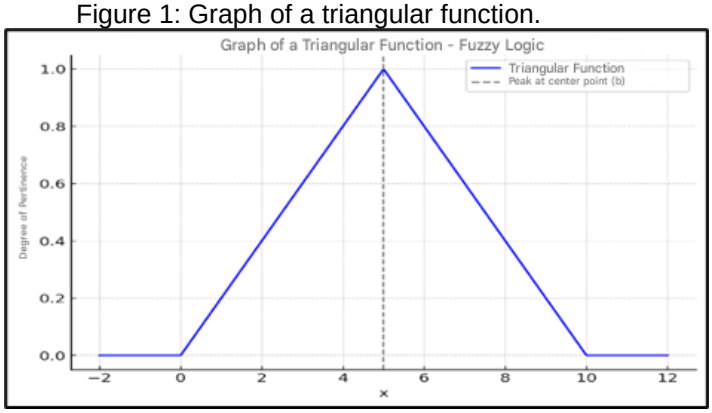
Pertinence Functions and Fuzzy Modeling

Pertinence functions play a crucial role in defining the degree of belonging of elements to fuzzy sets, allowing fine gradations of pertinence.

- **Triangular Function**: Represented by three points that define the beginning, peak, and end of the function. If a, b, and c are the points, then the triangular function μ\muμ for an element x is:

$$\mu_{\text{triangular}}(x) = \max\left(\min\left(\frac{x-a}{b-a}, \frac{c-x}{c-b}\right), 0\right) \quad (4)$$

Figure 1: Graph of a triangular function.

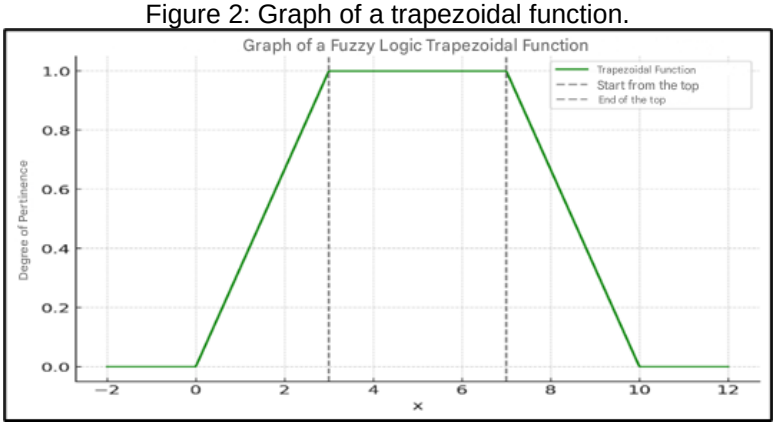


Source: Adapted from (Boratto, 2022).

- **Trapezoidal Function**: This function is an extension of the triangular, adding a flat part at the top. If a, b, c, and d define the function, the expression for x is (Kreinovich, 2020):

$$\mu_{\text{trapezoidal}}(x) = \max\left(\min\left(\frac{x-a}{b-a}, 1, \frac{d-x}{d-c}\right), 0\right) \quad (5)$$

Figure 2: Graph of a trapezoidal function.

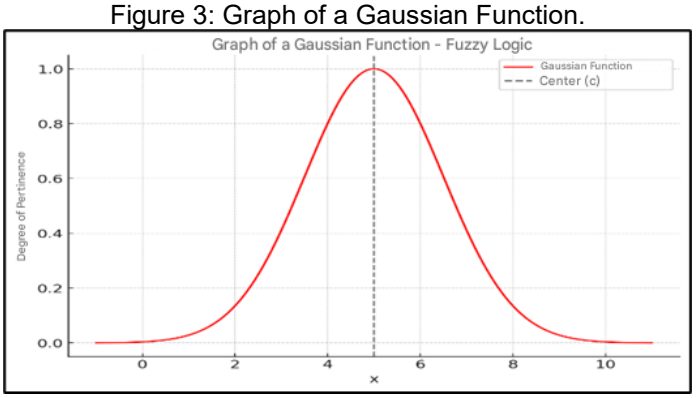


Source: Adapted from (Russo, 2022) and (Pujaru, 2024).

- **Gaussian function**: Used for smooth transitions, it is defined by two parameters: the center c and the standard deviation σ. The function for x is (Jain, 2020):

$$\mu_{\text{gaussiana}}(x) = e^{-\frac{(x-c)^2}{2\sigma^2}} \quad (6)$$

Figure 3: Graph of a Gaussian Function.



Source: Adapted from (Mazzutti, 2018).

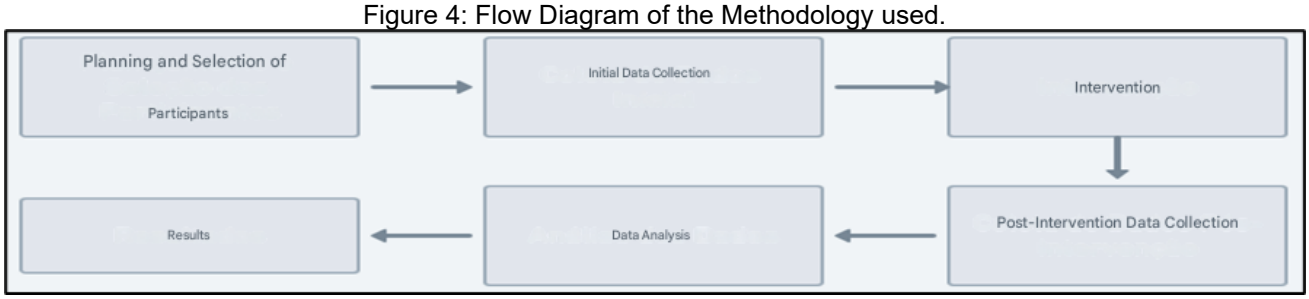
METHODOLOGY

The methodology adopted in this research was structured in six main steps, as shown in the flow diagram (Figure 4). This meticulously designed process ensures the validity and accuracy of the results, from initial planning to analysis and final conclusions.

Initially, the research begins with the careful planning and selection of participants, followed by the initial data collection. Subsequently, carefully planned interventions and a subsequent reassessment of the data are carried out. The analysis of the collected data precedes the last stage, where the conclusions are formulated and discussed.

The purpose of this method is to simplify the understanding of the investigative procedure, allowing a clear view of each phase and its interrelationship in achieving the research objectives.

Figure 4: Flow Diagram of the Methodology used.



Source: Author.

PLANNING AND SELECTION OF PARTICIPANTS

This research adopts a mixed approach, using quantitative and qualitative methods to examine the impact of Physical Education and Environmental Education interventions on the development of children with disabilities. Due to the practical limitations, it was decided to simulate scenarios that authentically reproduce the real conditions of these groups, enabling a detailed and controlled analysis of the interventions.

Participants: Three simulated scenarios were developed, each reflecting different special needs and environmental contexts, to illustrate the dynamics between the control and intervention groups.

Inclusion/Exclusion Criteria

- **Inclusion:** Included schools that already implement sustainable practices or located in areas of environmental relevance. Students from 6 to 12 years old benefited from the integration of physical and environmental educational practices were selected virtually.
- **Exclusion:** Excluded scenarios that do not have infrastructure for sustainable practices or that do not comply with ethical norms for the inclusion of children with disabilities.

Methodology in Practical Studies: The methodology is designed to be applied in real school environments, with selection of children with the consent of the parents and the educational institution. Intervention and control groups would be formed, and initial data collection would serve as a reference to assess progress after interventions.

Description of Interventions

- **Physical Education:** Use of recyclable and eco-friendly materials to promote physical development and environmental responsibility.
- **Environmental Education:** Implementation of school gardens, recycling programs and resource conservation, detailing the frequency and materials used to promote sustainable education.

Rationale for Using Simulated Scenarios: The choice for simulations is due to practical and logistical constraints, facilitating the modeling and evaluation of complex interventions under controlled conditions. This strategy allows testing and validating the fuzzy model for future practical applications, providing a solid theoretical and methodological basis for future studies that will directly measure the effects of interventions.

INITIAL DATA COLLECTION

The initial data collection phase of this study involves the use of simulated scenarios to model real conditions of children with disabilities, employing representative variables that allow robust and ethical initial analyses, suitable for future practical applications. For this, standardized assessment instruments are used that measure physical, cognitive and environmental aspects of the participants. These instruments include questionnaires and activities that assess everything from muscle strength and motor coordination to environmental awareness, focusing on sustainability and conservation practices.

Collection procedures have been carefully tailored to reduce environmental impact, with the use of digital technology for data collection and processing, minimizing paper usage and saving energy. Ethical aspects are strictly followed, with documents such as the Letter of Consent and the Informed Consent Form ensuring transparency and adherence to ethical standards. All data is treated with high confidentiality and anonymity, ensuring responsible and ethical collection of information.

INTERVENTION

The intervention phase of this study involves structured physical and environmental education activities designed to promote both physical development and environmental awareness among students. Physical education activities include running and jumping on natural or recycled surfaces, throwing and endurance using sustainable materials, and adapted games that encourage recycling and responsible use of resources. At the same time, environmental education activities engage students in planting and caring for school gardens, outdoor classes that explore local ecosystems, and educational games that teach about sustainability and energy conservation.

Interventions occur two to three times a week over the course of three to six months, allowing students adequate time to internalize the concepts taught and observe the practical effects of their actions on the environment. This method ensures deep learning and practical application of the acquired knowledge, aiming for a lasting impact on the participants' sustainable practices.

POST-INTERVENTION DATA COLLECTION

The post-intervention data collection phase in the study used fuzzy simulations to assess the effects of the interventions on the children's physical, cognitive, and environmental dimensions. This method employed variables established during the initial assessment to simulate the expected progress under different hypothetical conditions.

Adjustments were made to the fuzzy logic to include variables that reflect changes in the environmental behavior of the students, allowing a detailed monitoring of the results of the interventions.

New instruments have been developed to measure student engagement in sustainable practices, complementing the physical and cognitive assessment instruments used initially. These include questionnaires and practical activities aimed at assessing the effectiveness of sustainability interventions.

The choice for simulations was motivated by logistical and time limitations, aiming to offer a representation as close as possible to reality and including new environmental aspects. This validated approach under controlled conditions sets the stage for future practical implementations, where the impacts of interventions can be measured directly.

DATA ANALYSIS

The data analysis used fuzzy logic to interpret complex information obtained through questionnaires applied to teachers and guardians, in addition to the results of standardized physical tests. This approach allowed for an accurate and gradual assessment of children's progress, capturing nuances that traditional assessment systems might miss. The analysis also considered environmental aspects, evaluating the efficiency in the use of resources and participation in sustainable activities.

Definition of Fuzzy Variables

The fuzzy variables were divided into input and output variables to facilitate the analysis and interpretation of the collected data and the expected results.

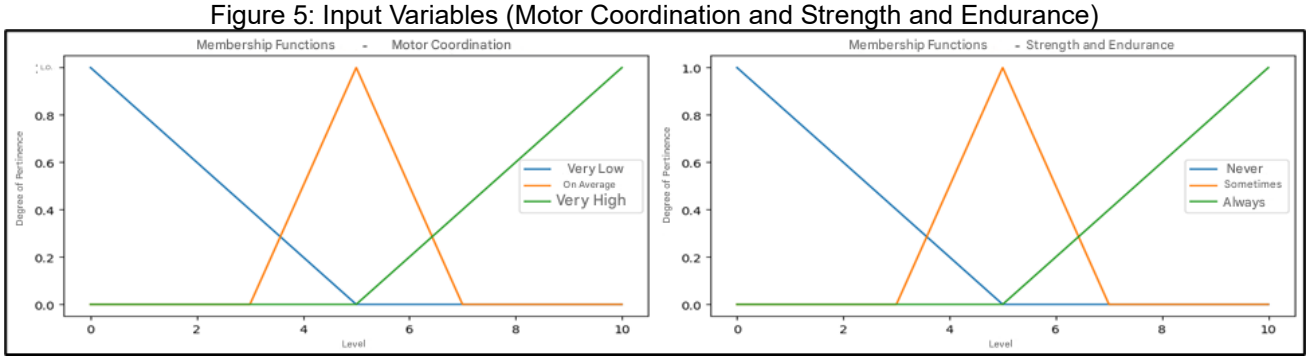
Rationale for the Choice of Input and Output Variables

The selection of variables was guided by frameworks established in the literature on fuzzy logic and educational evaluation, allowing a detailed analysis of educational activities considering imprecise notions such as "good", "bad" and "very good".

Fuzzy Input Variables:

- **Physical Performance:**
  - **Motor Coordination:** Evaluated through the answers about motor skills such as running, jumping, throwing, as recorded in the questionnaire.
  - **Strength and Endurance:** Based on the answers that describe the child's ability to complete and sustain specific physical activities without difficulty.

Figure 5: Input Variables (Motor Coordination and Strength and Endurance)

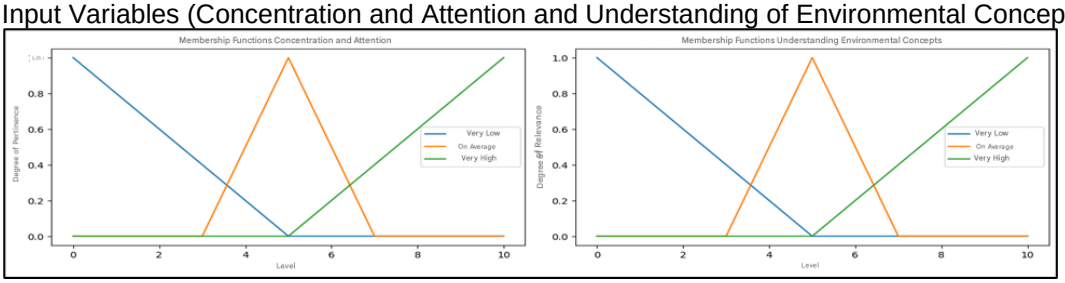


Source: Author.

Figure 5 illustrates the measurement scales for motor coordination and strength and endurance, showing the quantification of these attributes.

- **Cognitive Performance:**
  - **Concentration and Attention:** Assessed based on responses about the child's ability to maintain attention in educational and environmental activities.
  - **Understanding of Environmental Concepts:** Uses the answers about understanding the concepts of sustainability and the environment.

Figure 1: Input Variables (Concentration and Attention and Understanding of Environmental Concepts)

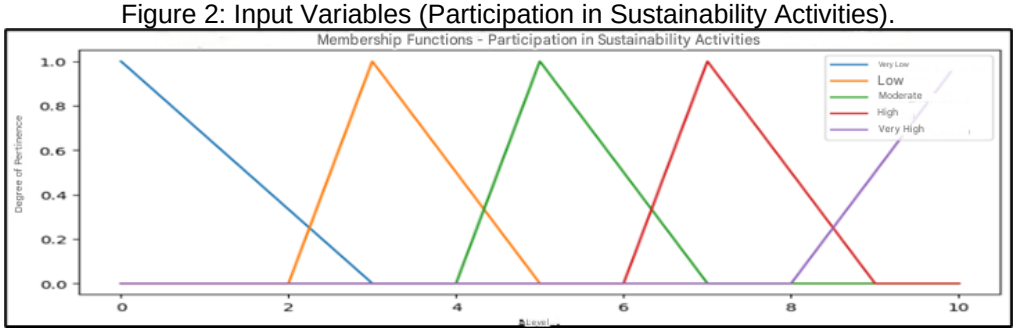


Source: Author.

Figure 6 presents the evaluation methods for concentration and attention, as well as the understanding of environmental concepts.

- **Environmental Behavior:**
  - **Participation in Sustainability Activities:** Student attendance and involvement in activities such as recycling, resource conservation, and other sustainable practices.

Figure 2: Input Variables (Participation in Sustainability Activities).



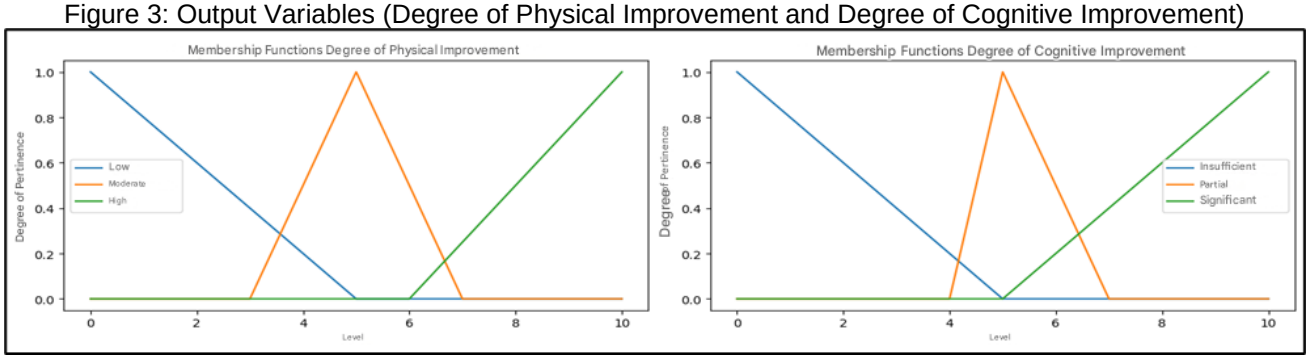
Source: Author.

Figure 7 shows the methodology for evaluating student participation in sustainable activities.

Fuzzy Output Variables:

- **Degree of Physical Improvement:** Categories of "Low", "Moderate", and "High", reflecting improvements in motor coordination, muscle strength, and physical endurance.
- **Degree of Cognitive Improvement:** Categories of "Insufficient", "Partial", and "Significant", evaluating the impact of interventions on cognitive development, including concentration and understanding of concepts.
- **Degree of Environmental Awareness and Behavior:** Categories of "Insufficient," "Basic," "Moderate," "Advanced," and "Excellent," measuring changes in environmental behavior.

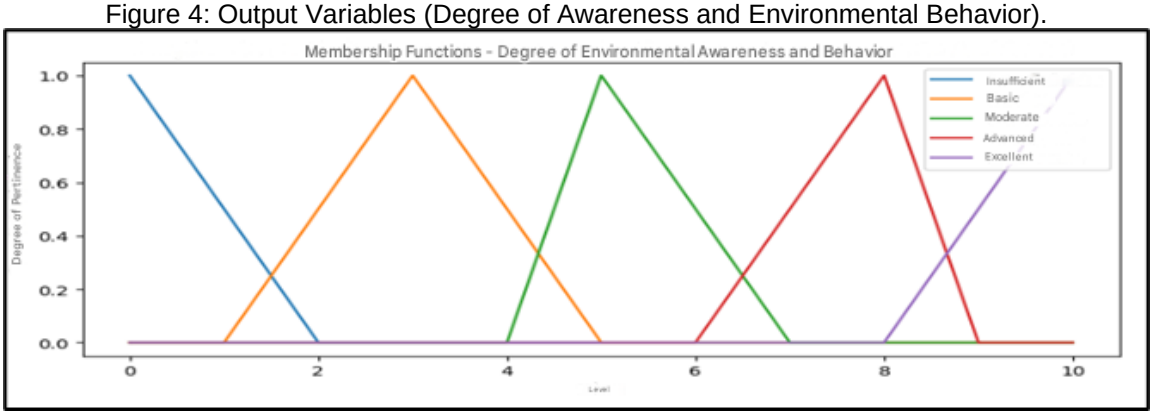
Figure 3: Output Variables (Degree of Physical Improvement and Degree of Cognitive Improvement)



Source: Author.

Figure 8 represents the categories of physical and cognitive improvement resulting from the interventions.

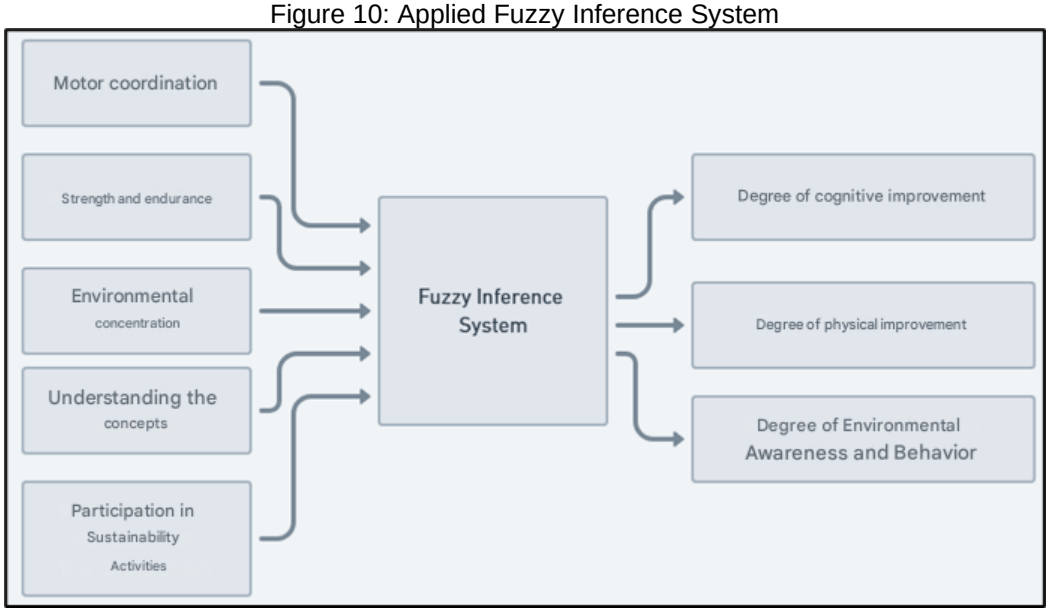
Figure 4: Output Variables (Degree of Awareness and Environmental Behavior).



Source: Author.

Figure 9 illustrates the categories of environmental awareness and behavior, providing a visual representation of the scales used to assess the effectiveness of interventions in terms of environmental education.

Figure 10: Applied Fuzzy Inference System



Source: Author.

Figure 10 compiles all the variables into a fuzzy inference system diagram, showing how the inputs are processed to generate the outputs through the defined fuzzy rules.

Fuzzy Analysis

The fuzzy system will be set up to receive the data collected in the questionnaire and convert it into continuous values that reflect each child's current situation. Using the input variables, the fuzzy system will apply pre-defined rules to generate the output variables, allowing a more detailed interpretation of the children's development, considering multiple variables at the same time.

RESULTS AND DISCUSSIONS

The simulated scenarios were created to represent different initial conditions, highlighting physical performance (such as motor coordination and strength/endurance) and cognitive performance (such as concentration and understanding of concepts). These scenarios were processed in the fuzzy system, which made it possible to predict the results in the output variables: degree of physical improvement and degree of cognitive improvement.

SIMULATION SCENARIOS IN THE FUZZY SYSTEM AND RESULTS

Table 1 aggregates the results of five different simulation scenarios evaluated in the study. Each scenario describes a distinct set of conditions relating to a child's involvement with sustainability activities, along with their cognitive and physical development.

Inputs are categorized into physical, cognitive, and environmental aspects, each evaluated using numerical and linguistic values derived from fuzzy logic.

These simulations help identify the impacts of various educational interventions on children's development, guiding future improvements in teaching strategies and intervention approaches.

Table 1: Summary of the Results of the Simulation Scenarios in the Fuzzy System

Scenario	Motor Coordination	Strength and Endurance	Environmental Concentration	Understanding Concepts	Participation in Sustainability Activities	Degree of Physical Improvement	Degree of Cognitive Improvement	Degree of Environmental Awareness and Behavior
1: Insufficient Participation	3	2	4	2	1	2.04, Low	2.25, insufficient	0.74, insufficient
2: Initial Engagement	5	5	5	5	4	5.0, moderation	5.33, partial	4.0, Basic
3: Highlighted Cognitive Progress	3	4	8	6	7	5.0, moderation	8.06, significant	7.61, Advanced
4: Holistic Advancement	7	7	8	8	9	8.36, high	8.14, significant	9.22, excellent
5: Low Participation, Cognitive Potential	6	5	9	9	2	5.0, moderation	8.28, significant	3.0, Basic

COMPARISON BETWEEN SCENARIOS

This topic analyzes the results of five simulated scenarios, comparing them to identify the different levels of progress achieved in three key dimensions: physical, cognitive, and environmental awareness improvement. This detailed comparison serves to understand how specific input variables influence output variables and to adjust future intervention strategies.

Table 2: Comparative Table of Scenario Results

Scenario	Degree of Physical Improvement	Degree of Cognitive Improvement	Degree of Environmental Awareness and Behavior
Scenario 1	2.04 (Low)	2.25 (Insufficient)	0.74 (Insufficient)
Scenario 2	5.0 (Moderada)	5.33 (Partial)	4.0 (Basic)
Scenario 3	8.37 (High)	8.15 (Significant)	9.22 (Excellent)
Scenario 4	8.37 (High)	8.15 (Significant)	9.22 (Excellent)
Scenario 5	5.0 (Moderada)	8.28 (Significant)	3.0 (Basic)

Comparative Analysis of Scenarios:

- **Physical Dimension:**
  - Scenarios 3 and 4 show the greatest improvements, indicating the positive impact of high levels of motor coordination and strength.
  - Scenario 1 reveals significant limitations, while Scenarios 2 and 5 show moderate improvements.
- **Cognitive Dimension:**
  - Scenario 1 records the least progress, affected by low concentration and comprehension.
  - Scenarios 2 show partial progress, and Scenarios 3, 4 and 5 demonstrate significant improvements, benefiting from high concentration and understanding of the concepts.
- **Environmental Awareness and Behavior:**
  - Scenario 1 is classified as insufficient, Scenario 2 as basic, and Scenarios 3 and 4 achieve excellent results.
  - Scenario 5, despite high cognitive potential, shows basic environmental engagement.

These data suggest that high participation and understanding of sustainable practices are essential to achieve substantial improvements. The analysis also highlights the importance of balancing physical, cognitive, and environmental development to achieve holistic and effective outcomes in educational and therapeutic contexts.

CONCLUSION

This study demonstrated the effectiveness of integrating adapted physical education and environmental education in the development of children with disabilities, using a fuzzy logic model for evaluation. The results of the simulated scenarios underline that balanced and inclusive interventions, which combine physical, cognitive and environmental awareness, are crucial to promote meaningful progress. The practical application of this evaluation model can transform pedagogical practices, making education more inclusive and effective, preparing students to face environmental and social challenges with greater competence and awareness.

THANKS

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DIGITAL TRANSFORMATION IN THE MANAUS INDUSTRIAL HUB: INCREASED EFFICIENCY IN THE PRODUCTION OF LITHIUM BATTERIES THROUGH INDUSTRY 4.0

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ABSTRACT

The lithium battery industry faces increasing challenges in terms of demand and expectations for sustainability and efficiency. In the context of the Manaus Industrial Pole, this study explores the application of Industry 4.0 technologies to overcome these challenges and increase production efficiency. The research implemented integrated cyber-physical systems, advanced automation, and real-time data analysis on a lithium battery assembly line, replacing manual processes with automated solutions. The results demonstrated a significant improvement in production accuracy and speed, with a 40% reduction in cycle time and a 75% decrease in product rejection rate, highlighting the potential of digitalization to optimize industrial operations and meet the demands of a competitive global market. This study contributes to the literature on digital transformation in manufacturing, offering practical insights into the implementation of emerging technologies in complex industrial environments.

Keywords: Industry 4.0. Lithium Batteries. Manaus Industrial Pole. Industrial Automation. Cyber-Physical Systems.

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INTRODUCTION

Industry 4.0 marks a technological revolution, characterized by the integration of cyber-physical systems (CPS) that connect the physical and digital worlds, facilitating automation and real-time monitoring of production processes. According to Lee et al. (2015), this technological evolution allows efficient communication between machines and equipment, increasing flexibility and safety in industrial environments. In addition, technologies such as the Internet of Things (IoT), Big Data, and artificial intelligence not only improve the monitoring of operations, but also optimize planning and minimize waste, promoting more efficient and sustainable resource management (Hermann et al., 2016; Xu et al., 2018). In this context, the transformation in the Manaus Industrial Pole stands out as a significant example of industrial adaptation to new technologies, essential to sustain competitiveness in a dynamic global scenario (DA SILVA, 2019).

For companies to take full advantage of the potential of Industry 4.0, Schwab (2016) and Zheng et al. (2018) highlight the need for significant investments in technological infrastructure and in the development of workforce skills, preparing employees to manage complex systems and voluminous data. The transition to this new industrial era transcends the technological aspect, also requiring a cultural transformation in organizations, where the promotion of a culture of continuous innovation is essential (Roblek et al., 2016). Monostori (2014) argues that the modernization induced by Industry 4.0 redefines production processes and demands a review of management practices to maintain competitiveness in a globalized market.

The Manaus Industrial Pole (PIM), highlighted as one of the most important industrial centers in Brazil, is central to the production of electronics, including cell phones, computers and batteries. It plays a crucial role in the development of the Amazon region, diversifying the local economy and promoting job creation, which is vital to combat socioeconomic inequalities in the North region (Pereira & Simões, 2016; Monteiro & Lima, 2017). In addition to serving the domestic market, Silva & Souza (2019) highlight that the hub contributes significantly to foreign trade, strengthening its economic importance in the national and international scenario. The Manaus Free Trade Zone's tax incentive policy further boosts social development and urbanization, reinforcing the role of the PIM as a pillar of sustainable regional development (Souza & Silva, 2018; Almeida & Santos, 2017).

To maintain its competitiveness in an increasingly technological market, PIM has incorporated industrial automation and cyber-physical systems, essential for Industry 4.0. Lima & Pereira (2020) and Fonseca & Ferreira (2021) observe that these technologies allow for more precise control of production and greater efficiency in the use of resources,

adapting the industrial environment to market demands. With investments in digitalization, PIM companies seek not only to increase productivity, but also to reduce operating costs and increase the sustainability of operations. Santos & Oliveira (2021) state that the adoption of these technologies is crucial for PIM to continue to be a reference in Brazilian and global industry.

The increasing demand for mobile devices, such as smartphones and tablets, has driven the need for lithium batteries, which are known for their energy efficiency and durability. Renowned companies, such as Samsung, require high-quality batteries, which encourages the search for reliable suppliers, such as those located in PIM (Silva & Rocha, 2018; Ribeiro & Santos, 2020). Costa & Silva (2020) note that in order to meet international performance and safety standards, it is essential that PIM maintains a high level of quality control and adopts advanced technologies.

The challenges faced by PIM include not only low productivity due to the lack of automation in various stages of production, but also the ergonomic risks associated with manual processes. Souza & Rocha (2020) and Ramos & Silva (2019) discuss how automation proves to be an effective solution to these problems, improving quality control and reducing the need for human intervention in critical steps. Modernization with automation and cyber-physical systems ensures that PIM maintains its competitiveness and relevance in a demanding global market, transforming the battery manufacturing process and enabling more efficient and faster production, which is essential to meet the growing demands of the global market.

MATERIALS AND METHODS

A new advanced automation system was implemented in the battery production line at the Manaus Industrial Pole (PIM) to transform the production process that was previously carried out manually. Previously, 28 workstations presented challenges such as variability in product quality and low operational efficiency. To achieve significant improvements in consistency, safety, and productivity, the project proposed the introduction of an automated system that utilizes modern technologies, including sensors, robotics, and control systems. This new system consisted of 12 automated stations, strategically distributed in the critical stages of the production line. The objective was to optimize process performance, reducing failures and increasing operational efficiency, ensuring a more standardized and reliable production.

MATERIALS

The Manaus Industrial Pole (PIM) implemented an advanced automation system in the battery production line, replacing and complementing the manual steps previously distributed in 28 workstations with a more efficient process composed of 12 automated stations. The technologies used in this new system ensure greater precision, consistency and safety in production, in addition to allowing real-time monitoring and reduction of human errors.

The automated system integrates several cutting-edge technologies, including cyber-physical systems, which continuously monitor and adjust operating parameters through sensors, actuators, and controllers. Advanced robotics are used to perform repetitive and critical tasks, such as tape application and laser welding, significantly improving production speed and accuracy. Artificial vision sensors are responsible for quality inspection during assembly, automatically detecting any defect or misalignment. Programmable Logic Controllers (PLCs) coordinate operations, optimizing the production flow and integrating all automated stations.

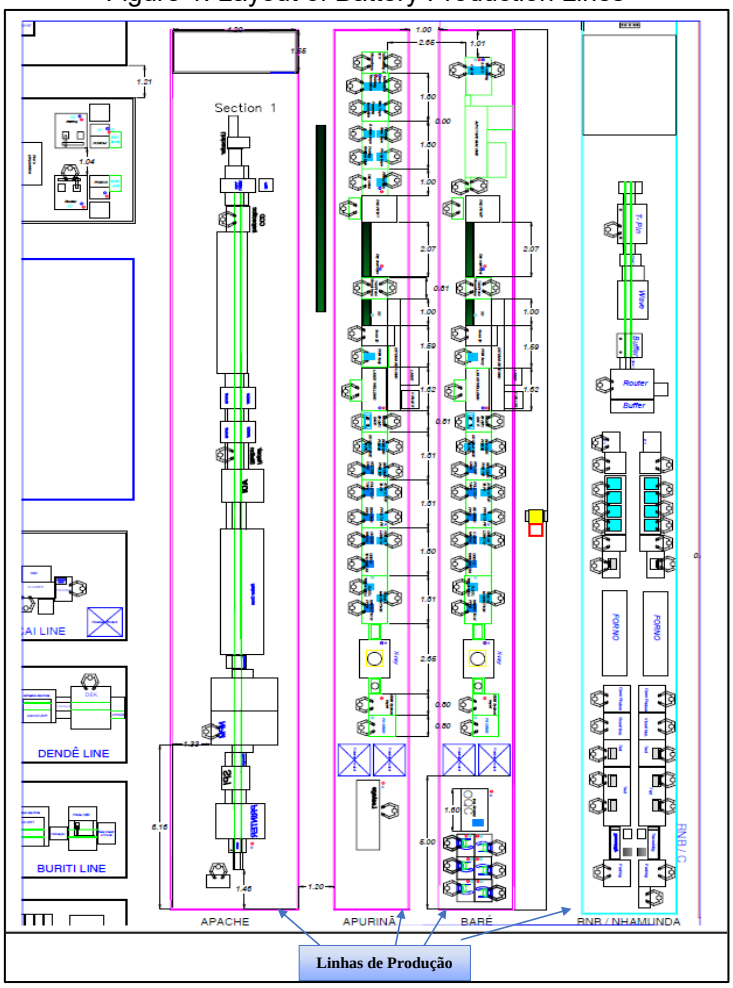
The implementation of this automation system represents a significant transformation in the battery assembly process at PIM, previously carried out predominantly manually in three main sections: Apache, Apurinã and Baré, ranging from the reception of materials to the final quality tests. Automating these steps aims to overcome the challenges of variability and inefficiency, ensuring a uniform and high-quality final product.

METHODS

Before automation, the production process at the Manaus Industrial Complex was carefully mapped to identify points of variability and ergonomic challenges in the 28 manual workstations, distributed in three sections: Apache, Apurinã and Baré. This mapping revealed critical dependencies of human operators on repetitive tasks and vulnerabilities in critical operations such as welding and inspection, which compromise production quality and efficiency. In addition, the constant manipulation of components and the execution of repetitive tasks increased ergonomic risks, affecting the health and productivity of workers.

Figure 1 illustrates the current layout of the production line, detailing the workflow and location of key critical points, clearly showing the areas that suffer the most from variability and repetitive effort, underscoring the need for automation.

Figure 1: Layout of Battery Production Lines



Source: Author.

The modernization of the production line was accomplished through the introduction of advanced technologies such as cyber-physical systems, advanced robotics, artificial vision sensors, and programmable logic controllers (PLCs). These technologies have not only replaced manual activities with automated processes at 12 specialized stations, but have also enabled accurate monitoring and adjustment of operations in real-time, increasing process consistency and reducing the risk of human error.

The development of the automation system was supported by software tools such as Easy Build and Cold Sys, which offered flexibility in PLC programming and efficient integration of control systems, making it easier to manage automated operations. These platforms helped maintain business continuity and minimize unexpected outages.

To assess the impact of automation, data collection was structured in three phases: before automation, during implementation, and after operations were stabilized. This approach helped monitor adjustments in real-time and evaluate the effectiveness of improvements through performance indicators, such as cycle time and bounce rate, accessible directly by the automated system.

Data analysis compared the results before and after the implementation of the technologies, using automatically generated graphs and tables to consolidate information on quality, productivity and safety. The detailed analysis allowed the identification of performance patterns and the correlation of operational variables with the observed results, optimizing the necessary adjustments to achieve continuous improvement.

RESULTS AND DISCUSSIONS

SUMMARY OF RESULTS OBTAINED

The implementation of automation in the battery production line has resulted in substantial improvements in the efficiency and quality of products. The technological innovations introduced have made it possible to increase the throughput rate to ≥99% and the production capacity to ≥1000 pieces per hour, while significantly reducing variability and production errors.

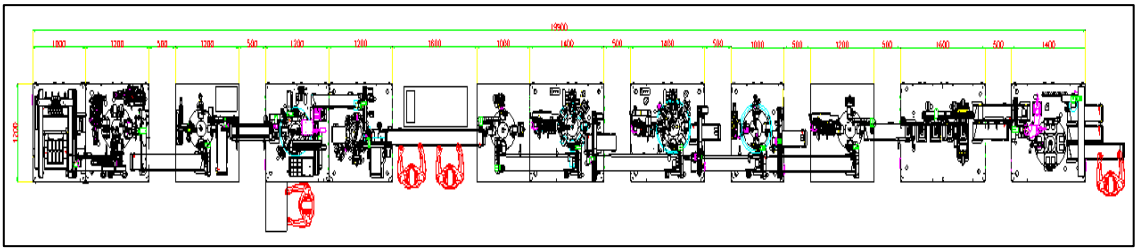
DISCUSSION ON TECHNOLOGICAL INNOVATIONS

The technologies implemented, such as automatic feeding machines, laser welding stations, and robots for applying tapes, have fundamentally transformed the production process. These technologies have not only automated repetitive and critical tasks, but have also integrated advanced controls to ensure the accuracy and consistency of operations, directly addressing the issues identified in the process mapping.

ILLUSTRATION OF LAYOUT AND STATIONS

The new layout of the automated stations is a visual representation of technological advancement on the production line. Each station is meticulously planned to maximize space efficiency and improve workflow, with configurations that facilitate integration and synchronization of operations.

Figure 2: General Layout of the 12 Automated Stations in Battery Production



Source: Author.

DESCRIPTION OF AUTOMATED STATIONS AND TECHNOLOGIES IMPLEMENTED

The 12 automated stations on the battery production line have been specifically designed to optimize various stages of the production process, operating in a synchronized manner to ensure efficiency, accuracy and consistency.

Each station incorporates advanced technologies that address different challenges identified in the previous manual process.

- Station 1: Automatic Cell Feeding Machine – Automates cell insertion, utilizing Cartesian manipulators and pneumatic suction cups for accuracy and reduced manual handling, essential for component integrity.
- Station 2: Application of Poron Tape – Automated robots apply tape consistently and accurately, reducing manual variability and improving grip, which is critical to the functionality of batteries.
- Station 3: CCD Scanning - Combines QR Code printing and data inspection, using CCD technology to ensure the correct identification of each cell and the quality of the subsequent process.
- Station 4: Laser Welding Station - Offers a high-precision welding process, directly contributing to the structural quality of the batteries and reducing assembly failures.
- Station 5: Laser Soldering and PCB Bending Inspection - Performs microscopic inspection and automated PCB bending, increasing accuracy and reducing manual effort, with immediate segregation of failed cells.
- Station 6: CLAD 90º Bending - Automates clad bending at a 90-degree angle, ensuring uniformity in the process and preventing damage to components.
- Stations 7, 8 and 9: Tape Application - Apply different types of tapes with precision and uniformity, essential for the mechanical integrity and protection of batteries.
- Station 10: 180º FPCB Adjustment - Performs FPCB adjustments, bending it 180 degrees with high precision, according to design specifications.
- Station 11: XYZ Measurement - Measures critical cell dimensions with a Cartesian robot, ensuring quality specifications are met.
- Station 12: Functional Testing - Subjects batteries to automated functional testing, segregating non-conforming ones to ensure that only quality products are distributed.

COMPUTATIONAL INTEGRATION AND CONTROL

The computational integration and control of the 12 automated stations on the battery production line were essential for the efficiency and synchronization of operations. Programmable Logic Controllers (PLCs) played a crucial role, coordinating all activities and ensuring accuracy at every step of the process. The system is designed to enable seamless communication and information sharing between stations, minimizing disruptions and maximizing operational efficiency.

Advanced system features include automatic segregation of non-conforming parts and data validation to ensure product compliance. The PLCs were configured to manage a variety of automated operations, such as moving robotic manipulators and monitoring critical parameters such as cycle time, reject rate, and equipment efficiency. This setting allows for automatic adjustments of operations to maintain optimal performance.

The control system provides detailed interfaces for setting operating modes and monitoring critical parameters, as shown in Figures 15 through 18. These interfaces allow precise adjustments in real time, ensuring the necessary flexibility to continuously optimize production operations.

Advanced machine vision sensors are integrated into the computer system, allowing real-time inspection and validation of components. These sensors help identify faults or misalignments before products move on to the next steps, with all information being shared between stations for necessary adjustments, maintaining consistency and product quality.

The real-time monitoring system collects and stores data in a centralized database, processed by specialized software for continuous analysis and adjustments. This integration not only optimizes the performance of the stations, but also lays a solid foundation for future innovations and responses to changes in demand, aligning with Industry 4.0 principles and promoting a continuous cycle of innovation and operational excellence.

EVALUATION OF COSTS AND BENEFITS

The evaluation of costs and benefits of implementing automation in the battery production line involves analyzing the investments made in comparison with the gains obtained in efficiency, quality and waste reduction.

Table 1: Evaluation of Costs and Benefits of Automation.

Indicator	Before Automation	After Automation
Initial Investment	N/A	Equipment acquisition, development of cyber-physical systems, advanced robotics and artificial vision sensors, operator training
Productivity Gains	Limited	Significant increase in production capacity
Reduced Bounce Rate	12%	3%
Reduction of Operating Costs	High reliance on manual labor	Significant reduction in operating costs with less dependence on manual labor and less incidence of leaves due to ergonomic problems
Cycle Time Reduction	5 minutes	3 minutes
Long-Term Benefits	N/A	Increased competitiveness, alignment with Industry 4.0, and opportunities for continuous innovation

Source: Author.

ERGONOMIC AND SAFETY BENEFITS

The implementation of automation in the battery production line has brought significant gains in safety and ergonomics, which can be directly related to the data presented in Chapter 3 and the performance indicators obtained. Prior to automation, manual labor on repetitive tasks such as taping and welding resulted in high reliance on human operators and an incidence of ergonomic issues such as repetitive strain injuries (RSIs) and sick leaves. With the introduction of the 12 automated stations, these problems have been significantly reduced.

The table below summarizes the main impacts of automation on safety and ergonomics, comparing the scenarios before and after implementation:

Table 2: Impacts of Automation on Safety and Ergonomics.

Aspect	Before Automation	After Automation
Reliance on Manual Labor	High dependence for repetitive and ergonomic tasks.	Robots and automatic manipulators perform critical tasks.
Incidence of Ergonomic Problems	Discharge, with frequent cases of RSI and leaves.	Significant reduction in problems related to RSI and health.
Work Posture	Operators exposed to static and uncomfortable positions.	Improved posture due to the shift to supervisory tasks.
Health Leaves	Frequent due to inadequate ergonomic conditions.	Reduction in leave rates.
Monitoring and Security	Reliance on manual inspections.	Real-time monitoring systems fix problems preemptively.
Operators' Quality of Life	Impacted by repetitive efforts and long hours.	Improved with a focus on supervision and reduction of physical effort.

Source: Author.

ALIGNMENT WITH INDUSTRY 4.0 AND CONTINUOUS IMPROVEMENTS

The automation implemented in the battery production line at the Manaus Industrial Pole is in line with the principles of Industry 4.0, using cyber-physical systems, intelligent sensors, and real-time connectivity. The use of these systems enables the continuous

monitoring of indicators such as cycle time, reject rate, and operational efficiency (OEE), creating a solid foundation for a continuous cycle of improvements. The data collected is processed automatically, allowing for quick adjustments to operations and ensuring greater accuracy and consistency over time.

The following Table summarizes the main aspects of alignment with Industry 4.0 and the continuous improvement strategies adopted in the automated system:

Table 3: Alignment with Industry 4.0 and Continuous Improvement Strategies.

Aspect	Description	Benefits
Cyber-physical systems	Integration of sensors, actuators and control systems connected in real time.	Continuous monitoring and automatic adjustments for greater accuracy and consistency.
Monitored Indicators	Cycle time, rejection rate, and operational efficiency (OEE).	Solid basis for continuous cycles of improvements and optimizations in the production process.
Automated Data Processing	Automatic collection and analysis of operational data.	It allows for quick and accurate decisions, optimizing workflow and reducing waste.
Preparing for Expansions	System designed to incorporate new technologies, such as AI and machine learning.	Increases predictive capacity, improves real-time decisions, and reduces failures.
IoT connectivity	Integration with other areas of the factory and external systems.	It facilitates predictive maintenance, big data analysis, and greater connectivity with the production chain.
Competitive Benefits	Adoption of advanced Industry 4.0 strategies.	It consolidates its competitive position and promotes continuous evolution with global technological advances.

Source: Author.

CONCLUSION

This study demonstrated the significant impact of the implementation of Industry 4.0 technologies in the production line of lithium batteries in the Manaus Industrial Pole. The automation of the stations, integrated with cyber-physical systems, advanced robotics and artificial vision sensors, has resulted in remarkable improvements in terms of efficiency, quality and operational safety.

The results obtained reflect a considerable reduction in process variability and rejection rates, as well as a significant increase in operational efficiency, as evidenced by the increase in OEE to 95%. These improvements not only increase the competitiveness of production in the global context, but also promote a safer and more ergonomic work environment for operators, aligning with sustainability and corporate social responsibility guidelines.

The successful implementation of the 12 automated stations highlights the feasibility and benefits of applying Industry 4.0 concepts in complex industrial environments. However, the study also recognizes that the transition to full automation is an evolutionary

process that requires continuous investments in technology, staff training, and infrastructure development.

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ABBAS KIAROSTAMI, THE TASTE AND POETRY OF IRANIAN CINEMA: WITH A TASTE OF CHERRY, THE WIND WILL CARRY US AWAY

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ABSTRACT

Jean-Luc Godard's statement that "Cinema begins with D. W. Griffith and ends with Abbas Kiarostami", demonstrates such importance and genius of the Iranian director Abbas Kiarostami. In this article we will reflect on Kiarostami's filmic narrative and his poetic cinema of "unfinished" style, as he himself states: "whenever we have the opportunity to include scenes in which we can solicit the viewer's imagination, we offer him the effective possibility of creating the film with us". Two great films, Taste of Cherry, from 1997, and The Wind Will Carry Us, from 1999, were chosen to come into focus in the discussion about how Kiarostami diligently seeks his truth as a human being in a perspective of poetic simplicity.

Keywords: Iranian cinema. Abbas Kiarostami.

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INTRODUCTION

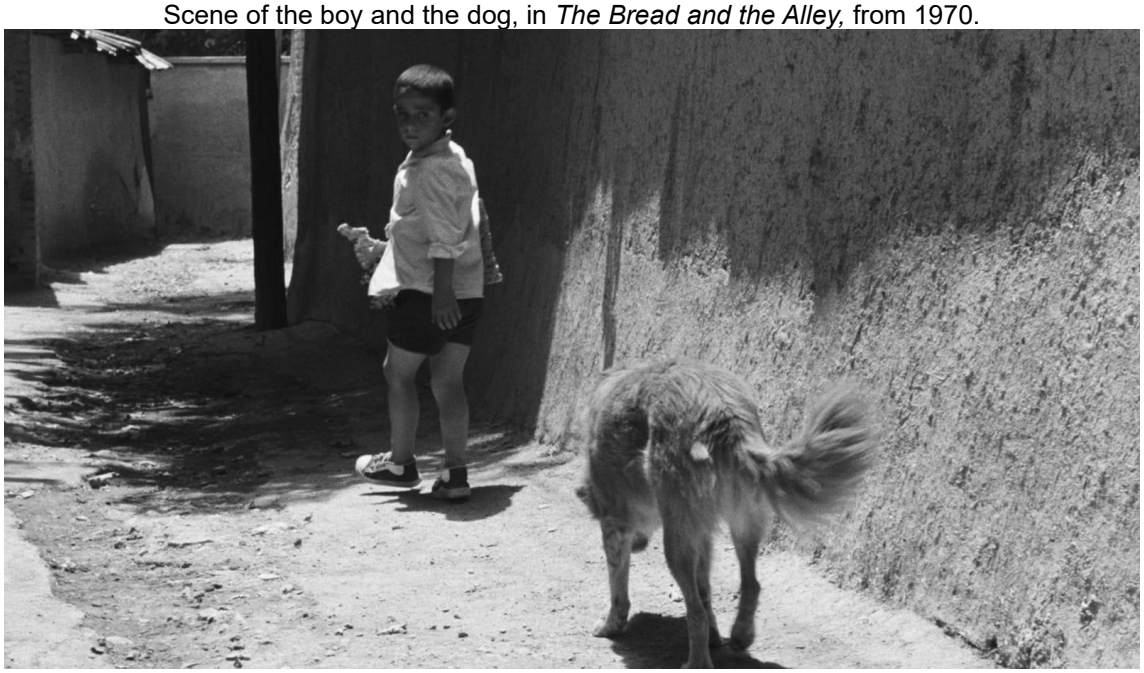
Iran knew cinema at its dawn, with the arrival of the first cinematograph, at the beginning of the twentieth century. Over half a century, Iranian cinema has gone through important twists and turns, ups and downs, as well as attempts to experiment in confronting the dominant Hollywood model, as has occurred in several countries. However, in the late sixties, a new wave of Iranian cinema was launched as a response to ordinary or popular cinema, which failed to reflect the culture and artistic taste of the Iranian people.

The new wave celebrated a series of international cinematographic movements, such as the *French nouvelle vague* or Italian neorealism — two of the most influential movements in the history of cinema. For a decade until the Iranian Revolution in 1979, films and a series of directors emerged who brought different and modern characteristics to the history of cinema in that country, such as Dariush Mehrjui, Nasser Taqvaei, Massoud Chemie and Bahram Bayzai, soon Mohsen Makhmalbaf, Amir Naderi and Abbas Kiarostami joined them. With the transition in Iran from the rule of the last Shah Muhammad Reza Pahlavi to the era of Ruhollah Khomeini, many filmmakers fled abroad, but Kiarostami stayed, simply because "when you take a tree rooted in the ground and take it somewhere else, it will not bear fruit again, and if that happens, the fruit will not be good enough. I was afraid that I would be like this tree if I left my homeland."

Abbas Kiarostami was born on June 22, 1940 and died on July 4, 2016, after spending much of his life in love with the image. He started as a painter, wrote poetry and screenplay, also worked with photography and soundtrack for more than forty films, including fiction, documentaries and short films, many of which have won international awards, being critically acclaimed, in addition to occupying important places in lists of fundamental films and opinion polls.

Aesthetically, Kiarostami proposes that existence means more than just life. We see this since his first short film, The Bread and the Alley, from 1970, a sensitive ten-minute story, in black and white, in which we follow the journey of a boy sent by his family to buy bread, when, on the way home, a hungry dog intercepts his path. Beyond the plot and the story, Kiarostami moves with the ease of a specialist, cutting out times, characters and events from the solidity of existence, giving them the kiss of life, mixing the documentary, the imaginary and the realistic with magic, with a remarkable degree of mystery, an unusual combination concomitant with simplicity and complexity.

Scene of the boy and the dog, in *The Bread and the Alley,* from 1970.



The French philosopher Jean-Luc Nancy considers Kiarostami's film *And Life Goes On* (1992) not a representation or a story, but a cinematographic guide. For Nancy (2008), the art of the Iranian director represents the crystallization of a profound movement that characterizes the cinema of our time and that goes beyond the notions of fiction, document or representation. This cinema would then be a direct opening on what Nancy defines as the world: a contingent space, devoid of any predetermined meaning, which necessarily appeals to our own responsibility, as builders of all stories.

In his narrative construction, Kiarostami repeatedly staged the illusion of confusing the real with the imaginary, so that fragments of his biography as a director were scattered in more than one film. In *Close-up* (1990), he gives more space to the cinematographic community, Iranian directors are characters themselves. The film tells the true story of Hossain Sabzian, a cinephile who posed as director Mohsen Makhmalbaf to convince a family to be the protagonist in his new film. It's the desire buried in us for diagnosis, representation, and passion for the dream of stardom. This particular film is an example of Kiarostami's artistic style, which claims a taste for cinema, or when "the film is made", as he puts it.

With a spirit that mixes experimentation with passion, the director formed most of his artistic experience, dressing in several nuances at the same time, taking into account a consistency, where the identity and simplicity of the poet are arranged with the refined vision of the specialist. Kiarostami likes the uncertainty of novelty, he always mentioned that the public can see things in his films that they did not know, this is the beauty of indirect meaning, because everything is open to multiple interpretations. In his art, behind the

simplicity of the image, hides a light for a new and continuous birth, evoking psychological levels that yearn for a comfort of his aesthetic thought.

FOR THE *TASTE OF CHERRY*

In 1997, Abbas Kiarostami presented to the world the film *Taste of Cherry*, winner of the Palme d'Or at the Cannes Film Festival, generating an endless debate between critics and audiences due to its open ending. The film revolves around the character Badii, played by Homayoun Ershadique, who drives her car through winding labyrinths in the mountains in search of a man to establish a strange existential agreement. Badii will swallow all his sedative pills and sleep in an empty hole. The man who accepts his agreement must go the next morning at six o'clock to check it in his hole. He will call him twice, if Badii answers, the man will help him get up and leave, if he does not answer, he will be covered with dirt, and in both cases, the man will return home with a bundle of money. The film goes through several characters and extensive dialogues. After Badii strikes a deal with one of the men, the film ends with an open-ended ending.

Kiarostami states that we accept abstraction and ambiguity in arts such as music, poetry, and painting, but we have a hard time accepting them in cinema. He tries not to make his films stories with a beginning, middle and moment of enlightenment, which reveals the mystery and tells the fate of his characters, but creates a story that resembles poetry or an intriguing painting, an aesthetic work that awakens in us the desire to fill our ambiguity, under the focus of personal interpretation. Attempts to explain the meaning of René Magritte's paintings, for example, will always bother, as well as to determine Badii's fate, in *Taste of Cherry*. Kiarostami stands by Magritte's side to tell viewers that the puzzle is the goal, not the solution.

The Iranian director's films depend on dialogue. In *Taste of Cherry*, we see a man looking for strangers to talk to. Whether they accept or reject it, it will never fade from their memories. The car and road film provides the appropriate medium for such a story, a recurring theme in Kiarostami's work — cinema is his car, and drama is his road. The passengers that the road offers him, in his films, there is always a car that welcomes strangers, or rather, welcomes stories. It is unusual for the dialogue to be born smoothly in the encounter with strangers, so the filmmaker makes the car an aesthetic trap. A metal can that forms a siege: two passengers so close cannot help but talk.

Badii drives his closed car and, by blocking it, can create a dialogue with strangers he meets along the way. The sequences are filmed inside the vehicle. Whether in the *close-up* image or in the open shots, we find Badii driving his car in curves through solid, heavy,

non-moving mountains. The metaphor of the life that Badii cannot bear, a weight that cannot be carried, he must circumvent it, through a death agreement. We follow the character's car in long shots and wide frames, like a prey in a maze, trying all the ways while the hard enigma of life is firm and does not move.

Scenes from *Gosto de cereja*, from 1997.



The choice of a setting, with dirty, pothole-ridden places and construction sites with workers, sums up Iran's ongoing recovery work. The country has been trying to rebuild since the 1980s, when the wars with Iraq took place. This environment is suitable for the film, as it is there that Badii tries to find the man with whom he will make the death agreement. Badii contemplates the digging machines, as they fill the holes with earth, their shadow reflected in the rock wall. He hopes that one of these holes will digest his own life. In a country that is trying to rise up and seek life at the hands of its workers, we find Badii, looking among them for a man who will provide him with the scene of his condemnation.

The spatial framing of the film is done with care. They will be repeated throughout the narrative, with the purpose that the viewer creates a map of the place to be better kept in their memory than the dialogues between the characters, The place is a complete portrait of the film's objective, while the dialogues are an evolutionary work that only achieves its purposes at the end. The places in *Taste of Cherry* tell us the story of the person trapped in the mystery of living in a circular prison, in the middle of a mountain or a dense reality, like a rock in the middle of the room that we are afraid to face. What you avoid will return to the same starting point, and that is the suffering of Badii, who does not have the courage to take his own life. Then, he should look for someone who understands his idea of death and

convince him to be an accomplice in it, emphasizing that he examines him carefully the next day to be sure of the realization of his intent.

The "hero" is caught between the weight of life and the desire for death, but wants to purge his personal tragedy into the task of a strange man who has no compassion or weakness, not questioning him with questions about the act. In his dialogues, Kiarostami hides the story of the "hero". We know nothing about his motives or what prompted him to make the decision of the strange death deal. Why doesn't he just kill himself? What is your intention? If the director gives a background to the story of his "hero", the whole film will become just the story of Badii.

The path of a great artist will always be taken by the abundance of his poetic experience, but the legacy of poetry is not established in the author. The poetic end takes over its flourishing in the relationship with the public. A poem read at different stages of life will always be open "to the eternal newness of the world", as Pessoa teaches us. If Kiarostami wished simply to tell Badii's story, he would print it as if it were the text of a novel, with a beginning, middle and end. But he "tells" a poetry that captivates forever and asks: if Badii came to you one day with a death agreement, would you have a reason to bring him to life and dissuade him from the funeral wish? What story would you tell him? It is enough to feel the *Taste of cherry* once for these questions to remain, obtaining differentiated answers over time, like the taste of poetry that is renewed.

At the end of *Taste of Cherry*, Badii, having apparently taken his sleeping pills, finally lies down in his ditch—he bodily entered the earth, the imaginative box. The earth darkens around him, suggesting a situation similar to darkening in a theater setting, as if Badii had settled into some inner meditation. The viewer's access to Badii disappears, his vision of his own world is undone by closing his eyes. The character and the viewer are left with the darkness. Although Badii lies down to sleep, it is possible to speculate whether as a character he lives or dies, as if he were abandoning his acting role and dissolving into the film. Perhaps he will also become a role model for Kiarostami's ideal audience, closing his eyes to express his dreams, letting himself go, abandoning the specifics of the film, such as plot and concrete logic. A constant idea in Kiarostami's work is that we don't need to see to know: by closing his eyes on purpose, while in his box, Badii may be suggesting the ending of the film that follows, or creating it together with us. In the interview given to Michel Ciment and Stéphane Goudet, in Paris, on May 29, 1997, the great filmmaker states:

> I didn't want there to be, in the last part of the film, the slightest reference to death and I refused to show whether the "hero" was dead or alive. I wanted to abstract this question and, above all, avoid the happyend, the cute and superficial ending, which would have created the following question in the viewer's mind: why not make a film

> about a successful suicide? With the ending I have chosen, it is up to the viewer's imagination to decide. Statistically, out of eighteen cases of suicide, seventeen attempts fail. Therefore, what interests me most is success, it is what I most want to talk about. But I didn't want to make a tragedy. [...] But the darkness had to be prolonged, so that the viewer was confronted with non-existence, which, for me, refers to the symbolization of death. So that he would look at the screen so he wouldn't see anything. When the green of spring returns, it is, at the same time, the resurrection of life and of the image. Almost always, when a person dies, our first gesture is to close their eyes. We act as if we put the lid back on the lens of a camera. (KIAROSTAMI, 2016)

Indeed, the subsequent shots that complete *Taste of Cherry*, in the broader context, may suggest that the moment when one sneaks in search of the darkness of the scene, to receive images or help create them, becomes a kind of death, that is, a transition, a closing of one's eyes to one world and one opening to another. Part of the reason the film ends in a "renaissance" is the closing of the distance between these seemingly disparate worlds, encouraging those who observe it to get to know them, imaginatively and experientially. Thus, blurring the lines between beginning and end, actor and non-actor, life and death, all worlds merge into one. If all these realms become one, why should there be an answer, a conclusion, an end to the experience? Why should there be, then, an image? A black screen takes over Badii and nothing is left but sound — rain that rises and disappears. The film leaves the viewer with this image of darkness for an extended period, effectively bringing one with oneself, aware of oneself, watching nothing, expecting everything, projecting everything. The absence of an image creates an empty and dark space that liberates. It is a pause for contemplation. The distance between images, like the space between the lines of a poem, requires the viewer to make a connection, to engage, to take an imaginative leap.

AND SO *THE WIND WILL CARRY US AWAY*

Acclaimed at the Venice Film Festival in 1999, where it won the Golden Lion, the film *The Wind Will Carry Us* borrows its title from the Iranian poet Forugh Farrokhzad. As in *Taste of Cherry,* the protagonist character drives a car along Iranian roads. Unlike the lifeless, barren landscape of the previous film, *The Wind Will Carry Us* has stunning cinematography, lingering in lush landscapes, with its colorful mountain ranges and cultivated fields, all illuminated with bright splashes of sunlight. The grainy yellow, olive green and rolling hills seem to want to recite the poetry of *Van Gogh's* Wheat Field with Crows.

The narrative begins with an aerial view of the car winding through hills in a sequence of colors and tranquil landscapes. There is no realistic aridity here, as in *Taste of Cherry*, which focuses in a claustrophobic way on the driver. The camera stages the beauty

and vastness. Advancing along the horizon toward Siah Dareh, a remote Kurdish village about four hundred miles from Tehran, a three-man film crew arrives in anticipation of the death of an elderly woman, whose ceremonial burial and mourning rituals will make up a television documentary. However, she does not die in the first few days, showing signs of recovery, so men are forced to wait for what would be inevitable. The wait causes frustration not only in themselves, but also in their bosses and the locals, who see these outsiders, identified as "engineers," as nothing more than opportunists. Most of the film focuses on the anonymous producer, played by Behzad Dourani, who is in charge of the impending filming and his day-to-day explorations of the village. It is led, most of the time, by a boy, who seems very happy to keep up with the stranger, as long as it does not interfere with his studies.

One of the beautiful scenes from *The Wind Will Take Us*, from 1999.



There's little traditional drama in *The Wind Will Carry Us*. Unpretentious moments with humor and irony are allowed without much fanfare, emerging from the routine activities of visitors and villagers. The wait for the lady's death drags on, seeming that death wanted to oppose the recording of scenes, just as the capture of images is not well accepted in the community. "No pictures," the tea seller said, when the protagonist wanted to document an argument between her and her spouse over a third job. However, the film creates landscapes with images characterized by photographic explosion, thus finding itself, from an aesthetic point of view, in a peculiar self-contradiction with its theme. There is a surplus that competes with the absence of desire of that people to register their cultural image. This is less dialectical than it may seem, for Kiarostami is not concerned with forcing a totality of

pictorial presence, nor does he want to divide the world of beautiful images with the conflict of their absence.

The juxtaposition of presence and absence seems to be important to the director, an unresolved contrast that becomes part of his "unfinished" cinema. There are characters in the narrative who do not show themselves, of whom we only hear the voices in the dialogues, as happens with the rest of the team of the protagonist "engineer". What is not shown leaves part of the film with an enigmatic presence. The plot is told only in fragments, in narrative excerpts, refusing to make a transparent statement about its outcome. Although *The Wind Will Carry Us* prolongs the waiting time in the narrative and in the viewer, causing a ritualistic repetition in the action, it is one of Kiarostami's busiest films and with the greatest comedy spirit. It can also be said that it is one of the most didactic. The presence of the school that the boy attends, the question of good and evil, the boy's withdrawal at a certain moment, everything seems to give the film a clear moral direction. However, in the end, all that is revealed is the persistence of the contradiction – the constructed moral suggestion has not been fulfilled.

Kiarostami's visual style is characterized by poetically engaging the viewer. In his films, his photographs have wide shots of a panoramic background or with the art of parallelism. This style, several times, is reproduced mainly in landscapes that escape from still life in its strict sense, such as photographing some fruits or household items. It seeks the transformation of nature into scenic focal points. This is the clear challenge to the gaze of visual decoding: not to understand it as mythical, but to bring to the scene an aesthetic charge that pulsates with a poetic charm that is not consumed. The horizon of interpretation remains and its poetic flavor has no room for coincidences, as it is characterized by strangeness and endless delight in its minimalist simplicity. It brings us back to the haiku philosophy of capturing the most accurate moments, which are formed before the viewer's view in a moment of time. It is originally an incessant search for a poetic truth that manifests itself in the diverse compositional forms of the human, animal, and spatial world.

The wind will carry us remains as an inexhaustible gaze that seeks, in the form of childlike curiosity, artistic and aesthetic methods and expressions. He moves between *design* and photography, composition and cinema, as if renewing the tools of his search for the secrets of consciousness through a moment, a transitory time. Artist Abbas Kiarostami always seeks unification and solutions to his theme, transcending the material to become immaterial and the visual to become invisible. Thus, your characters are always in search of something or some meaning.

Kiarostami diligently seeks his truth as a human being in a poetic perspective, projecting his intellectual and aesthetic concerns outside and onto the subjects of the image-scene. The scenes themselves become means to carry their deep connotations in the codification and multi-signified visual condensation. The scenes framed with great care in *The Wind Will Take Us*, combining the areas of the earth with the trees and winding paths, which are completed with the masses of clouds and the sky, can be transformed into objective equations for the characters in their search for an exploration of a circle of encounter between the ego and the world through the auditory or visual medium. In this process, the poet-director (Kiarostami also wrote poetry) acts as an observer of nature in its integration with moving images. May the winds carry away his verses:

> The night
> The sea
> winter.
>
> The flash of the first autumnal moon
> at the window
> shakes the windows.
>
> The quince tree
> Flourished
> in an abandoned house.
>
> The aroma of walnuts
> The fragrance of jasmine
> the aroma of rain on the earth.
>
> (KIAROSTAMI, 2018, p 13)

It is known that the aesthetic sensibility of the filmmaker, in general, is not only based on how much he responds to the mechanisms of the cinematographic language itself, but also and decisively on his intellectual and artistic references, which derive from all branches of art. Photography, painting, poetry, dance and theater are some of its components and energies. Kiarostami remains influenced by Persian poetry in his personal inclinations, when dealing with Iranian nature. Persian poetic writings are often referred to in excerpts from his films, as in the films of Tarkovsky or Godard, where poetry finds a place in the artistic and verbal construction of the narrative. It is natural that this aesthetic extension is to educate the gaze about the geometry of the universe, translating the impact of colors, sounds and subtle sensations and their brilliance into the awareness of words, phrases, images or scenes of extreme delicacy and precision.

A FINAL FOCUS

Abbas Kiarostami's cinema has always been humanitarian, but not in the often condescending and conventional sense of the word. His work carries the utmost respect for the public as a collection of thinking and intellectualized individuals. He never resorts to devices designed to openly arouse the emotions of the public, edit didactically to make a political point, or instruct through an obvious narrative structure. Its sparse narrative economy, composed of spaces and ellipses, chains episodes and presents experiences that require the audience to leap imagination or understanding. In *Taste of Cherry*, for example, a sweeping volume of sensory perception, triggered by multiple sounds—laughing children playing in a valley, the noise of distant construction vehicles, or the screeches of strange animals hidden behind a hill—suggests worlds beyond the frame. There is a continuous use of car horns, generating a greater awareness of the Doppler effect when they pass. Sounds that expand the main character's world and ours.

Complex and disconcerting, the director's films are often described by almost contradictory adjectives: poetic, neorealist, intellectual, mental, cerebral, etc. Kiarostamian cinema is rarely based on realistic descriptions, but rather on poetic suggestions and philosophical commentary. In other words, "an image does not represent, it does not present itself in the representation, but announces its presence, invites the spectator-reader to discover it". It is a cinema that is sensitive and attentive to the fine vibrations of life, ranging from existential anguish in the face of death to fascination with the beauty of the world. A cinema, sometimes minimalist, but deeply human, full of beautiful enigmatic characters, often torn between the desire to live and love and the obsession with dying and disappearing.

In addition to being a filmmaker, Kiarostami is also the author of poetry collections, photography books and painting exhibitions. "Being a filmmaker, photographer, poet, all at the same time, all this is motivation to live, to do something every day, whether it's cinema, photography or poetry." It is not a choice, it is a fatality. The result is an imposing, poetic and homogeneous production. Kiarostami's literary and visual works are, therefore, a profound journey into the world of words and the universe of images.

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THE CYTOKINES IL-1B AND TNF-A AND THE METABOLIC PROFILE IN COWS WITH HYPERKETONEMIA: A LITERATURE REVIEW

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ABSTRACT

Hyperketonemia is the most prevalent metabolic disease in the transition period of productive cows. It is characterized by the increase of ketone bodies in body tissues and fluids, in addition to changes in metabolic profiles and cytokine expression, which can result in significant economic losses and damage to animal health. Objective: To conduct a literature review addressing the main aspects related to hyperketonemia, with emphasis on changes in the metabolic profile and expression of the cytokines IL-1β and TNF-α during the transition period. Methodology: The review was based on articles found in the databases, published between 1972 and 2024, using specific terms such as "hyperketonemia", "transition period" and "metabolic profile". Literature review: Hyperketonemia develops in response to negative energy balance, when energy demand exceeds dietary intake, leading to mobilization of body reserves and increased non-esterified fatty acids (NEFAs) in the blood. These fatty acids are metabolized in the liver, favoring ketogenesis and resulting in metabolic disorders. The metabolic profile is an essential tool to assess the metabolic health of the herd, allowing the identification of changes in biochemical parameters, such as glucose, NEFAs, proteins and hormones. This monitoring reveals the relationship between metabolism and inflammatory responses, and is crucial for the early detection of disorders. The cytokines IL-1β and TNF-α, released during inflammatory processes, play an essential role in the transition period of dairy cows, contributing to the amplification of the inflammatory response associated with hyperketonemia. Conclusion: Early detection through biomarkers, such as β-hydroxybutyrate and NEFAs, is essential to prevent hyperketonemia. Inflammatory alterations, such as the elevation of IL-1β and TNF-α, reinforce the importance of integrated strategies for nutritional, genetic and immunological management, aiming to minimize damage to animal health and reduce economic losses.

Keywords: Ketosis. Interleukins. Transition period. Negative energy balance.

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INTRODUCTION

The transition period of productive cows occurs in the space between three weeks before and postpartum and is linked to the high demand for nutrients resulting from rapid fetal development and early lactation. In addition, it is marked by adaptive changes with the objective of preparing the cow for the end of gestation and the beginning of the lactation process, as well as maintaining its homeostatic state and avoiding metabolic disorders, such as hyperketonemia (Wittwer, 2000a; Torres et al., 2024).

Hyperketonemia is the most prevalent metabolic disease among dairy cows. It occurs in response to the negative energy balance (NEB) that affects cows in the transition period and is linked to significant metabolic changes in these animals. In addition, the disease can also serve as a gateway to other pathologies, decrease reproductive performance and result in loss of milk production (Soares et al., 2018; Gulinski, 2021; Bergmann et al., 2022; Monteiro, 2023).

In situations of BEN, caused by the imbalance between nutrient intake and nutrient intake, peripheral tissues develop a state of insulin resistance and glucose is directed mainly to the fetoplacental unit and mammary gland. To meet the need for energy, the body initiates beta-oxidation of fatty acids, leading to the production of acetyl-CoA, which relies on oxalacetate to enter the Krebs cycle. In the absence of this, acetyl-CoA is transformed into ketone bodies, which can accumulate and generate metabolic disorders (Wittwer, 2000a; Regnault, 2004; Thrall et al., 2012; González; Silva, 2017; Law; Simões, 2021).

For the study of metabolic diseases, since the 70's, the analysis of metabolic profiles has been used, whether of a single individual or of the entire herd. The evaluation consists of the analysis of metabolic variables by means of blood tests, and the analysis of indicators of the energy, protein, enzymatic, hormonal and mineral profile can be performed (Wittwer, 2000b; Cozzi et al., 2011; Silva; Bondan; González, 2022). In addition, the development of hyperketonemia has been linked to genetic factors such as single nucleotide polymorphisms (SNPs) and dysregulation in the gene expression of pro-inflammatory cytokines (such as TNF-a) (Zhang et al., 2016; WU et al, 2020).

The cytokines IL-1β and TNF-a play a fundamental role in cows in the transition period because they stimulate the uterine cells, expanding and inducing the calving process. In addition, they also promote collagen remodeling, contributing to the weakening of the fetal membrane and the expulsion of the fetus. Despite this, the increase in pro-inflammatory cytokine levels is associated with some common occurrences of the transition period, such as reduced food intake and clinical and subclinical mastitis (El-Deeb; El-Bahr, 2017; Tizard, 2018; Kuhla, 2020; Vitenberga-Verza, 2022).

Thus, the study aimed to review the literature addressing the main aspects related to hyperketonemia in productive cows, with emphasis on changes in the metabolic profile and expression of the cytokines IL-1β and TNF-α during the transition period of these animals.

LITERATURE REVIEW

TRANSITION PERIOD OF PRODUCTIVE COWS

The transition period is known as the most critical interval for productive cows. It is characterized by a phase of metabolic and oxidative stress that results in a pro-inflammatory and immunosuppressive state in cattle (Torres et al., 2024). Occurring in the space between the three weeks before and after calving (Alvarenga et al., 2015), the transition period is a phase marked by adaptive changes with the aim of preparing the cow for the end of gestation and the beginning of the lactation process, as well as maintaining its homeostatic state and avoiding metabolic disorders (Wittwer, 2000a).

Homeorresis, a concept used by Bauman and Currie (1980) was defined as "orchestrated or coordinated changes in the metabolism of body tissues, necessary to support a physiological state". Years later, the author applied the concept to illustrate the physiological states of pregnancy and lactation, and later of growth (Bauman, 2000). In this sense, homeorrhesia occurs when physiological adaptations happen without causing damage to the animal's metabolism. On the other hand, when the cow's body is unable to adapt to the physiological changes of the transition period, there may be the emergence of multiple metabolic diseases (Ortolani, 2009).

The transition period is linked to the high demand for nutrients resulting from rapid fetal development and early lactation. However, this period is characterized by greater occupation of the uterus in the abdominal cavity and consequent decrease in rumen volume, which results in a decrease in dry matter intake (Sargison, 2007). In the last three weeks prior to delivery, consumption is approximately 1.5% to 1.7% of body weight, but in the week of delivery it can be less than 1.5%, making this drop even more visible on the day of conception (Hayirli et al., 2003).

The decrease in nutritional intake goes against the energy demand of cows in the last days of gestation, a stage where, according to Gomes et al (2009), colostrum formation occurs, as well as the mammary gland's energy demand for glucose, amino acids, fatty acids, minerals and vitamins. In the transition phase, especially in high-producing cows, the mammary gland needs high amounts of glucose, especially in the first days after calving, for milk synthesis. A few days after delivery, the mammary gland's demands for glucose, amino

acids, and fatty acids are, respectively, 2.7, 2.0, and 4.5 times greater than that of the uterus in the final stage of gestation (Bell et al, 1995; Pereira, 2018).

The body's high demand for energy and insufficient intake of nutrients to match it result in negative energy balance (NEB). In this hypoglycemic situation, the cow mobilizes energy from its energy reserves, so there is greater movement of hepatic glycogen and adipose tissue. Fatty tissue, in particular, undergoes an increase in lipolysis, releasing non-esterified fatty acids (NEFAs) into the bloodstream, where in the blood they will be converted into energy and in the liver into ketone bodies. The latter will be used mainly by glucose-dependent tissues, which in states of caloric deficit, malnutrition or metabolic diseases, need to adapt to alternative energy sources (Drackley, 1999; Gomes et al, 2009; Santos et al, 2010; González; Silva, 2017).

In this sense, it is necessary to maintain an adequate nutritional balance, especially in periods of greater requirements, since energy imbalances can cause the so-called Metabolic Diseases or Production Diseases. These are caused by the imbalance between the nutrients ingested by the animal, its metabolism and those exited through feces, urine, milk and fetus, as is the case of hyperketonemia (Wittwer, 2000a; Vallenari et al., 2024).

HIPERCETONEMIA

In order to circumvent the negative energy balance (NEB) caused by the insufficiency in gluconeogenesis, the body starts to transform triglycerides into fatty acids (FA) to generate energy. In this reaction, there is an increase in the beta-oxidation of FAs in hepatocytes and consequent formation of acetylcoenzyme A (acetyl-CoA). On the other hand, the presence of a derivative of carbohydrate fermentation, oxaloacetate, is necessary for acetyl-CoA to be oxidized and generate energy in the Krebs cycle. In situations where there is an excess of acetyl-CoA and insufficient oxaloacetate, acetyl-CoA is used in the process of ketogenesis (Thrall et al., 2012; González; Silva, 2017; Law; Simões, 2021).

Ketogenesis occurs mainly in the liver, where the ketone bodies produced will be routed to the other tissues and serve as a source of energy. The main ketone bodies are acetoacetate, acetone, and β hydroxybutyrate (BHB), in which case acetoacetate is converted into acetone and BHB through chemical reactions. These soluble compounds will be found mainly in body fluids such as blood, urine and milk, with BHB being the ketone body with the greatest stability and predominance in circulation (Duffield et al., 2009; Thrall et al., 2012; Ospina et al., 2013; González; Silva, 2017).

When the body has large concentrations of ketone bodies in the body fluids and when the production of these compounds exceeds the amount used by the tissues for

energy production, hyperketonemia is established. Due to their instability, acetone and acetoacetate are not used as markers to measure the levels of ketone bodies, and BHB is the most common indication for the diagnosis of hyperketonemic condition. The detection of BHB in the blood is the most common, and it can also be traced in milk, due to its abundance and preservation in fluids (Oetzel, 2004; Duffield et al., 2009; Schein, 2012; González; Silva, 2017; Benedet et al., 2019).

The current reference values for the diagnosis of hyperketonemia in cows are ≥1.2 mmol/L. In this sense, the blood concentration of BHB ≥ 1.2 mmol/L and < 3 mmol/L was established for the diagnosis of subclinical ketosis and ≥ 3 mmol/L for the diagnosis of clinical ketosis. However, more recent studies such as the one by Vallenari et al (2024) use the reference value ≥ 1.2 mmol/L as a marker of both forms of hyperketonemia, whether clinical or subclinical. Thus, despite the subdivision, the term hyperketonemia now encompasses both presentations of the disease (McArt; Nydam; Overton, 2015; Benedet et al., 2019; Djokovic et al., 2019).

Hyperketonemia in cows can be categorized into three types, according to the etiology and duration of the disease: type I, spontaneous ketosis or underfeeding where there is low insulin concentration due to hypoglycemia; type II, occurs mainly in early lactation and is characterized by fatty liver and high food intake; the latter type is known as "butyric acid silage ketosis", it occurs when cows consume silage fermented with a ketogenic precursor, butyric acid (Oetzel, 2007; Zhang; Ametaj, 2020).

Ketosis is the most prevalent metabolic disease among high-performance dairy cows during the transition period, with the main symptom being the increase in ketone bodies in body fluids. This period is marked by increased energy demand for fetal development and milk production, along with the difficulty of meeting this need through feeding, leading to negative energy balance (NEB). When this condition intensifies, it can trigger metabolic disorders, such as reduced glycemic index and hyperketonemia (Constable et al., 2017; Gulinski, 2021).

Hyperketonemia can lead to clinical and subclinical ketosis, the signs of the first form are usually the strong smell of acetone due to the volatile content of this compound, decreased activity and appetite, weakness, apparent blindness, and marked loss of body condition. Subclinical ketosis, on the other hand, is characterized by an increase in ketone bodies in the circulation, but without the clinical symptoms of the disease. In more severe cases, some animals may manifest the nervous form of the disease, exhibiting signs such as walking in circles, pressing the head against surfaces, loss of balance, motor incoordination, hyperesthesia, aggressiveness or abnormal behavior, loss of visual acuity,

muscle tremor, among others. However, the clinical signs are nonspecific and difficult to detect, making it difficult to distinguish the forms of the disease in order to make an accurate diagnosis (Duffield, 2000; Berge; Vertenten, 2014; Constable et al., 2017; Soares et al., 2019).

In this sense, Gordon, LeBlanc and Duffield (2013) report that in their experiments, when examined, animals with high levels of ketone bodies may not show clinical signs, while animals with low levels may be weakened by the disease. Therefore, the disease can be better described as hyperketonemia, instead of distinguishing between clinical and subclinical, since the severity of the clinical signs of the disease seems to depend on the adaptation of each animal to process and tolerate ketone bodies in the body. In addition, it is understood that both presentations of the disease negatively impact milk production, reproductive performance, and the health of dairy cows (Herdt, 2000; Gordon; Leblanc; Duffield, 2013; McArt et al., 2013; Raboisson et al., 2014).

Studies such as those by Santschi et al. (2016) and Weigel et al. (2017) point to the prevalence and incidence of hyperketonemia in dairy cattle of 22.9% and 24%, respectively. Confirming the significant numbers of the disease, the study by Loiklung, Sukon, and Thamrongyoswittayakul (2022) shows a global prevalence of more than 22%. The highest prevalence of the disease is detected in the first two weeks of lactation, with a significant decrease after this period, as seen in the study by Drift et al. (2012) where there was a 60% decrease in the prevalence of hyperketonemia between the first and second months of lactation.

Among the risk factors for the occurrence, a higher frequency of the disease was observed in multiparous cows than in primiparous cows, suggesting that there is a direct relationship between hyperketonemia and the increase in parity, which can be justified by the simultaneous need for pregnancy and lactation. In addition, spring has been pointed out as the season of the year with the highest frequency of the disease, even though there are no biological elucidations for this. It is therefore believed that the higher frequency of the disease in this period occurs due to the use of silage with lower quality throughout the first half of the year (Berge; Vertenten, 2014; Vanholder et al., 2015; Santschi et al., 2016; Chandler et al., 2018).

Breed and nutritional management are also pointed out, where in the first case a higher prevalence of hyperketonemia is seen in Jersey cows (19%) than in Holstein cows (14%). A negative association was also observed between large herds and the prevalence of hyperketonemia, as well as a lower notification of the disease in herds that offer forage and concentrate at different times. In addition, the decrease in the disease extends to herds

that use the total mixed ration (RMR) during pasture periods (Berge and Vertenten, 2014; Santschi et al., 2016; Chandler et al., 2018; Benedet et al., 2019).

This disease is linked to several problems, such as the risk of contracting other diseases of the transition period, poor reproductive performance and economic losses in milk production that are around $289 in each case. Disease prevention is an important factor to reduce costs, losses and ensure animal welfare, and an efficient diet, body score assessment and periodic fluid screening for the detection of ketone bodies can be applied in dairy cattle farms (Raboisson et al., 2014; McArt et al., 2015; Madreseh-Ghahfarokhi; Dehghani-Samani; Dehghani-Samani, 2018).

There is a widespread consensus on the use of quantification of β-hydroxybutyrate and non-esterified fatty acids (NEFAs) for the diagnosis of the disease. In addition to energy indicators, other biomarkers of metabolism have been used to monitor the disease, such as the concentration of proteins in the body and milk, changes in the hormonal picture, changes in the mineral profile, as well as in cardiac biomarkers. In addition, the nutritional status, milk production and health condition of cows in the transition period are also analyzed (Antunovic et al., 2011; McArt et al., 2013; Soares et al., 2018, 2019; Benedet et al., 2019).

In addition to the metabolic profile, the development of hyperketonemia in the transition period has been inherently associated with genetic factors (WU et al, 2020). In the study by Nayeri et al. (2019), the presence of several single nucleotide polymorphisms (SNPs) and hyperketonemia susceptibility genes was observed. Other studies reported that pre- and hyperketonemic cows had a higher amount of circulating pro-inflammatory cytokines, such as interleukin-6 (IL-6) and tumor necrosis factor (TNF-a), compared to healthy cows. Thus showing that cows go through a process of chronic inflammation even before the establishment of the disease (Zhang et al., 2016). Therefore, along with the metabolic profile, genetic analysis is an important parameter for optimizing the diagnosis and prevention of the most severe cases of the disease.

METABOLIC PROFILE

In order to carry out the study of metabolic and nutritional diseases, the metabolic profile test, developed by Payne (1972), in Compton, England, has been used since the 70's. This evaluation consists of a combination of complementary tests for the investigation and diagnosis of metabolic and nutritional imbalances, and an unlimited number of variables can be analyzed, as long as there is prior and adequate knowledge of the biochemical and physiological specificities (González, 2000; Wittwer, 2000b).

From the analysis of the metabolic profile (PM) it is possible to identify the blood concentration of the indicators of the energy, protein, enzymatic, hormonal and mineral profile of a single specimen or an entire herd. The test can be used in conjunction with traditional assessment methods, such as body condition score, dietary assessment, productivity, milk composition, and others. However, it takes weeks or even months for these symptoms to be observed, thus making their application more useful in retrospective analyses, reserving the priority of the PM for obtaining more previous results (Wittwer, 2000b; Cozzi et al., 2011; Silva; Bondan; González, 2022).

In order to reach a result, the values of the biomarkers collected in the blood sample must be compared with the reference values established for that group. However, the interpretation of these data is more complex than it seems because it must take into account the aspects of each specimen such as age, breed, sex, physiological state, as well as environmental and management aspects. In the absence of any of these factors, there may be an inaccurate diagnosis, and the authors recommend the use of reference values of individuals similar to those analyzed and that these preferably come from similar management systems or climatic zones (Kida, 2002; Quiroz-Rocha, 2009; Cozzi et al., 2011; González; Silva, 2017; Silva; Bondan; González, 2022).

The application of PM has been widespread in the diagnosis, prognosis, and monitoring of metabolic and nutritional imbalances that affect ruminants in a transition period, it is possible to observe the application of the technique in sheep (Borowsky, 2021), goats (Soares et al., 2018), and cows (Alvarenga et al., 2015). Since metabolic or production diseases occur mainly in the transition period (Wittwer, 2000b) and hyperketonemia is the main disease at this time, PM analysis becomes an essential factor for adequate screening and monitoring of the disease.

Energy profile

β-hidroxibutirato (BHB)

β-hydroxybutyrate (BHB) is the main, most stable and abundant ketone body present in the ruminant circulation. It is a product of lipid metabolism, with its production occurring mainly in the mitochondria of hepatocytes, from the metabolization of NEFAs, and can also be synthesized by butyric acid present in the rumen mucosa. In the tissue that is demanding energy, BHB can be used as an energy source, if oxalacetate is available for its oxidation, otherwise, this compound will accumulate in the blood causing acetonemia or metabolic ketoacidosis (Wittwer, 2000a; González; Corrêa; Silva, 2017).,

Therefore, the increase of BHB in the bloodstream reveals a condition of negative energy balance (NEB) in the animal, since, in situations where the demand for glucose corresponds to its availability, the ketone bodies produced in the liver through oxidation will go to the tissues as an energy source, being mobilized by oxaloacetate. However, if glucose availability is low, oxaloacetate will be used to produce it. As a consequence, other energy production pathways will be triggered, and there will be a drop in the concentration of circulating oxaloacetate (Souto et al., 2013; Silva Filho, 2016).

Unlike other metabolites, whose concentration varies in response to feeding, BHB remains stable throughout the day, and is therefore the main biomarker for the diagnosis of hyperketonemia in ruminants. To diagnose hyperketonemic conditions in cows, the reference value ≥ 1.2 mmol/L is currently used (Leblanc, 2015; Benedet et al., 2019; Vallenari et al., 2024). BHB concentration can be determined in the bloodstream through commercial kits, despite the high cost, or through mobile electronic equipment (Panousis et al., 2012; Pichler et al., 2014).

Non-Esterified Fatty Acids (NEFA)

Although its levels vary throughout the day, together with BHB, NEFA is the most appropriate metabolite to indicate imbalances in the energy metabolism of cows. Higher levels of this metabolite are linked to lipomobilization of body reserves, and it is therefore used to indicate insufficient energy intake by these animals. This is the case of cows in the transition period, where a higher concentration of circulating NEFAs is observed a few days before calving, to meet the body's energy demands at that stage (Alvarenga et al., 2015; Leblanc, 2015; Benedet et al., 2019).

In dairy cows, NEFA concentrations are higher postpartum than prepartum, being approximately 0.2 mmol/L prepartum and 0.4 mmol/L on the day of conception, with the values extending up to 3 weeks postpartum. In the course of gestation, NEFAs, which are now at higher levels, will serve as a source of energy and develop a state of insulin resistance in cows by inhibiting the release of this hormone by pancreatic beta cells. This hinders the uptake of glucose by the peripheral tissues, directing it mainly to the feto-placenta unit (Regnault, 2004; Alvarenga et al., 2015; González; Corrêa; Silva, 2017).

Some studies, such as the one by Santos et al. (2012), reveal that nutritional management during the transition period is linked to serum concentrations of NEFAs. In this sense, the study observed that sheep that received propylene glycol (glucose precursor) supplementation in their diet during peripartum had lower mean NEFA values, while the control group had higher mean values.

Glucose

Glucose is an important variable in the metabolism of ruminants, on the other hand, these animals have homeostatic mechanisms that regulate blood glucose, which makes this carbohydrate a less appropriate marker to assess energy balance. Measuring this metabolite only once does not reveal the complete glycemic picture of the individual, as its concentrations undergo rapid and frequent changes throughout the day, due to diet and individual factors (Leblanc, 2010; Souto et al., 2013).

Despite this, in ruminants, the diet has little effect on blood glucose, because in addition to practically no glucose from the digestive tract entering the bloodstream, there is endocrine control of insulin and glucagon over glycogen, as well as glucocorticoids over gluconeogenesis. Thus, if energy intake is inadequate, these hormones stimulate the degradation of liver glycogen and the synthesis of new glucose in the liver. And in the cases of BEN, they stimulate the mobilization of triglycerides to provide fatty acids as an energy source, in addition to glycerol as a precursor of hepatic glucose (González; Silva, 2017).

In the final third of pregnancy, it is possible to observe a hypoglycemic condition, it is believed that due to the high demand of the fetus, with attenuation of this glycemic deficit in cases of twin pregnancy. However, in the peripartum period, it is possible to observe a condition of hyperglycemia, probably due to stress due to the increase in cortisol, as reported by Soares et al. (2018), in addition to insulin resistance in peripheral tissues. In the first weeks postpartum, the return of hypoglycemia is noted, especially in the first week and in cows with high milk production, as well as a greater presence of BHB during this period, which indicates the use of glucose mainly for lactation (Regnault, 2004; Raoofi et al., 2013; González; Silva, 2017).

Protein profile

Proteína Total (PT)

Blood proteins are produced mainly by the liver, and the rate of production is intrinsically related to the nutritional status of the animal and liver functionality. The increase in total protein (TP) can occur in cases of dehydration due to hemoconcentration, as well as the decrease occurs when liver failure, intestinal and renal disorders, hemorrhage or caloric deficit occur (González; Silva, 2017; Kirovski; Sladojevic, 2017).

The concentration of total proteins tends to decrease in the days before calving and, after it, it is restored. This decrease is linked to the use of amino acids for the synthesis of fetal proteins, since, in the last weeks before delivery, the growth of the fetus is exponential. Another factor responsible for the reduction in total proteins is the mobilization of

immunoglobulins for colostrum synthesis. Thus, dry cows may have higher levels of TP than cows in the transition period, and this drop in serum protein concentration also contributes to the reduction of milk production (Balikci; Yildiz; Gurdogan, 2007; Sadjadian et al., 2013; González; Silva, 2017).

In metabolic diseases such as hyperketonemia/toxemia of pregnancy, characterized by energy deficit, PT levels are usually lower. But, in addition to energy imbalance, PT levels are also influenced by inflammatory and infectious diseases, a period when it usually decreases. It is also possible to observe that cows with lower protein levels in the pre-calving period have a higher risk of presenting other conditions such as mastitis and placental retention at the beginning of lactation (Puppel; Kuczynska, 2016; Ruprechter, 2018; Soares et al., 2018).

Albumina

Accounting for about 50% of all plasma proteins, albumin is the most abundant protein in the bloodstream. Synthesized in the cytoplasm of liver cells, it is considered an acute negative phase protein, since its concentration tends to decrease in inflammatory and infectious diseases, in addition to having its synthesis reduced in cows with energy imbalances (Krause et al., 2014; Puppel; Kuczynska, 2016; González; Silva, 2017).

Its plasma concentration is affected by availability in the diet, protein loss in some diseases and especially by the functioning of the liver. Liver functionality can decrease with the fatty infiltration resulting from lipomobilization that occurs assiduously at the beginning of lactation, thus generating hypoalbuminemia in dairy cows. The decrease in albumin is caused by protein deficiency when, along with it, there is a reduction in urea levels. In cases of liver injury or failure, albumin levels are reduced, while urea levels remain normal or elevated and are accompanied by high levels of enzymes (González; Silva, 2017; Kirovski; Sladojevic, 2017).

It is possible to observe a decrease in albumin and total protein concentrations in the prepartum period of healthy ruminants, but this is due to the exponential growth of the fetus in the final third of gestation and the great mobilization of amino acids for this. However, animals with toxemia during pregnancy may also have albumin values within the normal range, thus indicating that there was no change in liver functioning (Sadjadian et al., 2013; Souto et al., 2019).

Globulina

The concentration of these proteins is obtained by the difference in concentration between the total proteins and albumin. Globulins can be divided into three types, α, β, and γ, identified from electrophoresis, and despite this, they are not considered good indicators of protein metabolism. Its importance is mainly focused on indicators of inflammatory processes. Thus, high levels of globulins are linked to infectious diseases or recent vaccinations (González; Silva, 2017).

Decreased globulin levels at the end of gestation and day of calving, as reported in Soares et al. (2018) are associated with the migration of gamma globulins for colostrum synthesis (Anwar; Ramadan; Taha, 2012). On the other hand, it is possible to observe that in animals affected by pregnancy toxemia/hyperketonemia, globulin levels can remain within normal limits (Souto et al., 2013). González and Silva (2017) explain that these variations are due to adaptation to stress. Thus, changes in globulin levels can be used to assess states of adaptation to stress and to identify adapted and non-adapted animals.

Urea

Urea is synthesized in the liver from ammonia, whether recycled from the rumen or from the catabolism of amino acids. Its levels are analyzed in relation to the level of protein ingested and kidney function, which makes it a sensitive and immediate indicator of protein intake. However, for kidney function, it is not the most appropriate indicator, since the degree of recycling of this metabolite between the blood and the rumen is very high, with creatinine being the most suitable metabolite for this (Souto et al., 2013; González; Silva 2017).

. Blood urea values fall moderately before and after calving in healthy cows. This decrease in urea concentration is attributed to the reduction in food intake caused by stress during peripartum. In animals with toxemia during pregnancy, high urea values are observed, probably due to renal failures, such as reduced glomerular filtration and increased protein catabolism for milk synthesis (Santos et al., 2011; Sadjadian et al., 2013; Souto et al., 2019).

Creatinina

Creatinine is a compound that results from the metabolism of creatine and phosphocreatine, which are primarily stored in skeletal muscles. Unlike urea, blood creatinine levels are not significantly influenced by diet, but they can increase sporadically in situations of intense muscle metabolism, leading to higher blood concentrations. The

blood elevation of this compound, as well as urea, reveals a picture of azotemia, which may be related to the decrease in the glomerular filtration rate and reduction in the urinary excretion of these compounds. In addition, its urinary excretion does not seem to vary according to the protein content in the body, as it does for urea (Souto et al., 2013; Thrall, 2015; Fischer et al., 2016).

The presence of this metabolite in blood is a highly sensitive marker to metabolic changes that occur during the reproductive cycle of ruminants, since studies show higher serum creatinine concentrations at the end of gestation and in the peripartum compared to the lactation period. This issue is attributed to the high mobilization of muscle protein to meet the energy demand generated by the accelerated development of the fetus. (Soares et al., 2014; Elzein; Osman; Omer, 2016; Soares et al., 2018).

For hyperketonemia, research suggests that kidney function can affect small ruminants, particularly in the later stages of the disease. This condition is usually associated with a specific prognosis for these animals, underlining the relevance of monitoring creatinine levels as an essential indicator of kidney health in these cases (Santos et al., 2011; Souto et al., 2013).

Hormonal profile

Insulina

It is a hormone related to energy metabolism because it acts by increasing the uptake of glucose by cells, stimulates its storage in the form of glycogen and stimulates lipogenesis in the liver and adipocytes. Insulin sensitivity and response will depend on body tissue and the physiological stage in which the animal is. In this sense, the liver responds to insulin by decreasing gluconeogenesis, adipose tissue with fat synthesis, and skeletal muscles with glucose absorption (Bell, 1995; Araújo et al., 2014).

In cows in the transition period, a lower aptitude for the use of glucose in the peripheral tissues is noted, which is available to the tissues with greater demand at that time, as is the case of the feto-placental unit, as well as the mammary gland. In addition, it is also possible to detect the effects of insulin decrease through the high mobilization of NEFAs to meet the high demand for energy, a fact that ends up attenuating insulin resistance (Regnault, 2004; Raoofi et al., 2013; González; Corrêa; Silva, 2017; González; Silva, 2017).

In general, in ruminants affected by hyperketonemia, it is common to observe reduced insulin values. However, some ruminants, such as primiparous goats, do not show this reduction in insulin levels at the beginning of lactation, even in the face of the great

demands of the mammary gland. It is believed that this limitation in the use of body reserves is a strategy to favor their own growth, considering that these animals are still in the maturation phase. (Souto et al., 2013; Araújo et al., 2014; Magistrelli; Rosi, 2014; Soares, 2017).

Cortisol

This hormone is used as an indicator of stress, although this position is questionable, as this glucocorticoid is influenced by several circumstances, which makes it difficult to interpret its results. However, its role in peripartum is widely recognized as a stimulator of gluconeogenesis to maintain blood glucose, reducing the ability of tissues to use glucose and acting in the opposite way to insulin. In addition, it works as a signal for the moment of calving because it is common to find levels above the reference values in females at the end of gestation (Beerda et al., 2004; Magistrelli; Rosi, 2014; González; Silva, 2017).

In several studies on hyperketonemia, there have been reports of elevated cortisol values in ruminants. According to the authors, this increase in the production of the hormone occurs, in fact, in response to the severe stress triggered by the pathological process and/or by the impaired ability of the fatty liver to metabolize and excrete it (Santos et al., 2011; Souto et al., 2013; Soares et al., 2018).

CYTOKINES

Cytokines are polypeptides secreted by a wide range of cells such as lymphocytes, macrophages, natural killer (NK) cells, mast cells, and others involved in pathological processes. These proteins play an essential role in the immune response, acting mainly in communication within this protection system. They also impact the activity, differentiation, and development of various immune cells, as they act as mediators of autoimmune and inflammatory diseases (Tizard, 2018; Shea; Gadina; Siegel, 2019).

Cytokines can be grouped into different categories, such as tumor necrosis factors (TNFs), interleukins (ILs), lymphokines, monokines, and interferons (IFNs). According to their function, cytokines are also classified as pro-inflammatory (such as L-1β, IL-6, and TNF-α) or anti-inflammatory (such as IL-10, IL-11, and IL-13). In addition, a single cytokine can be secreted by different cells and have both pro-inflammatory and anti-inflammatory activities (such as IL-6), which can generate multiple responses in an inflammatory condition (Boshtam et al., 2017; Monastero; Pentyala, 2017; Liu, Chao et al., 2021).

Variations in cytokine levels in biological fluids provide important information about the diagnosis, stage, and prognosis of various diseases. Abnormal or excessive cytokine

production, also known as a cytokine storm, can result in organ failure and even lead to death. Thus, cytokine levels are considered an essential indicator for the evaluation of clinical disorders of cows in the transition period (Mehta et al., 2020; Liu, Chao et al., 2021; Poole et al., 2021).

Studies in the literature show that increased levels of pro-inflammatory cytokines in cows is associated with decreased fertility (Samir et al., 2017). In addition, in cows in the transition period, higher concentrations of pro-inflammatory cytokines are related to reduced feed intake, which results in a negative energy balance (Kuhla, 2020). High levels of these proteins are also observed in cases of clinical and subclinical mastitis (Vitenberga-Verza, 2022) and in situations of hyperketonemia (El-Deeb; El-Bahr, 2017).

Interleukine 1-beta (IL-1β)

When sentinel cells (such as macrophages) are exposed to infectious agents or their pathogen-associated molecular patterns (PAMPs), their signaling pathways activate genes that produce and secrete three major cytokines, including IL-1β. The synthesis of IL-1β and IL-1α occurs when sentinel cells are activated by CD14 and TLR4 proteins, and IL-1β production is 10 to 50 times higher than IL-1α; in addition, IL-1α remains associated with the macrophage, while IL-1β is secreted (Tizard, 2014; 2018).

IL-1β is initially synthesized as an inactive 31 kDa precursor, pro-IL-1β. The maturation and release of IL-1β are tightly controlled processes, which depend on the cleavage of pro-IL-1β to the active form of the cytokine through the action of caspase 1. In its active form, IL-1β acts as a small pro-inflammatory cytokine agonist (17.5 kDa), being produced mainly by CD4+ helper T lymphocytes, monocytes and macrophages. In addition, it is also synthesized by non-immune cells, such as fibroblasts, endothelial cells, microglia, and astrocytes in the central nervous system, in response to cell lesions, infections, and inflammatory processes (Lopez-Castejon; Brough, 2011; Tizard, 2018).

This cytokine is a very potent pro-inflammatory mediator that has its effects on several cell types, acting on several inflammatory diseases, such as stroke, diabetes, and genetic autoinflammatory disorder. In the immune system, it induces Th17 cells to produce other cytokines, making the body susceptible to the development of chronic inflammatory diseases. In its pro-inflammatory action, IL-1β promotes the attraction of granulocytes to the inflamed tissue. As well as, from the hypothalamus, it induces the expression of prostaglandins during the acute inflammatory response, which, at a systemic level, triggers fever (Sutton et al., 2009; Hong et al., 2019; Galozzi et al., 2021).

In humans, IL-1β is a fundamental cytokine for labor (PT), being released by leukocytes infiltrated in the uterus and myometrium, where it enables the metabolism of progesterone and induces cervical maturation. It is also believed that IL-1β acts at the beginning of labor by inducing the entry of calcium into the smooth muscle cells of the myometrium, stimulating uterine contractions. As in the human species, cows also have high concentrations of pro-inflammatory cytokines (such as IL-1β) in the placenta, amniotic membranes, and other tissues during gestation. During calving in cows, IL-1β, along with other cytokines, stimulates uterine stromal cells, amplifying the calving process. In addition, it acts on collagenase to remodel collagen, which weakens the fetal membrane, relaxes the cervix, and increases myometrial contractility, resulting in the expulsion of the fetus. In the postpartum period, the uterus involutes, since most of the cells that stimulate cytokines disperse or are destroyed (Tizard, 2018; Patel et al., 2018; Pierce et al., 2018; Menon; Richardson, Lappas, 2019).

Elevation in serum IL-1β levels has been reported in the stages involving the transition period of dairy cows. In this sense, most studies suggest that high concentrations of this cytokine are associated with behaviors and clinical conditions characteristic of the transition period, such as a higher number of mastitis cases, lower feed intake, and reduced milk production (Trevisi, 2015; Kuhla, 2020). In addition, Tizard (2018) reports that during severe infections, IL-1β acts in conjunction with tumor necrosis factor alpha (TNF-α), and the synergistic effect of this interaction induces unhealthy behavior in cows by acting on the brain, causing fever, lethargy, malaise, and loss of appetite.

Fator de necrose tumoral alfa (TNF-α)

As with IL-1β, TNF-α production results from sentinel cell signaling in response to infectious agents and their PAMPs. TNF-α is the first cytokine to be produced by activated sentinels, with its synthesis occurring early in inflammation, followed by a heavy flow of IL-1 and later IL-6. TNF-α can also be produced by endothelial cells, stimulated fibroblasts, T lymphocytes, and B lymphocytes. It can also be generated both in soluble form and bound to the membrane, the latter of which is cleaved from the cell surface by a protease called TNF-α convertase (Tizard, 2018; Holbrook et al., 2019).

TNF-α is synthesized as a 26 kDa type II transmembrane protein, forming a stable and active homotrimeric molecule, mTNF-α. This molecule can be processed by proteolytic cleavage by the TNF-α converting enzyme, resulting in a 17 kDa monomeric protein, also biologically active, called sTNF-α. TNF-α triggers multiple cellular responses through its interaction with two transmembrane receptors: the type I receptor (TNFR1) and the type II

receptor (TNFR2). In physiological terms, TNFR1 is expressed constitutively in various cell and tissue types, while TNFR2 is predominantly expressed at low levels in immune and endothelial cells (Leung; Cahill, 2010; Urban; Socool; Azevedo, 2014).

Therefore, TNF-α is a primary mediator of inflammation because, together with IL-1, it triggers changes in the endothelial cells of small-caliber blood vessels. Thus, a local increase in TNF-α concentration generates the classic signs of inflammation, such as heat, swelling (tumor), redness, and pain. TNF-α amplifies and prolongs inflammation by stimulating macrophages to synthesize other inflammatory mediators such as NOX2 and COX-2. This cytokine also induces macrophages to increase their own production, along with that of IL-1. As its name suggests, TNF-α has the ability to destroy some tumor cells and virus-infected cells (Tizard, 2014; 2018; Holbrook et al., 2019).

TNF-α is among the most important cytokines in labor induction in human females. It can be found in large quantities in the placenta and embryonic appendages, being produced mainly by the membrane that protects the embryo in placental mammals, the chorionic decidua. TNF-α can intensify or trigger the labor process by inducing the expression and secretion of proinflammatory cytokines and chemokines, in addition to increasing the expression of the prostaglandin synthase 2 enzyme, thus promoting the production of COX-2 and PGE2, fundamental regulators of myometrial contraction (Lappas, 2016; Edey et al., 2018; Patel et al., 2018; Menon; Richardson, Lappas, 2019). According to Tizard (2018), for calving cows, TNF-α will act in a similar way to IL-1β, since, together with other cytokines, it stimulates uterine cells, expanding the calving process. In addition, it promotes collagen remodeling, contributing to the weakening of the fetal membrane and the expulsion of the fetus.

CONCLUSION

Hyperketonemia, prevalent in dairy cows in the transition period, is associated with negative energy balance, influenced by metabolic, nutritional and genetic factors, and negatively impacts the health, productivity and reproduction of the animals. Early detection through metabolic monitoring, especially of biomarkers such as β-hydroxybutyrate and non-esterified fatty acids, is essential for diagnosis and prevention. Inflammatory changes, including elevation of cytokines such as IL-1β and TNF-α, reinforce the need for strategies that integrate nutritional, genetic, and immunological management. In addition, practices such as balanced diets and the use of quality silage are essential to reduce the risks of the disease and promote the sustainability and profitability of cattle production.

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QUALITY OF LIFE AT WORK OF EARLY CHILDHOOD EDUCATION TEACHERS IN A MUNICIPALITY ON THE COAST OF THE STATE OF PARANÁ

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ABSTRACT

Introduction: Teaching is a profession that requires dedication and knowledge, facing challenges such as devaluation and work overload. This study investigates the quality of life at work (QWL) of Early Childhood Education teachers in Pontal do Paraná, considering factors such as working conditions and professional recognition. Objective: To analyze how the teaching work impacts the quality of life of teachers, seeking to understand the realities of local institutions and identify unsatisfactory and satisfactory aspects in the work environment. Method: Descriptive and exploratory research, which applied the Total Quality Work Life questionnaire (TQWL-42) to assess QWL. The questionnaire was distributed electronically to 24 teachers, and data analysis was performed using the syntax SPSS and TQWL-42. Results: The results indicated an unsatisfactory level of quality of life, especially in the biological sphere, which includes physical and mental disposition, work capacity and health services. Excessive workload and lack of job stability were identified as critical factors. Most of the participants were female, facing double workdays. Conclusion: The research highlights the need to value the work of teachers, improving working conditions and health care. Aspects such as freedom of expression and autonomy are unsatisfactory, while job security is a positive point. Recognizing and supporting teachers is crucial, as they play a vital role in education and society, positively impacting the school environment and student development.

Keywords: Quality of life. Early childhood education. Teaching work. Teachers.

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INTRODUCTION

Teaching is a profession that requires dedication, knowledge and commitment, in addition to playing an identity role in the lives of individuals, as highlighted by Taveira (2013). This study investigated the quality of life at work of Early Childhood Education teachers in a municipality on the coast of Paraná, considering the complexity of their functions and factors such as devaluation, workload inside and outside the school system, career plans, professional recognition, inadequate resources during the hour-activity and low remuneration

The research sought to answer: how is the quality of life at work of Early Childhood Education teachers in the public network of the municipality from the analysis of the impact of the teaching work on the quality of life of teachers to understand the realities of local institutions.

QUALITY OF LIFE

The concept of quality of life is intrinsically abstract, varying in meaning for different individuals, in different contexts and situations. Historically, the term was introduced in the early twentieth century by Pigou and gained prominence after World War II as a critique of policies focused exclusively on economic growth (Klutchovsky; Takayanagui, 2006). Over time, the concept expanded to include aspects of social development, such as education, health, and leisure.

In addition, quality of life is directly related to the individual's ways of life and relationships, with their habits and environment being the main factors of positive or negative classification. It expresses the level of basic and supplementary human conditions, including physical and mental health, social relationships, education, and other parameters that affect human life. Quality of life is an eminently human notion, linked to the degree of satisfaction in the family, love, social and environmental spheres, as well as to existential aesthetics (Minayo, Hartz & Buss, 2000).

Therefore, quality of life arises from the interest in measuring an individual's living conditions in relation to their expectations, norms, and concerns, reflecting the difference between their expectations and their current experience (Gómez & Caballero, 2021). It is a topic widely discussed and researched by scholars from various areas, with the difficulty of definition being a common characteristic (Herculano, 1998).

QUALITY OF LIFE AT WORK

The concept of quality of life at work (QWL) refers to the level of satisfaction of a professional in relation to the functions performed in an organization. It involves aspects such as management, infrastructure and health in the work environment (Rodrigues, 2007). QWL emerged in the 1970s, with a shift in the focus of organizational management, and has evolved to include socioeconomic, organizational, and human condition at work currents of thought.

Workers' health is directly related to the quality of life at work. The World Health Organization defines QWL as the individual's perception of their position in life, within the cultural context and values in which they are inserted, in relation to their goals, expectations, standards and concerns (WHO, 1998). The regulation of occupational health standards began in the 1970s, bringing benefits that include the elimination, control and preservation of health and well-being in the workplace (Sampaio, 2004).

Thus, health and quality of life are interconnected issues, with physical and mental health being essential for a good quality of life. The absence of medical care can negatively impact quality of life, affecting personal, professional, and social relationships. From the employer's point of view, QWL is seen as a means of enhancing productivity and the quality of results (Rocha, 2007).

Finding a balance between the demands of employers and employees is ideal for building a healthy organizational culture, valuing the employee and caring about the results delivered. QWL involves employee satisfaction with their functions and the work environment, covering physical, emotional, psychological and financial issues (Chiavenato, 2004).

According to the legislation, QWL is an organizational precept that aims to promote physical, psychological, and social well-being, based on the humanization of work and the social responsibility of the institution (Brasil, 2021). The promotion of health, safety at work and well-being are essential components for creating a healthier and safer work environment.

Initiatives related to QWL seek to promote the integral health of workers, adjusting to management practices that have evolved over time. Programs such as the Chico Mendes Institute for Biodiversity Conservation aim to improve the organizational climate, value work and encourage beneficial habits, promoting healthy social integration and family life.

Chart 1 lists three factors that affect the creation of a healthier and safer work environment (Ministry of Health, 2021)

Chart 1 - Factors that affect the work environment.

Physical well-being	Physical health status, which is related to the functioning of the human body, encompassing aspects such as genetics, nutritional conditions, disposition, strength, physical activity, sleep and rest
Mental well-being	It consists of managing emotions in a positive way in the face of adversities imposed by external factors
Welfare	It is the individual's ability to interact in society in a healthy and balanced way for all

Source: Adapted from Pafiadache (2021)

Working conditions, career satisfaction and socio-occupational relationships are fundamental to improve the promotion of health and quality of life at work for public servants. To this end, plans and actions are developed considering the recognition and appreciation of civil servants, addressing factors that affect their individual and collective health.

The Gaffrée and Guinle University Hospital (HUGG), part of the Brazilian Company of Hospital Services (Ebserh) and linked to the Ministry of Education (MEC), created the Committee for Quality of Life at Work (CQVT) to focus on actions in this regard. The CQVT conducted an organizational climate survey to capture the opinion of employees, essential for an accurate and effective diagnosis.

After identifying the needs, the Committee proposed short, medium and long-term implementations, with the main objective of improving the quality of life at work. The choice and execution of appropriate programs are differentials that result in improvements in the organizational climate, increased satisfaction, employee health, performance, reduction of stress and absences, in addition to more engaged and motivated employees. These factors also contribute to a better corporate image (Brasil, 2021).

It should be noted that improving QWL benefits not only employees, but the organization as a whole, since satisfied and healthy employees are more productive.

QUALITY OF LIFE IN THE TEACHING PROFESSION

From early childhood education, teachers strive to create an environment that facilitates learning, using attractive materials and dedicating time for children to explore and interact, making learning enjoyable and stimulating. However, this dedication can result in overload and stress, with teachers sacrificing their personal lives to dedicate themselves fully to their work.

Kanaane (1999) highlights that "Quality of Life is represented by facilitating conditions that imply the well-being of the employee, in terms of the achievement of what he seeks as a person, as a professional, as a social being" (p.58). Thus, for teachers' QWL, it

is essential that schools and their managers are concerned with the daily life of teachers, providing a collaborative and valuing work environment.

It is worth mentioning that the motivation of teachers is driven by a continuous process of professional improvement and updating. Thus, managers should facilitate access to training and events that promote best practices and educational innovations, encouraging the exchange of ideas and experiences.

Godinho (2018), in turn, points out that problems such as lack of motivation, inadequate working conditions, and deficient salary structures significantly affect the teaching work. In addition to classroom activities, teachers face the overload of administrative tasks and planning, which can negatively impact their personal lives, which is why teachers need to be encouraged to balance their professional responsibilities with time for leisure and rest.

In addition to QWL being a relevant topic today, since it directly influences professional performance (Fernandes, 1996), in the educational context, teachers' working conditions not only affect their own lives, but also have a multiplier effect on student development and school dynamics as a whole.

An analysis of recent studies on this topic showed that university teaching, professional career, the challenges of teaching practice at the time of the pandemic, and the teacher in the context of the public university are subjects strongly related to the working conditions of teachers, which unfold into remuneration and compensation for work, mental health support, and balance between curricular and extracurricular activities, in addition to the impact of management models on the work environment (Sanchez et al. 2017; Veiga et al. 2017; Square; Oliveira, 2020; Klein et al, 2022).

The balance between work and leisure is essential for teachers to perform their duties well. Dumazedier (1973) recalls that the teachers' routine goes beyond the activities carried out in the classroom, including the correction of assignments and the preparation of lesson plans. However, it often becomes inevitable to accumulate tasks in and out of school. Factors such as competitiveness, precarious material resources, low salaries and the increase in teachers' responsibilities contribute to exhaustion and contradiction in relation to the training offered (Gomes; Brito, 2006).

Excessive involvement in professional activities, depending on working conditions, the pace and number of tasks, can harm the health of workers. The long working day is one of the main manifestations of the intensification and overload of demands on teachers, most of whom are women who still face the burden of domestic work (Campos; Viegas, 2021, p. 02).

Faced with these conditions, teachers often prioritize their professional obligations over self-care, resulting in physical and mental exhaustion. Among teachers, there is a unanimous perception that the work is becoming increasingly intense, leading to overload, exhaustion and exhaustion (Campos; Viegas, 2021).

IMPACT OF TEACHER APPRECIATION AND TRAINING ON QUALITY OF LIFE AT WORK

Education is widely recognized as one of the fundamental pillars of a society, and, therefore, teachers should occupy a prominent position, receiving appreciation and adequate conditions for the exercise of their functions. Education is a social practice that shapes human existence, both individually and collectively, developing in individuals the essential characteristics of the human being.

According to Libâneo (2010), educators are professionals involved in various educational practices, directly or indirectly related to the organization and transmission of knowledge and behavior patterns. These professionals meet the objectives of human formation defined in their historical context. Valuing teachers is crucial to ensure quality education, as teacher performance impacts both student performance and the quality of schools and the progress of nations.

To achieve these goals, it is necessary for teachers to receive adequate remuneration, have access to the necessary resources to fulfill their responsibilities, and actively participate in the formulation of public education policies. Recently, the Ministry of Education (MEC) announced a readjustment of the teachers' salary floor, in accordance with the professional enhancement policy provided for in the National Education Plan (PNE). Goal 17 of the PNE aims to equate the average income of teaching professionals in public basic education networks to that of other professionals with equivalent education (Brasil, 2023).

The 14.9% adjustment was implemented on January 17, 2023, raising the minimum salary for teachers from R$ 3,845.63 to R$ 4,420.55. However, on February 27, 2023, an injunction filed by the Intermunicipal Consortium of Education and Teaching of Paraná (CIEDEPAR) suspended the right to the floor. The Federal Government argued that the update of the value for 2023, according to the attacked Ordinance, followed the update criterion established in Opinion No. 1/2023/CGVAL/DIFOR/SEB/SEB (Brasil, 2023).

The withdrawal of this right significantly affects the personal and professional lives of educators, as the expectation of salary increases provides security for new acquisitions and ideas. Financial satisfaction, derived from what money can provide, is one of the factors that influence quality of life.

Landini (2007) highlights that the interest in the well-being of teachers has revealed the relationship between teaching practice and teachers' health conditions. These conditions can bring both satisfaction and pathologies, resulting from the working conditions themselves. The contemporary conditions faced by teachers have generated high levels of anguish and suffering, resulting in mental health problems.

Several factors make up the quality of life in the teaching work, including infrastructure, work environment, access to health services, time for leisure and family life, working hours and workload. Godinho (2018, p. 31) states that "work is an important source of meaning for a happy life", influenced by environmental, organizational and behavioral factors. The teachers' working hours, considering the time of rest and leisure, often exceed 40 hours per week, due to activities such as correction of assignments and preparation of materials carried out beyond the hours accounted for (Pizzio; Klein, 2015; Johanim, 2018).

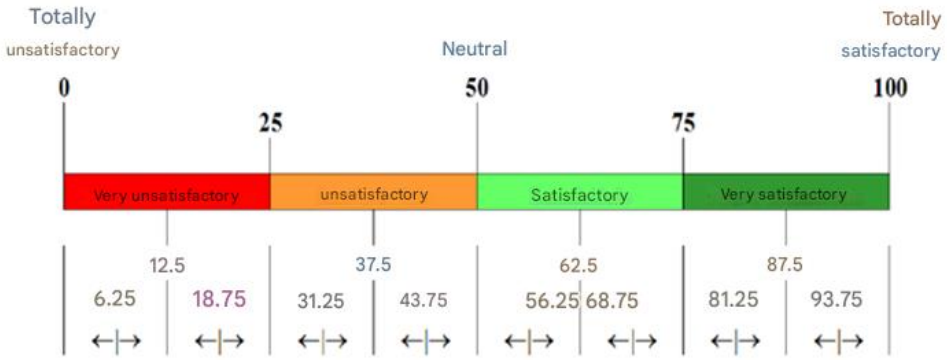
METHODOLOGICAL PROCEDURES

The study, of a descriptive and exploratory nature, was conducted with Early Childhood Education teachers in Pontal do Paraná. According to Gil (2017), exploratory research aims to familiarize the researcher with the phenomenon under study, while descriptive research aims to characterize a population or phenomenon without interference in the data (Gil, 1999). The exploratory phase included a bibliographic survey and the research was approved by the UNESPAR Ethics Committee (CAAE 51963421.8.0000.9247).

The Total Quality Work Life questionnaire (TQWL-42), developed by Pedroso (2010), was statistically validated with a Cronbach's alpha coefficient of 0.85, indicating high reliability (Pedroso et al., 2014). The questionnaire, similar to the WHOQOL and WHOQOL-Bref of the WHO, globally assesses the quality of life at work, without prevalent domains, with 47 questions: 5 identification and 42 in the biological, psychological, sociological, economic and environmental areas (Pedroso, 2014).

The questionnaire was adapted for Google Forms and distributed remotely to teachers. Data analysis was performed using the syntax SPSS and TQWL-42, provided by Pedroso. To interpret the results, the quality of life at work scale by Timossi et al. (2009) was applied, where the central point (50) indicates an intermediate level, with values below and above representing dissatisfaction and satisfaction, respectively, as shown in Figure 1:

Figure 1 – Scale used for data analysis.



Source: Source: Classification of quality of life at work Timossi et al. (2009) Apud Pedroso (2010.p.109)

RESULTS AND DISCUSSION

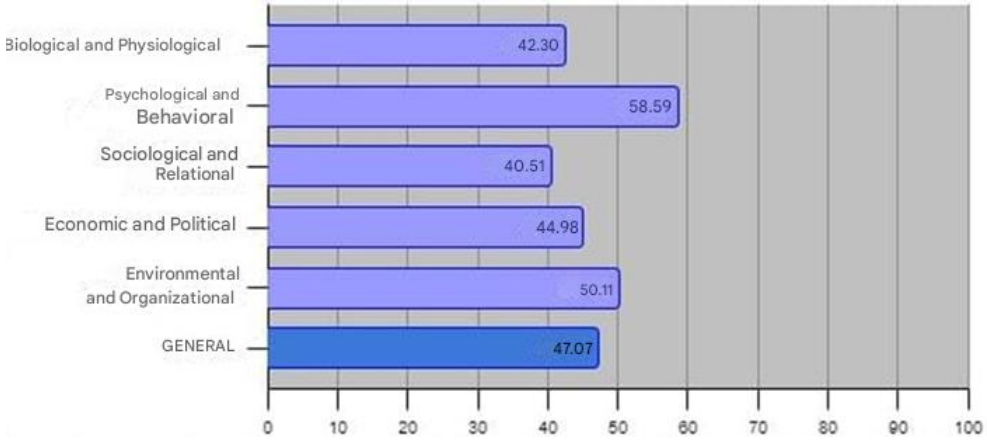
The questionnaire "TQWL-42 – Questionnaire for the Assessment of Quality of Life at Work" was administered electronically via Google Forms, with the voluntary participation of 24 teachers of Early Childhood Education in Pontal do Paraná. Participants answered 47 questions, mostly multiple-choice, without personal data collection, for the sole purpose of scientific research.

The data analysis revealed that the participants are aged between 17 and 59 years, with a predominance of 87.5% of females and 12.5% of males. In terms of marital status, 41.7% are married or in a stable union. Regarding academic training, 29.2% have completed a postgraduate degree, while 37.5% are studying undergraduate or specialization.

Teachers have, on average, approximately 53.41 months of service time, equivalent to about 4.4 years of professional experience in the area of education. These data indicate the construction of careers within the educational sector. The results presented were based on the identification questions, and then the results of the research using Pedroso's (2010) calculation instrument will be discussed.

The analysis of the data presented in Figure 2 reveals that teachers report an unsatisfactory level of quality of life, with 42.41% of the answers reflecting this perception. Previous studies, such as those by Koetz et al. (2013) and França and Lacerda (2020), have also identified a negative perception of quality of life among teachers. The lowest scores were observed in the biological sphere.

Figure 2 - Distribution of responses by the spheres evaluated by the TQWL (n=24).

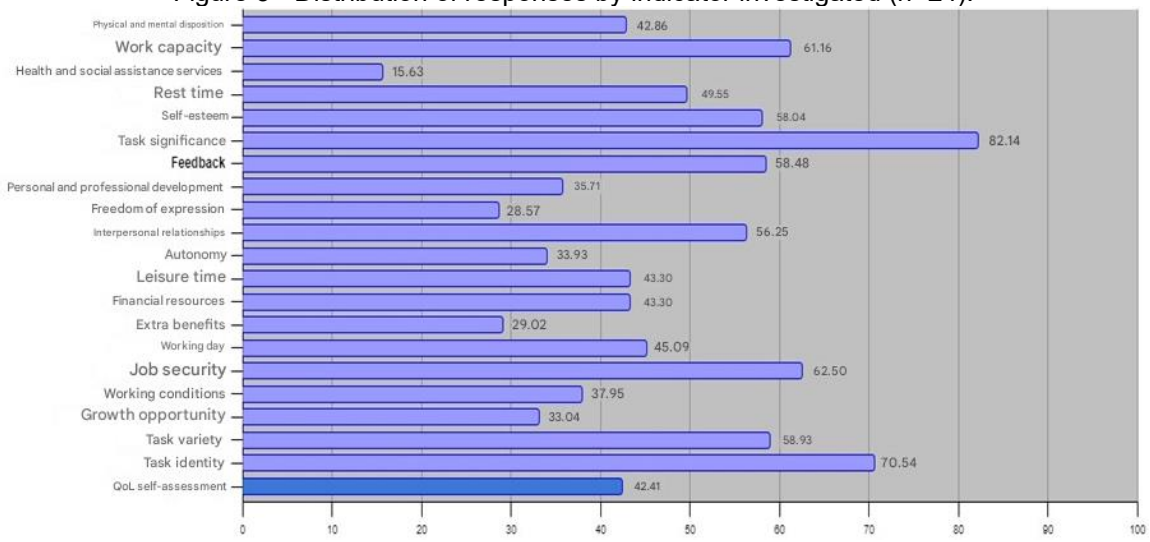


Source: The authors.

The results regarding the lowest scores corroborate studies such as that of Oliveira (2017), which identify workload as a determining factor for occupational illness. Pizzio and Klein (2015) and Johanim (2018) highlight that teachers' working hours often exceed 40 hours per week, in addition to underlining the double shift faced by teachers, who reconcile professional activities with domestic tasks. This is particularly relevant considering that the majority of participants in this study are female.

According to Pedroso (2010), the biological sphere includes indicators such as physical and mental disposition, which refers to the energy available for work; work capacity, related to effectiveness in the execution of tasks; health and social assistance services offered by the institution, including medical, dental and psychological care; and rest time, which is the period available for rest between working days. The detailed indicators, in turn, are presented in Figure 3.

Figure 3 - Distribution of responses by indicator investigated (n=24).



Source: The authors.

Significant negative aspects also include insufficient health and social care services offered to teachers, as well as extra benefits, financial resources, and autonomy. Veiga et al. (2017) identified that the greatest dissatisfaction is linked to the dimension of remuneration and compensation.

It is important to highlight that this research was conducted with teachers from the public school system, of whom 38% have temporary positions, meaning that 10 participants have no guarantee of functional stability. According to Pizzio and Klein (2015), job stability contributes to the reduction of illness among teachers, improving their quality of life at work.

Lago et al. (2015) observe that, in public educational institutions, although there is identification with stability and personal fulfillment, precariousness and work overload prevail, which promotes suffering and illnesses.

Basso (1998) emphasizes the importance of teacher autonomy for the effective development of knowledge. However, this research reveals that teachers often do not have autonomy in their actions, being conditioned to the approval of the coordination.

FINAL CONSIDERATIONS

The study enabled an analysis of the quality of life at work of Early Childhood Education teachers in Pontal do Paraná. The professors identified the most unsatisfactory and satisfactory aspects experienced in the last two weeks in their work environment.

Among the most unsatisfactory aspects are freedom of expression, autonomy, working conditions, health care services offered by the employer and extra benefits. This suggests the need to value the teaching work through actions that build an effective assistance network and a work organization that correctly measures the responsibilities of teachers. In addition, it is crucial to distribute activities fairly, including management and coordination positions, to ensure freedom of expression in the workplace, allowing everyone to contribute to the success of the institution.

On the other hand, satisfactory aspects such as job security and career importance must be maintained and expanded to mitigate job insecurity. Despite the challenges and devaluation of certain aspects of the teaching profession, most professionals report an average quality of life at work.

It is important to remember that, in addition to their professional function, teachers are individuals with feelings, emotions, anxieties and fears. Therefore, the biological, psychological and physical aspects of these professionals need greater protection and attention. We must recognize and value teachers who play a crucial role in our society, expressing our admiration and respect for their contribution to education and building a

better future. They accompany students, transmit knowledge and actively participate in the teaching and learning process, facing educational and emotional challenges, and adapting students' previous knowledge to the school's curricular content.

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HEDONIC, EUDONIC AND MAKARISTIC HAPPINESS: DIALOGUE BETWEEN ANCIENT PHILOSOPHY AND POSITIVE PSYCHOLOGY

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ABSTRACT

This work proposes to raise a discussion about the concepts of happiness in Positive Psychology from the understandings of happiness in ancient philosophy, considering Cyrenaic hedonism, Aristotelian eudaimony, Nicomachean Ethics and Epicurus' Makaristics. Presenting the three philosophical concepts, it is understood that the Makaristic understanding of happiness has been neglected in Positive Psychology, and can be included in the psychological construct to enrich the proposal of happiness.

Keywords: Positive Psychology. Happiness. Ancient Philosophy. Epicurus.

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INTRODUCTION

HAPPINESS IN POSITIVE PSYCHOLOGY

Positive Psychology arises from the perspective of looking beyond psychological illness, highlighting the positive potential of human beings' existence. From this perspective, factors that influence and contribute to well-being and happiness were investigated. In this effort, several assessment instruments have been developed and validated in several countries, including Brazil. Then, some works on happiness appeared that became known and were translated into Portuguese, such as: The Psychology of Happiness (CSIKSZENTMIHALYI, 1992); Authentic Happiness (SELIGMAN, 2002); The Harvard Way of Being Happy (ACOHR, 2012); the text of Omais on Happiness in the Manual of Positive Psychology (2018). There is even a World Happiness Report, which is updated annually.

We realized that happiness has become a construct that has been widely studied scientifically, and a theory called PERMA has been developed, which has five aspects linked to well-being, which are: positive emotions, engagement, positive relationships, meaning and fulfillment.

We must, however, understand that this construct – Happiness – is still in the process of being built in psychological science and lacks some reflections, especially because it is influenced by different philosophical understandings of happiness.

Positive Psychology starts from two "types of Happiness" (OMAIS, 2018, p.11) from ancient philosophy, but ignores a very important understanding of happiness, from Hellenistic philosophy, also from ancient Greece, which we will present later.

The look at happiness of Positive Psychology was reduced to the hedonic and eudaimonic understanding.

> Hedonic happiness comes from the pursuit of immediate pleasure and the reduction of suffering and pain, while eudaimonic happiness would be a more lasting happiness, which comes from the pursuit of moral good, a fuller and more meaningful life, and a selection of desires to be fulfilled. (OMAIS, 2018, p.11).

A third understanding of happiness, which I am calling *makaristic, has been left unobserved*, because of the Greek concept *makarários*, which we usually translate as blessed.

> Like the gods, the human being must be among his equivalents or equals, living among men, as if he were a god, for he would have attained the blessed life; since immortality is not of his nature, the human being must live prudently, feeding his life on the virtues, without the fear of death, even though life is ephemeral. In this way we affirm that the happy life, presented by Epicurus in his *Letter to Meneceus*, is analogous to the condition of the gods, a blessed life. (SOUSA, 2020, 31)

This concept is used by Epicurus, a philosopher of the Hellenistic period, who discusses his philosophy as a way to develop oneself towards a happy life (*makararios zein*). He also discusses the relationship between pleasure and happiness, which may lead some to a mistaken reading that he would be a hedonist, but his writings make it clear that it is a different form of happiness.

Let's get to know a little about the three philosophical proposals of happiness in order to enrich the understanding of happiness as a psychological construct.

HAPPINESS IN ANCIENT PHILOSOPHY

HEDONIC

The hedonic understanding of life arises, especially, with Aristippus of Cyrene and the Cyrenaics, who were direct or indirect followers of Aristippus. For them, the *summum bonum* (sumo bem) was pleasure (*heidonê; heidos*), which "consists of 'gentle movement', with pain being a 'sudden movement' and the neutral state of 'immobility'" (Sextus Empiricus, 1933, xvii). Aristippus, a disciple of Socrates, "was the first of the Socratics to charge fees and send money to the master" (D.L, II, 65).

For him the supreme end is the "gentle movement", which provides the sensation, in this sense the best is not to abstain from pleasure, but to be able to master it, not being harmed by it. Later, his disciples developed their ideas by admitting two states of the soul – pleasure and pain, with "immobility" being the negation of both, as defended by the master of Cyrene. For them, there was no difference between pleasures, in quality or intensity, but pleasure is physical, which is also the supreme good. In this sense,

> The Cyrenaics hold that there is a difference between the highest good and happiness. The supreme good is in reality isolated pleasure, while happiness is the sum of all isolated goods, in which past and future pleasures are also included. Pleasure alone is desirable for its own sake, whereas happiness is desirable not for its own sake but for the sake of pleasures alone. The proof that pleasure is the supreme good lies in the fact that from childhood we are instinctively attracted to pleasure, and when we obtain it, we no longer seek and avoid as much as possible its opposite, pain." (DL, II, 87-88).

Pleasure is the principle of happiness, because happiness is nothing more than the sum of pleasures experienced throughout existence. For the Cyrenaics, psychic pleasures and pains are directly linked to somatic pains and pleasures and are determined by them. In this way, the body (*soma*) determines psychological well-being or malaise, so somatic pain is worse than psychic pain, so more attention should be paid to the body than to the soul (*psyche*).

Later disciples of Aristippus of Cyrene will state:

> Happiness is utterly impossible, for the body is affected by many sufferings, and the soul suffers together with the body and is disturbed by it, and fortune prevents the realization of many hopes; consequently happiness is unattainable. Moreover, life and death are desirable alternately. (DL, I, 94).

The understanding of pleasure linked to the body reduces, for the Cyrenaic hedonists, the possibility of thinking about happiness, due to the condition of human nature and its real conditioning factors of life. The followers of Aniceris, one of the Cyrenaics, understand that the happiness of one friend, that is, of the other, cannot be desired by itself, because it is not felt by the one who desires; however, they do not deny friendship, gratitude and respect for parents, who can move people to act in a way that causes them embarrassment, but the "wise man will not be less happy, even if he has few pleasures left" (DL, II, 96).

It is perceived that happiness in the context of Cyrenaic hedonism will have an eminently corporeal character, whose emphasis is sensation or 'gentle movement'; thus, it is not the things themselves that provide happiness, but the sensation that they provoke in the body. Aristippus highlights this with his *luxury modus vivendi* , a "lustful nature" (DL, II 66), marked by food, feasting, and the company of "courtesans."

Pleasure and pain, for the Cyrenaic hedonists, especially Theodores, are in an intermediate position between good and evil; on the one hand, wisdom, prudence, and justice are derived from the supreme good; while folly, imprudence, and injustice derive from the supreme evil.

EUDAIMONICS

It can be seen that in the history of philosophy, Aristotle was one of the best known and most discussed philosophers who spoke about happiness (*eudaimonia*) in a more conceptual and systemic way. This discussion appears in the Nicomachean Ethics (EN) in a very direct way. Therefore, when we think of Felicity (*eudaimonia*) in Aristotle, we immediately think of his writing to his son Nicomacheans.

Aristotle builds his discussion on happiness, starting from the principle that "all art and all investigation, as well as all action and all choice, have in mind some good" (EN, I, 1). In this way, we can say that "the good is that to which all things tend" (EN, I, 1). This principle is important, because happiness would be a good, or even the supreme good. However, the question of the good must take into account that there are "goods in themselves" and other goods related to them.

He himself will say:

> If there is only one absolute end, it will be what we are looking for; and if there is more than one, the most absolute of all will be what we seek.
> Now we call that which deserves to be sought for its own sake, more absolute than that which deserves to be sought with a view to something else, and that which is never desirable in the interest of something else, more absolute than things desirable both in themselves and in the interest of a third; That is why we call absolute and unconditional that which is always desirable in itself and never in the interest of something else.
> Now, this is the concept that we preeminently have of happiness. It is always sought for its own sake and never with a view to anything else, whereas we do choose honor, pleasure, reason, and all the virtues for their own sake (for even if nothing came of it, we would continue to choose each of them); but we also choose them in the interest of happiness, thinking that the possession of them will make us happy. Happiness, however, no one chooses for any of these, nor, in general, anything that is not itself. (EN,I,7).

Aristotle rejects the hedonistic understanding that happiness is directly and inseparably linked to bodily pleasure. However, it is important to consider that happiness (eudaimonic) is the most desirable good, which is not counted among other goods, but understands these "other goods" as instrumental in the service of happiness and never the other way around.

Since the good is "that in whose interest all things are made", what would be the "function of the human being", which would give direction to his thinking, his choices and his acting?

> we affirm that the function of man is a certain kind of life, and this life an activity or actions of the soul that imply a rational principle; and we add that the function of a good man is a good and noble accomplishment of them; and whether any action is well performed when it is in accordance with its own excellence; If this is so, the good of man appears to us as an activity of the soul in accordance with virtue, and if there is more than one virtue, as the best and most complete. (EN,I,7).

Thus, Aristotle states that happiness is "a kind of good life and good deed" (EN, I, 8). It is perceived that there is an understanding of the state (an idea of passivity) and a dynamic understanding, provoked by the action in a virtuous activity, because there is, for him, a direct relationship between happiness and virtue. However, Aristotle does not deny the reality of life, which is linked to things and people influencing the human being. Virtue cannot be exercised without the proper means and "in many actions we use friends, wealth and political power as instruments" (EN, I, 8). Thus, circumstances, including a kind of economic-structural prosperity, influence the happiness of human beings.

Happiness, for Aristotle, is a virtuous activity of the soul." (EN,I,9) "Of the other goods, some must necessarily be present as preconditions of happiness, and others are naturally cooperative and useful as instruments." (EN,I,9) However, we must highlight that for happiness, nothing is lacking, because it is self-sufficient; Happiness is therefore desirable in itself, and seeks nothing but its own activity.

In this way, happiness is linked to life activities that are consistent with the condition of the human being, because virtue is what makes the being what it should be. Aristotle, therefore, does not understand happiness as the result of passivity, as something that affects him from the outside, but as a construction of being, which affirms him as a being.

Aristotle admits a "perfect happiness" (*teleia eudamonia*), but also a "divine" happiness, which would be a kind of "bliss", a *Makaristic happiness*.

He himself will say: "Consequently, the activity of God, which surpasses all others by blessedness, must be contemplative; and of human activities, which has the most affinity with the latter, it is the one that should most participate in happiness." (EN,X,8).

This contemplative activity establishes an "affinity" with the gods; then, the human being who does this "will presumably also be the happiest. So that in this sense too the philosopher will be the happiest of men" (EN, X, 8).

This understanding of Aristotle already opens up another idea of happiness, discussed by Epicurus in his Letter to Meneceus.

MAKARISTICS

Aristotle mentions in his Nicomachean Ethics the *makários*, or the blissful makaristic, happiness; but for him this happy, complete life is inaccessible to the human being.

> But such a life is inaccessible to man, for it will not be in so far as he is a man that he will live in this way, but in so far as he possesses something divine in himself; and so far as this element is superior to our composite nature, so is its activity to the exercise of the other kind of virtue. (EN,X,7).

Epicurus makes a great contribution to this question, as he considers it fully possible to live "as a god among men". Diogenes Laertius dedicates book X (DL,X) to the teachings of Epicurus, who highlights his importance to Greek thought in the Hellenistic period.

In the letter to Meneceus it is very clear that *Makaristic happiness* can be experienced by the human being: "A righteous contemplation (*aplanes theoria*) of these things knows all the choice and rejection for the health of the body and tranquility of the soul (*psyche*), since this is the end of a happy life (*makarious zên*)." (DL, X, 128). In other words, it is the sure knowledge of the doctrine taught in the Garden, the school of Epicurus, that makes it possible to choose or reject the events of life, pleasures, for example, leading to the health of the body and the tranquility of the soul (*psyche*), because this is the purpose of the happy, blissful life, of *Makaristic happiness*.

It is already perceived here that this happiness to which Epicurus refers involves the whole of the human being: his completeness, body and soul; It seems to be about the full

realization of this human being, including health and imperturbability. The disturbance, for Epicurus, comes from the belief that nature can be blessed (makaristic) and incorruptible, as the gods would be.

> Thus, to 'put into practice' or 'meditate' on the fundamental principles of doctrine, stoiceia, in a certain way inserts man on the path of things that leads to blessedness. In this we distinguish beatitude as an essential attribute of the gods and an accidental attribute of men. (SAPARERRO, 2014, p.18).

The human being can reach a blessed life, that is, *Makaristic* happiness, not as a result of his nature, but as a result of his *modus vivendi*, as proposed by the philosophy of the Garden.

We can say that the *Makaristic understanding* of happiness for Epicurus has a fundamental psychological factor, as it requires philosophical effort, which includes the defense and preservation of what leads the human being to a blissful life (*makarious zên*). "All the things to which I have exhorted you continually, attain them and do them, taking them as rudiments of good living (*kalous zên*)." (DL, X, 123)

It is not a solipsistic philosophy, marked by the reflection of the individual, but a *modus vivendi*, in which the choices and rejections of pleasures are part, as well as the other is included by friendship (love – *philia*).

> It should also be reflected that of the desires, some are natural, others vain. And of the natural ones, some are necessary, others only natural; Of those necessary, some are necessary for happiness, others for freedom from disturbance of the body, some, for living. [128] A righteous contemplation of these things knows all the choice and rejection for the health of the body and tranquility <of the soul>, since this is the end of a happy life. For the sake of this, we practice all things, so that we have no pain, no fear. Once this has been achieved in relation to us, the whole storm of the soul is calmed, and the living being does not have to go about looking for something and looking for something else with which the good of soul and body will be completed. So, we lack pleasure when we feel suffering because pleasure is not present; <When we don't suffer, > we no longer need pleasure.
> That is why we say that pleasure is the beginning and the end of living happily; [129] We understand it as the first and inherent good, and from it we begin all choice and rejection, and we arrive at it, judging all good with feeling as a rule. And since this is the first and congenital good, for this reason we do not choose all pleasure, but pass over many pleasures when a greater annoyance comes upon us from them; and we consider many sufferings better than pleasures, when a great pleasure follows a long time of enduring pains. For all pleasure, because it has a proximate nature, is a good, but not all of it must be chosen; just as all pain is an evil, but not all [it] is to be avoided. [130] Therefore all things are to be discerned in a proper way, by comparison, utility, and harm. (DL, X, 127-130).

Despite Epicurus stating that pleasure is the beginning and the goal, the end, pleasure must be measured in its result, for its acceptance or rejection. It is a way of life in which the teachings are applied to avoid suffering and disturbance; It is important to highlight that this is not just a dichotomy between pleasure and pain. This is clearer in

Vatican Sentence 5, which says: "It is not possible to live pleasantly without living with prudence (*phronismos*), rectitude (*kalous* - beauty) and justice (*dikaious*); when this does not occur, it is not possible to live pleasurably (it is not a pleasurable life – *ouk estin hêdous zên*)." (SV,5)

Another fundamental aspect for *Makaristic happiness* in Epicurus, which shows that it is not a solipsistic philosophy, is the understanding of friendship, *of philia*, that is, the love of a friend. We have this established in the Principal Maxims and the Vatican Sentences (SV): "Of the things that wisdom provides for lifelong happiness, the acquisition of friendship is by far the greatest." (DL,X, 148,(27)). "Friendship leads its dance all over the world, inviting all of us to awaken to the celebration of happiness." (SV, 52).

The Vatican Sentences will show us that the philosophy of Epicurus indicates a *modus vivendi*, much more than a reflection that abstracts the human being from reality, taking him away from the real encounters of life.

"It is necessary to laugh when philosophizing, and also to manage the house and to make use of all the things that are proper to us, without ever ceasing to propose the words of correct philosophy." (SV, 41).

"One should not pretend to philosophize, but to philosophize effectively; for we need not appear healthy, but have true health." (SV,54).

Epicurus begins the letter to Pythocles by emphasizing the positivity of affection, which is marked in the memory, which contributes to a blissful life, a *Makaristic*, happy life. "In your letter, which Cleon has brought me, you continue to show me the affection I deserved for the devotion I have to you, and you try, not without success, to recall the considerations of what makes a life happy (*makarion bion*)." (DL, X, 84).

These aspects show, in my view, clearly, that the philosophy of Epicurus distances itself from the proposal of classical philosophy, especially with Plato and Aristotle, bringing philosophy to the day-to-day life in its concreteness in time and space, as stated in Vatican Sentence 17:

> We should not consider the young man happy (*makaristós*), but the old man whose life was fortunate. The young man, full of vigor, follows, at the whim of fortune, the thoughts of others; the old man reaches old age as in a port, where he has housed goods whose expectation was previously uncertain and which he now retains in the security of recognition. (SV,17).

Makaristic *happiness* is a construction of life, which develops throughout existence. This does not mean that one should think that the path to the blessed (*Makaristic*) life is a thing for the elderly, but only in the course of the history of existence is one perceived the happy life.

Epicurus says at the beginning of the Letter to Meneceus:

> Let no one, being young, postpone philosophizing, nor, being old, begin to tire of study. In fact, no age is premature or late for the health of the soul. Anyone who says that the time to study philosophy has not yet come, or that it has passed, is the same as saying that the time for happiness (*eudaimonian*) has not yet arrived or no longer exists now. Consequently, wisdom must be sought in the young and the old: in one, so that, as he grows old, he may be young in good things, because of the grateful memory of what has passed; while the other, that he may be both young and old, because he is not afraid of things to come. Then we must take care of the things that make happiness (*poiounta tên eudaimonian*), since, if such is present, we possess everything of it, and if absent, we do everything to have it. (DL,X, 122)

Here, Epicurus speaks of *eudaimonian, eudaimonic* happiness, which like the 'beautiful life' and 'pleasure' is part of a blissful life, a *Makaristic* life, or a happy life.

To close our reflection on Epicurus' *Makaristic* happiness , we must mention the so-called *tretrapharmaco*, or the four remedies of Epicurus' philosophy, which help us to perceive his philosophical proposal as a *modus vivendi*.

1. Do not fear the gods: "The happy and eternal being has no disturbances or imputes to anyone, therefore, he does not exist for anger, nor for thanks; in reality, all this [exists] in what is weak." (DL, X,139(1)).

This is true of the gods who do not punish or engage with the human being so as not to affect his imperturbability; but I understand that it applies to the human being with a *Makaristic* life, too. He who is well and full, blessed, has no disturbances in his *psyche*, nor does he disturb others; he does not affect or is affected in his soul.

2. Do not fear death: "Get used to considering that death is nothing to us; for all good and evil is in sensation, and death is loss of sensation." (DL, X, 124).

> Then death, the most terrible of evils, is nothing to us, since, when we exist, death is not present; and when death is present, we do not exist. Therefore it is nothing, both for the living and for the dead, for as far as the former [living] are concerned, and the others [dead] no longer exist. (DL, X, 125).

3. Knowing how to deal with pleasure: "The limit of the magnitude of pleasures [is] the removal of all suffering. Where pleasure is present, as long as it lasts, there is no pain, or disturbance or both together." (DL,X, 139(3)). The amplitude of pleasure in the body establishes the presence of what your body lacks and the absence of what makes you suffer. But we must remember that for Epicurus there must be an analysis for the acceptance and rejection of pleasure, so that it does not bring him more suffering than this pleasure provides in terms of satisfaction.

4. It is possible to endure evil, for it is not eternal:

"Continuous pain in the flesh does not last, but the great pain is present for a short time, and also that which is only equal to pleasure through the flesh, does not remain for many days. Prolonged illnesses take greater pleasure in the flesh than pain." (DL,X, 140,(4)). In this sense, it makes no sense to be distressed by suffering, because it is ephemeral, knowing how to deal with pain in life is one of the formulas for living well and consequently, I went on to a blessed, *Makaristic life*.

It can be seen that Epicurus' proposal of *Makaristic* happiness is different from the hedonic and eudaimonic proposals, already well known in Positive Psychology.

5. Inclusion of the concept of *Makaristic Happiness*

It is perceived that the discussion about happiness in ancient philosophy has a special place and can be an enriching element for understanding happiness in Positive Psychology.

We must understand that there are three understandings of happiness that are distinct: hedonic, eudaimonic, and makaristic. Each of them highlights important aspects, such as pleasure, with happiness being the sum of these in the course of life; virtue, that which makes being what it should be; and a plenitude of the human being in his *psyche* and in his body, as health of the body and imperturbability of the soul (*ataraxia*). In this understanding, the biopsychosocial and "theological" dimensions are included.

Elements such as self-sufficiency (*autarchia*), prudence (*phronesis*), justice (*dikaios*) are not denied, quite the contrary, they are an integral part of this happy life, as well as friendship (*philia*). This understanding of happiness makes human beings responsible for their positive affects and care for negative affections, helping them to understand their weaknesses and potentialities.

Makaristic happiness has a strong aspect of personal responsibility (*autarchia*), but it is not limited to aspects of virtue (*phronesis*, *dikaios*, and others). It implies the ability to resist external attacks that take away your tranquility (*ataraxia*), a kind of shield, which avoids being affected by things that are negative to you, exercising positivity, well-being. This Makaristic happiness requires the "critical" capacity (analysis with criteria) in the face of pleasures, perceiving their potentiality to provide more pain, as well as the "criticism" of pain, which can provide more satisfaction.

Another important aspect in this Makaristic happiness is resilience, that is, the ability to resist pain, in the understanding that no pain is eternal.

We can see that there is much to explore in this Epicurean understanding of happiness, which needs to be realized so that the concept of happiness as a psychological construct in Positive Psychology is expanded.

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PEACE JOURNEY: A GAME INSPIRED BY UNO FOR MITIGATING SCHOOL VIOLENCE

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ABSTRACT

This study presents the methodological development and validation of the game "Journey of Peace: Building a World without Violence", an educational game based on the dynamics of UNO, aimed at adolescents aged 13 to 17 years. The objective was to create a playful tool capable of stimulating reflections on types of violence, prevention/mitigation strategies and reporting channels, strengthening pro-social behaviors. The development was structured in four phases: integrative literature review, construction of the theoretical framework, prototype development and validation with experts. Professionals from the areas of education, health and design participated in the process, who evaluated the game in terms of educational impact and user experience, based on the ARCS model and Bloom's Taxonomy. The results indicated positive acceptance, with suggestions incorporated to improve the clarity of the rules, inclusion of representative characters and improvement of interactivity. It is concluded that the "Journey of Peace" game is an innovative and effective tool to sensitize adolescents about violence and encourage preventive attitudes, becoming a promising resource in the school environment.

Keywords: Educational games. School violence. Prevention. Adolescents. Gamification.

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INTRODUCTION

Violence in the school context is a complex and multifactorial phenomenon that affects the cognitive, social and emotional development of adolescents. According to the World Health Organization (WHO), violence is defined as the intentional use of physical force or power, real or threatened, against another person, resulting in injury, suffering, or even death (WHO, 2002). In the school environment, it manifests itself in various ways, such as bullying, physical aggression, psychological violence and cyberbullying, compromising the quality of interpersonal relationships and the school climate (ISOLAN, 2012). Adolescence, in turn, is a critical period in human development, characterized by biological, social and emotional transformations that make individuals more vulnerable to risky behaviors and traumatic experiences (BANDURA, 1977). Thus, effective and innovative educational strategies are needed to promote safer and more collaborative school environments.

Education, as an instrument of social transformation, plays a central role in mitigating violence. In this context, gamification has stood out as an innovative pedagogical approach, which uses game elements to engage students in the learning process (KAPP, 2012). By integrating playful activities into the educational environment, educational games promote the development of socio-emotional skills, such as empathy, cooperation, and conflict resolution, which are key to building a culture of peace. Bandura's (1977) Social Learning Theory suggests that behaviors can be modeled through observation and social interaction, which makes games an effective tool in the prevention and mitigation of violence, as they allow simulating real situations and proposing practical solutions.

In addition, the Flow Theory, proposed by Csikszentmihalyi (1990), emphasizes that challenging and immersive activities facilitate the internalization of knowledge and the motivation of the participants. This theory corroborates the effectiveness of educational games, as adolescents are inserted in an interactive and stimulating environment, in which learning occurs in a meaningful way. In addition, according to Habermas (1981), dialogue is an essential element in the transformation of social relations, being fundamental to promote critical reflections and the construction of consensus. Therefore, games that encourage communication and group decision-making create opportunities for strengthening interpersonal relationships and deconstructing violent behavior.

Based on this theoretical framework, educational games emerge as innovative and promising pedagogical tools in the approach to sensitive themes, such as school violence. Unlike traditional methods, which often fail to engage teenagers, games provide a hands-on and engaging experience, stimulating reflection and behavior change. According to Martins

and Oliveira (2021), educational games have the potential to transform the way adolescents perceive and face conflict situations, by developing skills such as assertive communication, peaceful problem solving, and respect for diversity.

Based on these assumptions, the present study developed and validated the game **"Journey of Peace: Building a World without Violence"**, inspired by the dynamics of UNO. The game was created with the aim of sensitizing adolescents about the different types of violence (physical, psychological, sexual and digital), promoting dialogue on prevention and coping strategies and encouraging the use of reporting channels. The proposal is to offer a playful and educational resource that integrates theoretical and practical content, facilitating the development of socio-emotional skills and the construction of a more peaceful and inclusive school environment.

The general objective of this study is to develop and validate the **"Journey of Peace" game** as an educational tool aimed at the prevention and mitigation of violence among adolescents in the school environment. The specific objectives include: (1) to elaborate the theoretical framework to support the creation of the game; (2) develop a prototype based on the principles of gamification and the theories of social learning and communication; (3) validate the content and mechanics of the game with experts in the fields of education, health and design; and (4) propose adjustments to the game based on the suggestions of the experts, aiming at its practical application and pedagogical effectiveness.

Thus, this study contributes to the development of innovative educational practices, which use gamification as a strategy to engage adolescents and promote critical reflection on school violence. By creating an interactive and collaborative environment, the **"Journey of Peace" game** seeks to encourage pro-social behaviors and the construction of a culture of peace, strengthening interpersonal relationships and the integral development of adolescents.

METHODOLOGY

This study is characterized as a methodological development research, structured in sequential and integrated stages. First, an integrative literature review was carried out, which supported the theoretical and practical foundation of the educational game. Databases such as Scopus, PubMed, and Web of Science were consulted, using descriptors such as educational games, violence prevention, gamification, adolescents, and health education. The thematic analysis identified that the use of educational games in the

prevention of school violence contributes to the development of socio-emotional skills, such as empathy, self-control and conflict resolution (GEE, 2007; MARTINS; OLIVEIRA, 2021).

In the construction of the theoretical framework, the Theory of Social Learning (BANDURA, 1977), which highlights the role of observation and imitation in learning, and the Theory of Flow (CSIKSZENTMIHALYI, 1990), which emphasizes immersive engagement as a facilitator of the internalization of knowledge, were used as central references. Bloom's Taxonomy (1956) was also applied, focusing on the first three levels: knowledge, comprehension and application, guiding the pedagogical objectives of the game. Finally, the Theory of Communicative Action (HABERMAS, 1981) supported the creation of a tool that stimulates dialogue and critical reflection as means of social transformation.

The prototype development phase took place collaboratively, with the participation of experts in education, health and design. Meetings were held to define the game mechanics, the content covered and the necessary materials. The game was titled "Journey of Peace: Building a World without Violence", being inspired by the dynamics of UNO, but adapted to the theme of school violence.

In the validation with experts, 10 professionals with experience in education, psychology, health and game design participated, who evaluated the prototype through a structured questionnaire based on the ARCS model (KELLER, 2010) and user experience (UX). The Content Validity Index (CVI) was calculated to verify the agreement between the evaluators on the relevance of the game's content and mechanics. Values higher than 0.8 were considered satisfactory (ALEXANDER; COLUCCI, 2018). The main criteria evaluated included clarity of the rules, adequacy of the content, educational impact and potential engagement of adolescents.

The validation of the game **"Journey of Peace: Building a World without Violence"** was carried out with the participation of 10 experts, carefully selected to ensure an interdisciplinary and in-depth analysis. The group was composed of professionals from the areas of education, psychology, public health and game design. All had proven experience in the development of educational tools or in working with adolescents in school contexts.

The evaluation was conducted through a structured questionnaire, containing items that analyzed five main criteria: clarity of the rules, relevance of the content, engagement, educational impact and game design.

Finally, ethical aspects were respected in all stages of the research, ensuring the confidentiality and integrity of the participants involved, according to the guidelines of Resolution No. 466/2012 of the National Health Council.

RESULTS

The game **"Journey of Peace: Building a World without Violence"** was developed with the aim of raising awareness among adolescents about different types of violence, stimulating critical dialogue and promoting preventive behaviors. The following are the detailed elements of the game:

- **Objective:** To sensitize adolescents about physical, psychological and digital violence, encourage the identification of signs of abuse and disseminate mitigation strategies and reporting channels.
- **Materials Needed:** A deck containing 108 cards, divided into four categories (Concept, Warning Sign, Positive Action and Denunciation), as well as an instruction manual with clear rules.

GAME STAGES AND HOW TO PLAY

1. **Preparation**: The game is ideal for groups of 4 to 6 participants. Each player receives 7 cards at the beginning. The remaining cards are shuffled and placed in the center of the table.
2. **Rounds**: Each participant, in turn, must play a card corresponding to the color or category requested by the previous card. If the player does not have a valid card, they must draw one from the deck.
3. **Card Categories**:
   - **Concept**: Defines types of violence and their characteristics.
   - **Warning Sign**: Points out risk situations and signs of abuse.
   - **Positive Action**: Proposes preventive strategies and conflict resolution.
   - **Denunciation**: It presents support channels and services such as Dial 100.
4. **Scoring**: Each card played accumulates specific points. The winner is the one who reaches 100 points first or runs out of cards in his hand.

EVALUATION BY THE EXPERTS

The experts pointed out that the game proved to be a promising tool for the prevention of violence in the school environment, with good acceptance in all the criteria evaluated. The **overall Content Validity Index (CVI)** was higher than 0.9, indicating high

agreement on the suitability of the game for the target audience and its pedagogical objectives.

Criteria Evaluated	IVC	Comments
Clarity of Rules	0,9	Need for simplification in the initial description.
Content Relevance	0,95	Adequate content aligned with pedagogical objectives.
Engagement and Accessibility	0,85	Effective playful proposal for teenagers.
Educational Impact	0,9	Ability to promote reflection and critical learning.
Design and User Experience	0,87	Suggestion of greater representation in visual charts.

MAIN POSITIVE POINTS IDENTIFIED BY THE EXPERTS:

- **Thematic Relevance**: Experts praised the approach to the types of violence (physical, psychological, sexual and digital), considering it essential for adolescents.
- **Interactivity**: The game was recognized for promoting a collaborative environment, which encourages the exchange of ideas and dialogue between participants.
- **Stimulus to Critical Reflection**: The *Warning Sign* and *Denunciation* letters were highlighted as elements that help adolescents to identify risk situations and propose solutions.

IMPROVEMENT SUGGESTIONS:

1. **Simplification of Rules**: Some experts have suggested tweaking the manual to make it more accessible to teenagers with different levels of understanding.
2. **Contextualized Examples**: They recommended the inclusion of practical examples in the *Positive Action* letters, to facilitate the understanding of the proposed coping strategies.
3. **Inclusion of Visual Representativeness**: They indicated the need to diversify the illustrations of the cards, with more inclusive representations related to the target audience.

Based on the feedback received, the following modifications have been implemented:

- Revision of the instruction manual to simplify technical terms and include a supporting glossary.
- Inclusion of practical examples in some letters, especially in the categories *Positive Action* and *Denunciation*.
- Updated the design of the cards, with greater cultural, racial and gender diversity in the illustrations, reflecting the heterogeneity of the target audience.

The results of the evaluation show that the game, even in its initial version, has great educational potential and positive impact to promote dialogue, active learning and the construction of prosocial behaviors among adolescents.

The experts highlighted the effectiveness of the game in engaging adolescents, with satisfactory scores in all the criteria evaluated. Specific adjustments were suggested, such as simplifying the manual and including more representative visual elements.

DISCUSSION

The results of this study corroborate previous research that highlights the potential of educational games in promoting meaningful learning and engagement. According to Csikszentmihalyi (1990), the sensation of Flow, achieved during immersive activities, facilitates the absorption of complex content and stimulates the interest of the participants. In the case of "Jornada da Paz", the mechanics inspired by UNO provided a dynamic and collaborative environment, essential for social-emotional learning.

Bandura's Social Learning Theory (1977) maintains that adolescents learn through observation and interaction. By addressing practical situations and proposing positive actions, the game facilitates the internalization of preventive attitudes and the construction of new behavioral models.

In addition, Habermas' Theory of Communicative Action (1981) is evident in the game by stimulating dialogue among participants. The debate generated by the letters promotes critical reflections on violence and the forms of confrontation, transforming the playful space into an educational environment.

Validation with experts demonstrated that the game is an effective tool for the school context. According to Keller (2010), the ARCS model of motivation highlights that well-designed games, which align relevant content and engagement, have greater potential to impact the target audience.

Finally, the importance of gamification in health education is highlighted. As pointed out by Freire et al. (2019), educational games not only transmit knowledge, but also stimulate social skills, such as empathy and conflict resolution, which are fundamental in the prevention of violence.

CONCLUSION

The study developed and validated the game "Journey of Peace: Building a World without Violence", highlighting its potential as an educational tool for adolescents. The

game promotes active learning, engagement and critical reflection, stimulating preventive attitudes in the face of school violence.

It is recommended to apply the game in educational contexts, with longitudinal studies to assess its long-term impact and continuous improvements in design and content.

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EXPERIMENTAL EVALUATION OF SOLAR COLLECTORS

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ABSTRACT

The purpose of the present work was to investigate the association of two important engineering devices, the two-phase thermosyphon and the solar collector. A cycle to obtain high vacuum was set up to manufacture thermosyphons, which were inserted into evacuated glass tubes to compose the structure of a solar collector prototype. The prototype was operated over a period of eight months, during which two other solar collectors were tested simultaneously for comparison purposes. The other two collectors were purchased on the market, one of which already included the thermosyphons, while the other operated without them. Temperature readings were taken at the manifold inlet and outlet, as well as in the main water supply, and in the storage tank. The temperature data were analyzed and could be condensed into just two 24-hour periods, as they showed reproducible behavior. A calorimeter allowed estimating the amount of stored energy, which in this case used twenty 24 hour periods for analysis. It was concluded that the solar collector that uses the thermosyphon can reach higher temperatures at the manifold outlet, but the storage tank can interfere, causing a decrease in the temperature of the water that reaches the consumer.

Keywords: Solar collector. Thermosyphon. Experimental study.

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INTRODUCTION

The thermosyphon is a device that can be called a heat superconductor, despite its relatively simple construction. Since the name thermosyphon appeared around 1928, reported by Japkise (1973), this device has been studied and improved, as it presents great potential in heat transport. The literature is extensive and covers both the experimental and theoretical parts, as can be seen in the works of Faghri (1995) and also of Peterson (1994).

Solar collectors are of several types depending on their purpose, as shown in the works of Abdel-Dayem, et al., 1999, Azzolin, et al., 2018, Fan and Furbo (2007), Ismail. et al., 2016, Kalogirou (2003), Kalogirou (2004) and Vejen, et al., 2004. The literature has propagated the benefits offered by renewable sources, as well as the environmental problems related to the use of conventional energy sources and, as part of the solution, the use of various types of collectors such as flat plate, compound parabolic, vacuum tube, parabolic trough, Fresnel lens, etc. Solutions for solar water heating, space heating and cooling, heat in industrial processes, steam generation systems, desalination, chemical applications, among others, are exhaustively studied. As seen, systems that use solar energy can be applied to a wide range of problems and provide significant benefits, so they should be used whenever possible.

This study aims to compare solar collectors that use two-phase thermosyphon technology with conventional collectors. Three collector models were studied, two with the presence of two-phase thermosyphons, one of which was entirely built in the laboratory, while the other was purchased commercially and one did not use the thermosyphon. All collectors used were made of double evacuated glass tubes and had identical storage tanks.

EXPERIMENTAL APPARATUS

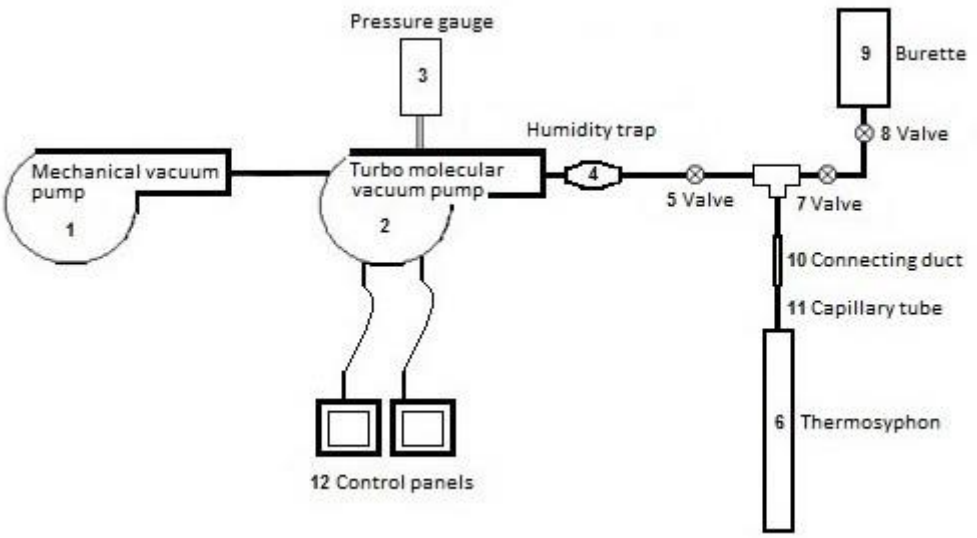
CONSTRUCTION OF THE VACUUM CIRCUIT

The research project began with the assembly of a system capable of producing high vacuum. This system was assembled using two pumps coupled in series. The Pascal-SD series rotary vane mechanical vacuum pump, model 2005 SD, ADIXEN brand, with double stage and pumping flow of 5.4 m^3/h, with final vacuum of 0.2 Pa was connected in series to a drag turbo molecular vacuum pump, model HiPace 80 DN 63 ISO-K, as shown in Fig. 1.

This configuration allowed the internal structure of the turbo molecular pump to be protected during the initial vacuum generation process, up to the safe operating limit of the turbo molecular pump. After activation of the turbo molecular pump, the mechanical pump is manually switched off and then the time required to reach the required vacuum inside the

thermosyphon is waited. During this stage, only valve 5 is open. As soon as the suitable vacuum is reached, the turbo molecular vacuum pump is switched off via the control panel and the process of filling the thermosyphon with the working fluid begins. Valve 5 is closed, valve 7 is opened, and valve 8 serves as a level control valve to allow the thermosyphon to be filled with the desired amount of working fluid. After filling, valves 7 and 8 are closed and the capillary tube is clamped by two flat face pliers, the connection sleeve is broken and the capillary tube is sealed with silver solder. The circuit was well optimized, with very interesting engineering solutions such as, for example, the moisture trap, which in more sophisticated systems usually involves expensive techniques where equipment and/or substances lower the temperature of the working fluid in an attempt to freeze it and consequently prevent it from returning to the pump. In this system, a component that caused pressure loss by retaining all the moisture was used, which met the project's needs very well. The entire vacuum circuit was created with the purpose of manufacturing two-phase thermosyphons with a vacuum sufficient for their proper functioning. The lowest vacuum obtained being 0.08 Pa and the highest being 0.1 Pa.

Figure 1. Vacuum circuit.



Source: From author.

TWO-PHASE THERMOSYPHON CONSTRUCTION

Before the copper tubes were connected to the vacuum circuit, they underwent a rigorous process of manual internal cleaning with acetone to prevent contamination of the working fluid with solid residues. Then, their ends were sealed with appropriate caps using silver solder, and one of the sides received a capillary tube, as shown in Fig. 2, which was responsible for connecting the thermosyphon to the vacuum system. At the end of the filling and sealing process, they had to undergo a check regarding the amount of working fluid that

each one received. The check was done by weighing the copper tube before and after filling with the working fluid, using a 5.10^{-7} kg precision scale from the KALA brand.

Ten two-phase thermosyphons were built to compose the solar collector that was tested, where each tube was filled with 30% of its total volume with distilled water, which was used as the working fluid. The smallest error in the filling process was 2.2% and the largest was 17.2%. The geometric characteristics of the tubes were: 1.8 m in length; external diameter of $1.21x10^{-2}$ m and internal volume of $2.1x10^{-4}$ m^3.

Figure 2. Detail of the thermosyphon cap – without external cleaning.



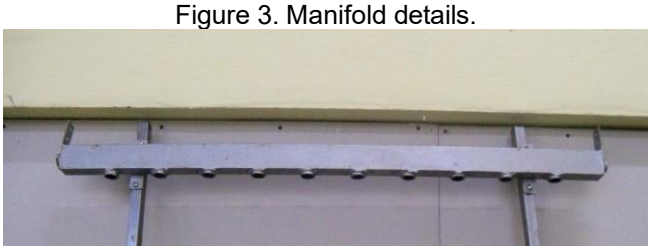
Source: From author.

To test the operation of the constructed two-phase thermosyphons, two procedures were used: first, one end of the tubes was immersed in a boiling water at approximately 100 ºC, while the other end was manually inspected to observe the heating time of the end and the noise caused by the heat exchange process; in the second procedure, the tubes were shaken until they produced a noise similar to two metals colliding. These simple inspection methods proved to be quite reliable, since when these phenomena were not observed during operation of the tubes that presented problems related to leaks.

SOLAR COLLECTOR CONSTRUCTION

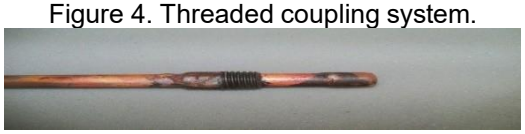
The construction of the prototype began with the assembly of the main steel structure that was responsible for accommodating and supporting the weight of the double vacuum tubes with the two-phase thermosyphons. The internal part of the manifold, which is the region through which the water circulates, shown in Fig. 3, was built with a threaded system, which did not present major assembly problems or leaks. The thermosyphon could be fitted perfectly into the manifold using a threaded ring that was welded to it, as shown in Fig. 4. Next, the collector itself was assembled, starting with the placement of the thermosyphons, checking for leaks in the hot water flow, assembling the double evacuated tubes and, finally, filling the manifold insulation box with expanded polystyrene spray.

Figure 3. Manifold details.



Source: From author.

Figure 4. Threaded coupling system.

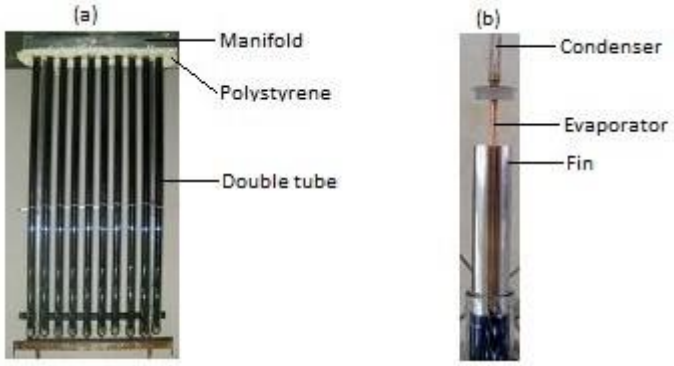


Source: From author.

The purpose was to build a solar collector with commercially available evacuated double tubes, but adapting two-phase thermosyphons inside it. Fig. 5(a) shows an overview of the prototype that was manufactured, which had its structure modified when compared to those purchased on the market. Fins are generally used to improve the heat exchange performance between the thermosyphon and the internal walls of the double tube, as can be seen in Fig. 5(b), which elucidates the use of an aluminum fin around a heat pipe in the commercially available solar collector. In the prototype, only radiative effects were predominant in the heat exchange process in the region where the evaporator of the two-phase thermosyphon is located, dispensing with the use of a fin that provides an increase in area and heat transport by thermal conduction.

After the prototype assembly process, it was taken to a suitable test station and three models of ASUS solar collectors were carefully installed in the same position. All were mounted facing geographic north with an inclination angle of 28º. The storage tanks used had a volume of 200 liters and all the pipes and connections were properly insulated and maintained a similar lengths and curvatures. After a few hours of operation, all models were monitored with a thermal imaging camera to detect small leaks that could compromise the tests.

Figure 5. Construction details of solar collectors: (a) Prototype and (b) Commercial solar collector.



Source: From author.

When consulting the manuals that accompany collectors sold on the market, it was observed that some of them include the term heat pipes. To resolve the doubt, one of the supposed heat pipes – Fig. 5(b) – was opened and its working fluid was quantified and chemically analyzed by the Chemistry and Environmental Department of UERJ-FAT. A fluid similar to distilled water was found, but mixed with a powder that was identified as a mixture of copper and copper oxide. The liquid part occupied approximately 4.02% of the total volume and the most interesting discovery is that the tube was not a heat pipe as announced in the manufacturer's manual, but rather a two- phase thermosyphon. In this case, it is not clear whether it was simply a confusion on the part of the person who wrote the manuals or whether there is some intrinsic conceptual error in the definition between heat pipe and thermosyphon on the part of the manufacturers.

DATA ACQUISITION AND STORAGE

To track the data required for collector analysis, thermocouples with compensation wire were manufactured to reduce project costs. The wire used was composed of a Chromel-Alumel alloy, known in the market as conductive wire with the code KX, with a diameter of 1.8 mm, which is suitable for working with type K thermocouples. The records of the water inlet and outlet temperatures in the manifold were made by an eight channel automated data acquisition system – Fieldlogger from Novus Produtos Eletrônicos Ltda.

All thermocouples were calibrated based on the ice melting temperature, ambient temperature (compared with a YOKOGAWA Thermo Collector TM10 sensor) and water boiling temperature, considering the altitude of the city of Resende - RJ.

From the comparison of the results, adjustment curves were extracted for each thermocouple. Then, first-degree correction equations were used to minimize the error of the thermocouples. The temperature of the water stored in the storage tanks was also monitored by means of a calorimeter, thus allowing the accounting of the energy production

in the form of heat. Daily samples of similar amounts of water were extracted from the collectors at pre-established times. Knowing the temperatures involved in the process, which were read by the thermocouples and obtained by the calorimeter, and using the energy conservation equation to calculate sensible heat, it was possible to obtain the value of the energy gain in the form of heat over the analyzed period. It is important to note that before each collection, 3 liters of water were always discarded, thus ensuring that the water analyzed always came from inside the storage tank and not from the piping, despite the fact that a very short section of duct was used in the water extraction position. The experimental uncertainties regarding the results of the energy gain in the form of heat were calculated, and the values found were insignificant.

ANALYSES OF RESULTS

The aim was to measure the water temperature at the manifold outlet and also at the point of consumption, thus quantifying the energy accumulated in a defined mass of water. Three models of solar collectors were tested simultaneously: collector 1 from the ASUS brand, which is made up of double evacuated glass tubes and two-phase thermosyphons with fins; collector 2 from the ASUS brand, made up of double evacuated glass tubes and without two-phase thermosyphons; and collector 3 from the ASUS brand, made up of double evacuated glass tubes and two-phase thermosyphons built at the Center for Renewable Energy Sources of UERJ – FAT. All collectors had 10 glass tubes making up the same external area. It is worth noting that in the double evacuated tube collector, the water penetrates the interior of the glass tube, while in the collector that uses the thermosyphon, the interior region does not have contact with the water. Therefore, there are construction differences in the manifold in the set situations and also between collectors 1 and 3, although less pronounced. This will cause changes in the water flow pattern inside the manifold, imposing changes in the flow rate and pressure drop, thus not allowing a complete similarity between the models tested.

The tests were carried out over a period of eight months and, as there was qualitative reproducibility of the results. Two specific periods were chosen for presentation. The graphs that were presented in the sequence were constructed using a 24 hour period, starting at 12:00h on one day and ending at 12:00h on the next day. For convenience during the construction of the figures, the x axis uses a range from 12 to 36 configuring a 24 h period. At the thirty-sixth hour, the temperature readings at the inlet and outlet of the collector 1, 2, 3, of the water coming from the supply network and of the water collected at the outlet of the storage tank by a calorimeter were recorded for analysis purposes.

With the experimental values in hand, the calculation of the heat stored in each calorimeter collection over a 24 hour period could be obtained, and served for the purpose of comparing the collectors. With the appropriate assumptions and assuming that there was no phase change, the energy conservation equation can be written in the form:

$Q = m\ c_p\ \Delta T$ (1)

where: Q= represents the heat stored in the fluid contained inside the calorimeter, [kJ]
m= mass of water contained in the calorimeter, [kg]

c_p= the specific heat of water at constant pressure, [kJ/kgK]

ΔT= temperature difference between the water collected by the calorimeter and the water coming from the supply network, [K]

TEMPERATURE BEHAVIOR STUDY

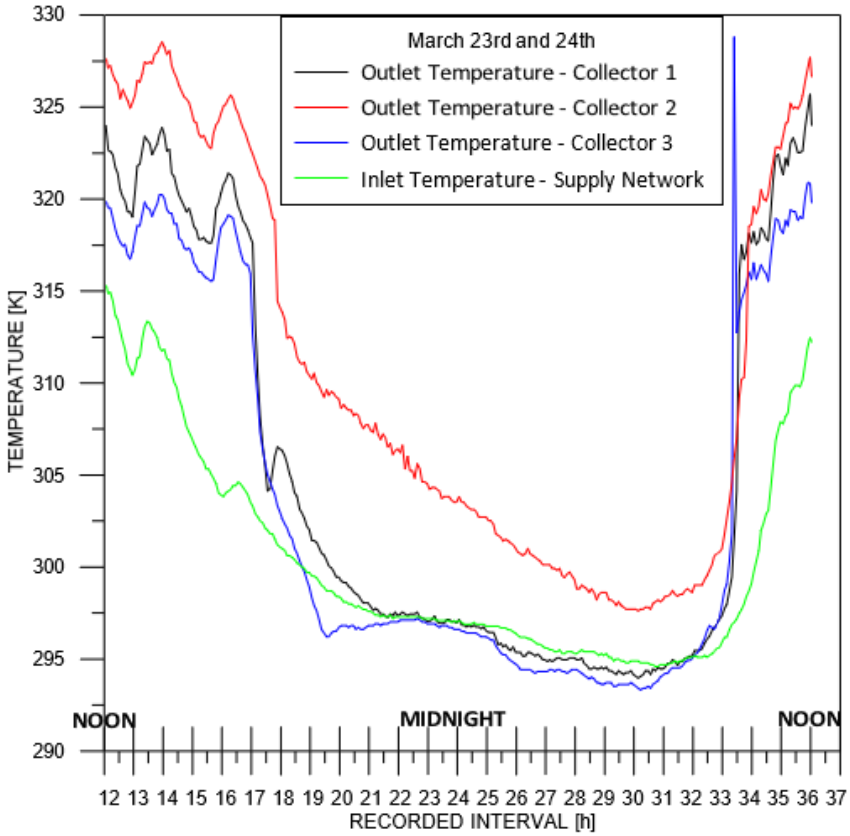
Fig. (6) shows the temperature value as a function of time at the collector outlet and also at the water supply network that feeds them. Collector 2 presents higher temperatures than the others in the afternoon period – 12:00 A.M to 18:00 P.M – but is practically the same as collector 1 in the morning period – 35 h to 36 h. Collector 3 shows a temperature pattern that is always lower than the others in the period mentioned. The same pattern was found in Fig. (10), which was a cloudy day with lower feed water temperatures. The difference is that in this case collector 1 surpassed the others and collector 3 continued to supply the lowest temperatures. The set of graphs shown in Fig. (7), Fig. (8) and Fig. (9) presents the temperature difference between the manifold inlet and outlet region for all collector models in the period between March 23 and March 24. The largest temperature difference considering 12h as a reference was found in collector 2, while collectors 1 and 3 with lower differences obtained practically the same value. Larger temperature differences in the manifold are certainly an indication of obtaining a higher value in the buoyancy force, which is responsible for the proper functioning of passive systems. It is important to point out that the mass flow rates for the collectors were different. In the collectors with thermosyphons the head loss is smaller since the fluid flows directly across the manifold while in the other collector the flow must go through the entire heating tube. As the mass flow rate is smaller, for the same collected heat, the achieved temperatures were higher. For the cloudy day, the values of the temperature difference between the inlet and outlet region of the manifolds were shown in the set of graphs represented by Fig. (11), Fig. (12) and Fig. (13). It is noted that the values of the temperature difference of collectors 1 and 2 are similar and higher than collector 3, taking 12h as a reference time.

A temperature inversion phenomenon between the inlet and outlet region was

captured in collectors 1 and 3 that use two-phase thermosyphon technology. This inversion that occurs approximately between 18 h and 34 h should be caused by the drop in ambient air temperature. The two-phase thermosyphon will not work, but the copper structure can act as a fin. This is shown in Fig. (7), Fig. (9), Fig. (11) and Fig.

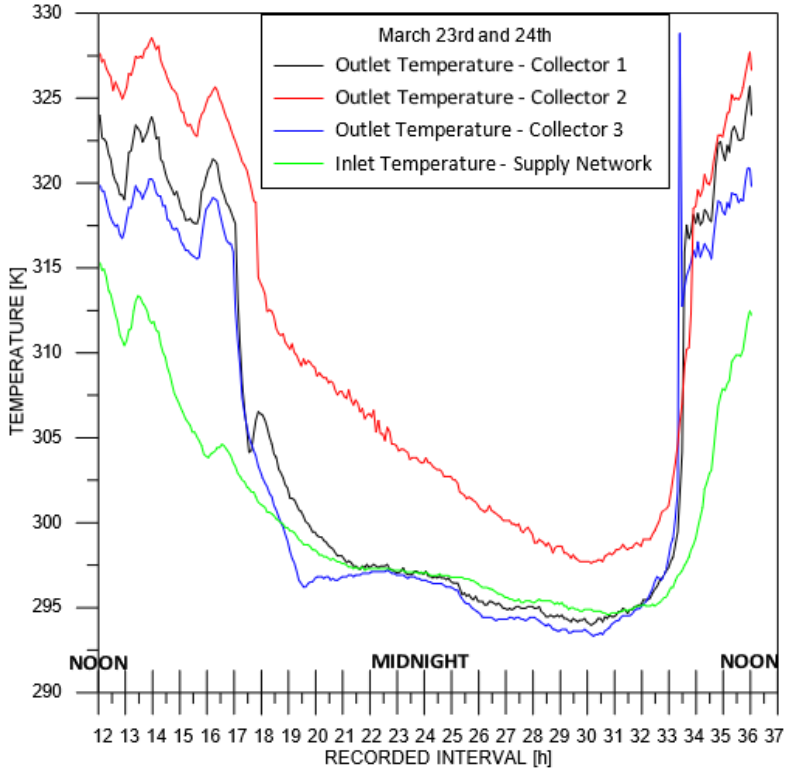
(13). This temperature inversion phenomenon does not occur in collector 2, as corroborated by Fig. (8) and Fig. (12).

Figure 6. Temperature between 12 A.M. of one day until 12 A.M. of the next day.



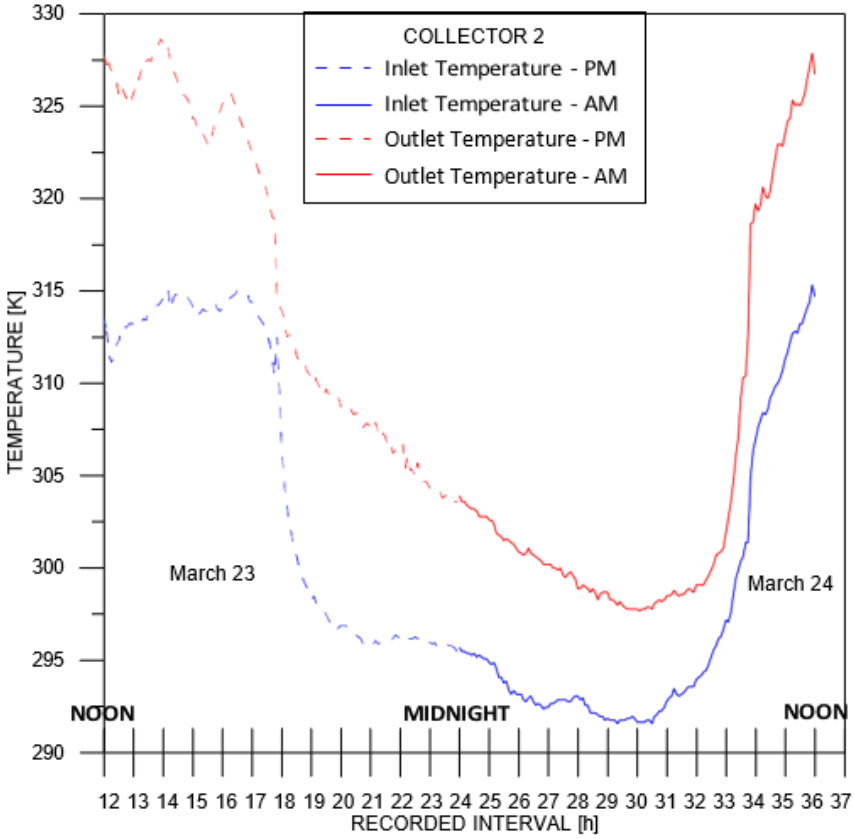
Source: From author.

Figure 7. Temperature between 12 A.M. of one day until 12 A.M. of the next day.



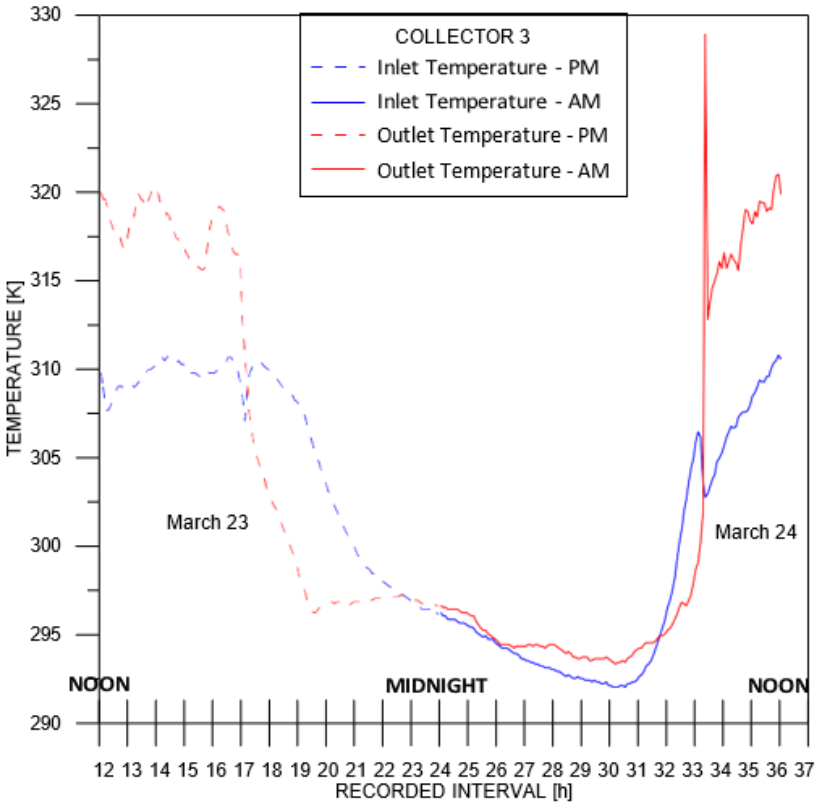
Source: From author.

Figure 8. Temperature between 12 A.M. of one day until 12 A.M. of the next day.



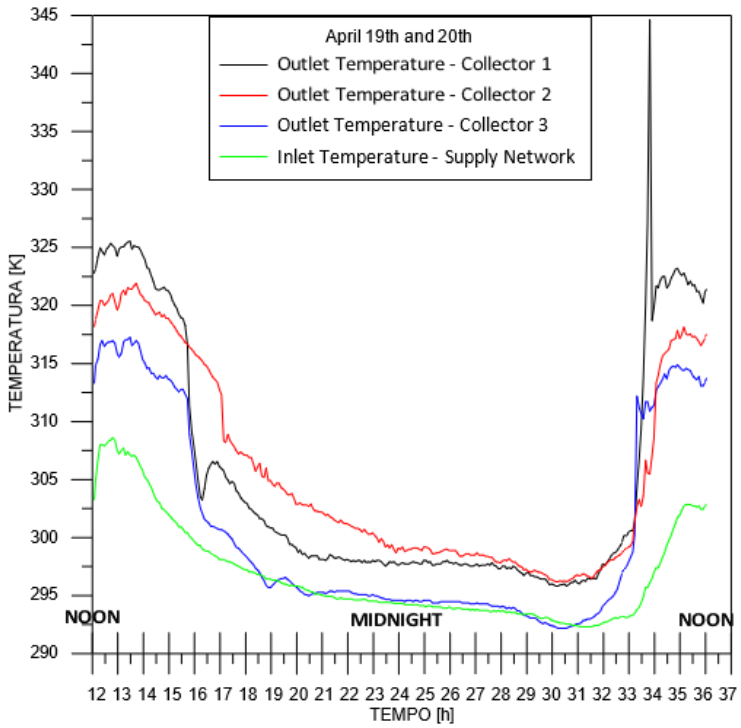
Source: From author.

Figure 9. Temperature between 12 A.M. of one day until 12 A.M. of the next day.



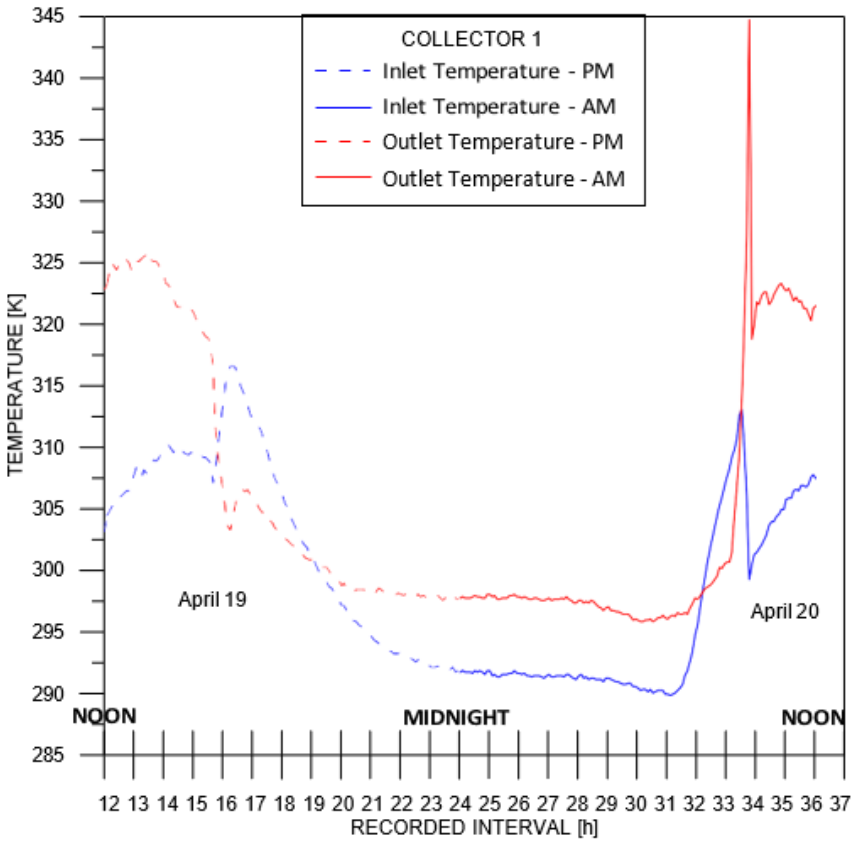
Source: From author.

Figure 10. Temperature between 12 A.M. of one day until 12 A.M. of the next day.



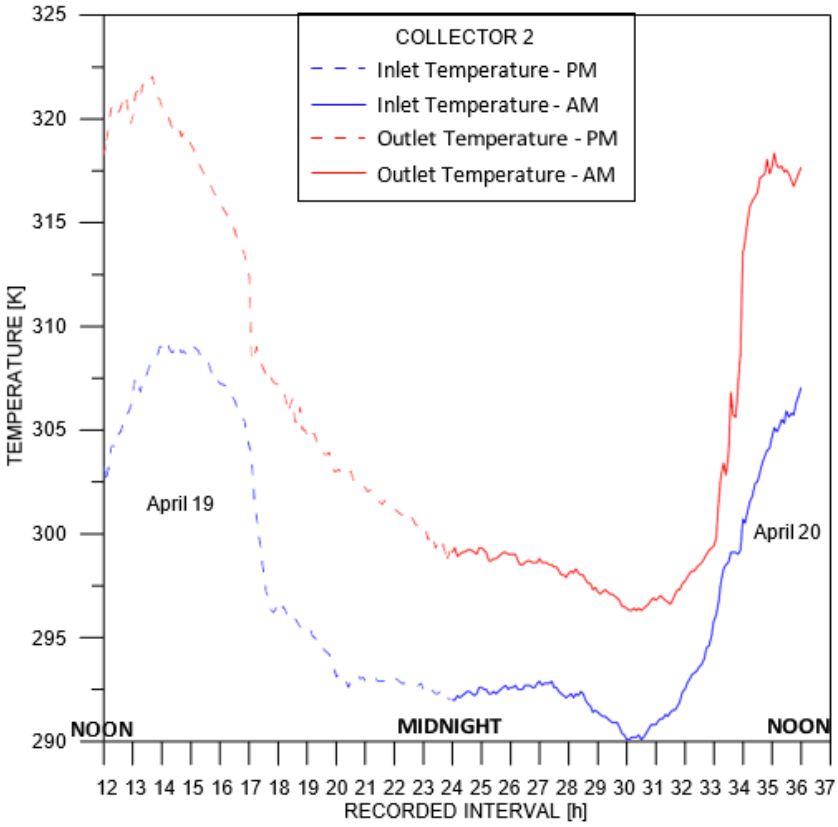
Source: From author.

Figure 11. Temperature between 12 A.M. of one day until 12 A.M. of the next day.



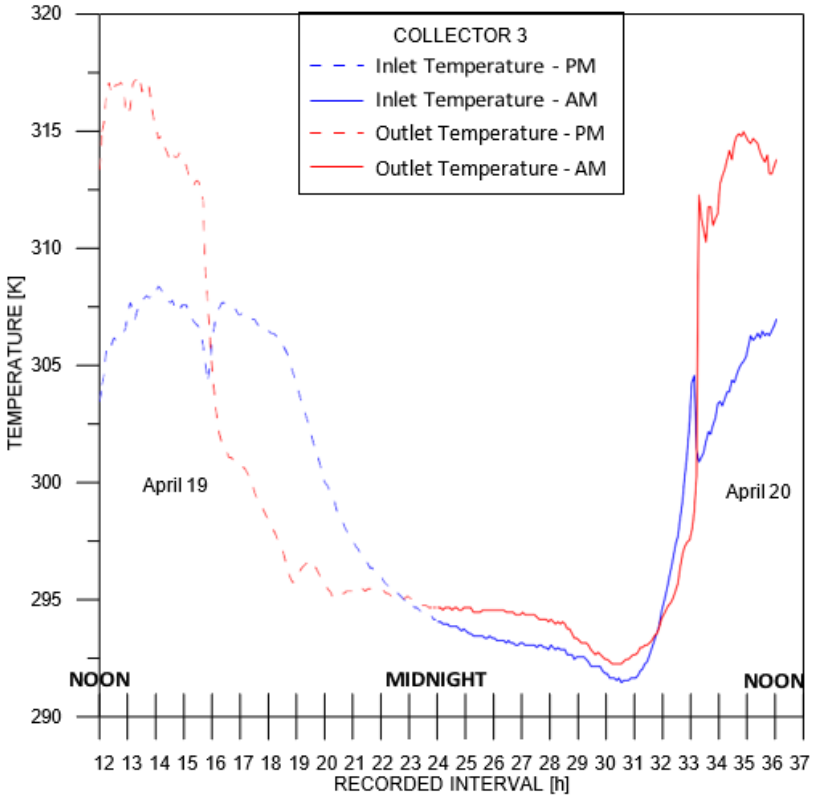
Source: From author.

Figure 12. Temperature between 12 A.M. of one day until 12 A.M. of the next day.



Source: From author.

Figure 13. Temperature between 12 A.M. of one day until 12 A.M. of the next day.



Source: From author.

ENERGY ACCUMULATION

The energy accumulated in the mass of water contained in the calorimeter was measured over a period of 20 days, covering the months of March, April and May. This period was chosen because it presents more pronounced climate variations, such as variations in ambient temperature, cloudy days and rainy days in the region where the test was carried out, when compared with the period of eight months. Table (1) shows the results obtained from the use of Eq. (1) to find the accumulated energy and its respective percentage deviations between each collector, in situations where the temperature taken into consideration was that of the storage tank and also that of the manifold outlet.

Table 1. Sum of the accumulated energy for each collector over the twenty-day period.

Solar Collector	Storage tank [kJ]	Deviation [%]	Manifold output [kJ]	Deviation [%]
1	125.7	D_{12}=22.9%	338.6 kJ	D_{12}=20.0%
2	154.5	D_{23}=10.5%	282.2 kJ	D_{23}=57.5%
3	139.8	D_{31}=11.2%	179.2 kJ	D_{31}=89.0%

Source: From author.

It is important to clarify that the energy stored inside the tank was the value for the period of time considered and the energy at the manifold energy is an average value at noon. The results point out that the collector without thermosyphons provided more energy

accumulated inside the storage tank for a long period, while the collector with the thermosyphon collects more energy in the short period close to noon. This can be explained when the heating process is analyzed. The energy is more efficiently transferred to the fluid by the thermosyphon but during the period without solar radiation the thermosyphon acts as a thermal diode. This fact can be confirmed by the temperature curves, that shows that the outlet temperature of the manifold reaches the ambient temperature. All the energy stored in the manifold is lost. In the tubular collector, there is a large amount of water inside the tubes that also stores energy. Even during the absence of solar radiation, part of the energy collected during the day will remain in the water mass and will be transferred to the tank.

The results of the accumulated energy from the temperature that represents the storage tank show the superiority of collector 2, which does not use the two-phase thermosyphon technology, followed by collector 3, which was the prototype built, and finally collector 1, which is sold on the market, both with the two-phase thermosyphon installed. The largest percentage deviation (D) found was between models 1 and 2. Now, when the temperature at the manifold outlet is taken into account, collector 1 stands out, occupying first place, followed by collectors 2 and 3. In terms of percentage deviation, all collector types start to move away from each other, especially models 1 and 3, with a value of 89%.

The results suggest that the two-phase thermosyphon technology, when used properly, can achieve the highest temperatures at the manifold outlet; however, this does not mean that the consumer will enjoy these temperature levels in a long-term period. Since all the collectors used in this work were of the same brand, were installed in a strictly identical way and occupied the same external area for solar energy collection, it seems that the thermal and fluid dynamic processes within the storage tank are strongly affected by the way in which solar energy is captured. It was also possible to note that in relation to the temperatures taken at the manifold outlet, the prototype was compromised by the non-use of a fin as was done in collector 1.

FINAL STATEMENTS

This study concludes that:

- Double evacuated tube solar collectors with thermosyphon operating in a passive system present higher water temperature levels at the manifold outlet.
- Thermal and fluid dynamic processes in storage tanks can be influenced by the collector model used to capture solar energy, resulting in a drop in the temperature of the water that reaches the consumer.
- Active systems – the use of pumps – can benefit solar collectors that use two-

phase thermosyphon technology by improving the internal film coefficient inside the manifold and also perhaps reducing the stratification that occurs inside the reservoirs.

- Removing the fin covering the two-phase thermosyphon can only be performed if there is an adequate design of the thermosyphon, to compensate for the loss of solar energy capture area.
- The solar collector without the two-phase thermosyphon is cheaper and seems to serve domestic consumers well, but the solar collector with two-phase thermosyphon technology has great potential for industrial use.

ACKNOWLEDGMENTS

The authors would like to thank the institution where they work, the State University of Rio de Janeiro - UERJ, for providing the physical infrastructure necessary for the development of this work. They would also like to thank the funding agencies CNPq and FAPERJ for financing the equipment used during the experimental tests.

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EDUCATION THROUGHOUT HISTORY: FROM ORIGINS TO CONTEMPORANEITY

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ABSTRACT

This article aims to present a history of education through History, it presents in a synthetic way the main characteristics of education during the various historical periods addressed here, they are: Education of Primitive Man; Education in Greece; Education in the Middle Ages; Education in the Protestant Reformation and the Counter-Reformation; Education of Bourgeois Man and Socialist Education. Who were the first teachers? How did this knowledge take place? Which classes or groups of people had the right to education? What is the character (religious, secular, public, private, state) that education assumes in the various historical periods? Who did education serve? These and other questions are addressed by provoking an opportunity to reflect on education in the past for a better understanding of education in the present. The work was carried out through bibliographic research, based on a dialectical analysis based on the historical conceptions of education of authors such as Aranha, Ponce, Manacorda, among others, which corroborate with the theoretical contribution that underlies the research.

Keywords: Education. History. History of Education. Historiography.

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INTRODUCTION

For a long time, man has been looking for a way to improve (enhance) the environment in which he lives in search of comfort and security. One of the ways found was to seek in every way to have control of nature, as well as the formation of societies to improve knowledge in search of this ideal.

With the passage of time, it is perceived that the history of humanity is directly linked to scientific knowledge, since it is through education (knowledge) the maintenance of power, which can be confirmed throughout history, since those who held knowledge also held power. And improving knowledge by keeping it in the hands of a few was also a way of maintaining power, which is implicit throughout the history of education.

Thus, this work aims to present a history of education through historiography, presents in a synthetic way the main characteristics of education during the various historical periods, being structured as follows: the Education of Primitive Man will be addressed; Education in Greece; Education in the Middle Ages; Education in the Protestant Reformation and the Counter-Reformation; Education of Bourgeois Man and Socialist Education.

The search for answers to several questions that will unveil questions such as: Who were the first teachers? How did this knowledge take place? Which classes or groups of people had the right to education? What is the character (religious, secular, public, private, state) that education assumes in the various historical periods? Who did education serve? They are addressed in this research. These and other questions are discussed, provoking an opportunity to reflect on education in the past for a better understanding of education in the present. It should be noted that this chapter was previously published in the format of an article as the first publication in the Revista Caderno Pedagógico volume 21 number 13.

EDUCATION OF PRIMITIVE MAN

Varieties of the human species have been around for at least half a million years. Over the past six or five hundred thousand years, various groups of food gatherers and hunters have lived scattered over the wide expanse of the earth. But it was only in the last six or eight thousand years that some men began to dedicate themselves to agriculture, on the banks of the great rivers.

The education of primitive peoples consisted of promoting the adjustment of the child to his physical and social environment through the acquisition of the experience of past generations. A fact that can still be observed today among the indigenous people of the

upper Xingu (Kuarup), the Papuans of New Guinea, the Australian aborigines, the Bushmen of South Africa and Namibia or the Inuit of Greenland.

Among primitive peoples the child acquires the necessary knowledge through imitation of the activities of adults, first unconsciously and then consciously. The importance of hunting and animals was depicted in paintings at the bottom of caves, in turn, accompanied by magical-religious ceremonies designed to ensure the success of the hunter and the abundance of the game. The famous painting of the masked "sorcerer" from *Trois Fréres*, supports such an interpretation. These initiation ceremonies have special educational value in the following aspects: moral, social, political and religious.

> When acting, man imitates the gods in the rites that make the primordial myths present, that is, each one repeats what would have happened to gods at the beginning of time, Only in this way does the seed sprout from the earth, women become fruitful, trees bear fruit, day follows night, and so on (ARANHA, 2005, p.26)

Primitive peoples believed that the power of their technology was limited and resorted to special techniques of worship or magic and the religion that we now call animism, that is, the belief that everything has a soul (trees, rivers, bows and arrows, etc.). Hence the treatment given to the dead, who were carefully buried with their belongings by Neanderthal man and other peoples of the Upper Paleolithic. Thus, it becomes necessary to learn the methods that will "appease" the world of spirits, which constitutes the most important part of education.

The first teachers were, initially, the classes formed by the heads of family groups. Later, instruction began to be given by priests (shamans) who became the first professional teachers, thus causing the proliferation of myths and ceremonials of complicated social and kinship rules as can be observed in contemporary indigenous societies.

EDUCATION IN GREECE

Greek education gave more opportunity to individual development, what we call today liberal education. However, the educational processes were separated according to social classes. In Sparta, only Spartans, who made up just under half of the population, had the right to education. In Athens, only free men, who corresponded to 10% of the population, had access to education.

For the class of rulers there was a school that prepared for "thinking" (politics) and "doing" (weapons). The workers were offered no school, but training on the job, through observation and imitation of the activities of other adults. For the excluded classes (slaves and foreigners), no school and no training.

> The pedagogical ideal can no longer be the same for everyone; not only do the ruling classes have very different ideals from those of the dominated class, but they also try to make the working mass accept this inequality of education as an inequality imposed by the *nature* of things, an inequality, which it would therefore be madness to rebel against. (PONCE, 2005, p. 36)

Individuals in the ruling class are warriors in their youth and politicians in their old age. The Iliad and the Odyssey, poems attributed to Homer, portray this model of heroic civilization. The Teachings of Chiron (Hesiod) constitute a patrimony of peasant wisdom and morality, but unfortunately few fragments have come down to us. The teachings contained in the Homeric poems of the Archaic period reappeared in Greek education through music and gymnastics.

Lycurgus (9th century BC) organizes the State and Education in Sparta. Education becomes the task of the State, which entrusted the education of boys to a magistrate. The goal of education in Sparta was to form the ideal soldier, obedient to the laws, with courage and physical perfection.

In other Doric cities and Crete, education was also state-owned. From the Hellenic periphery to Magna Graecia, schools of philosophers emerged. The School of Pythagoras (XVIII century) VI BC) paves the way for the education of young people as a foundation for democratic societies, but these schools were neither public nor state-owned. In Athens, the Legislator Solon presents to the court the text of the law that deals with Athenian education, whose ideal was the complete formation of the citizen (physical and intellectual).

With Greek alphabetic writing (5th century BC), the figure of the master of the letters of the alphabet appears alongside the masters of gymnastics and music. During this period, the State began to ensure personal freedom for all free citizens, creating conditions for the development of education. The new rhetorical education for saying and doing is now transmitted through letters. The child is educated by his parents, who are nurtured and pedagogue (slave who accompanies the child to school); by the grammarian; by the sitharist and pedophist and by the city in learning the laws and duties of Citizens.

Music and gymnastics were reserved for free men, worthy of these teachings. Grammar was usually taught by a pedagogue (slave or freeman who fell from grace due to debt or war). The punishment of the students was frequent on the part of the masters. There were also cases in which teachers were assaulted by students. The situation of grammar teachers was dire, as the act of teaching in exchange for money was considered undignified. Hence the criticism of the Sophist philosophers who were itinerant and taught for large amounts.

Plato distinguished between private education (family) and public education (polis). Aristotle informs us that at the end of the fourth century B.C., in most Greek cities, education was private, but it was favorable to public schools. Throughout the Greek world, the school evolves thanks to financial contributions from individuals, cities or sovereigns. The learning of trades, mechanics and medicine also had a great development in this period.

With the dismemberment of Alexander's empire, Greek civilization spreads throughout the empire. From the second century B.C. onwards, education will reach not only free children, but girls, the poor and even slaves. Several libraries are created, especially the one in Alexandria. Thanks to the works of the Greeks, knowledge becomes universal.

EDUCATION IN THE MIDDLE AGES

With the dismemberment of the Western Roman Empire and the emergence of the barbarian kingdoms (6th century AD), there is the gradual disappearance of the classical schools and the emergence of the Christian school (episcopal and cenobitic).

There was a cultural impoverishment with the loss of classical culture, which came to survive only in the scrolls of monasteries. Pope Zenobius in the year 418 A.D. created the first religious schools for priests to learn to read before teaching. The school model was that of the synagogue of the Hebrews.

Parents gave their children to be educated in the priesthood. In the monasteries there was no distinction between manual and intellectual labor. Educational discipline was severe and punishments were frequent.

Due to the differences between Christianity and Greek and Roman knowledge, various priests occupied different positions regarding the teaching of classical texts. The early Christian Church turns its attention to the moral education of its members. We can highlight in this period the work *De magistro* de Santo Agostinho.

Later, the schools were organized by the bishops and were called cathedral schools. They were intended to prepare the clergy for the Church. Due to the conquest of new souls to the priesthood, there was a fall of prejudice against the instruction of the poorest. The increase in the number of monks and abbots contributed to the maintenance and copying of manuscripts and the condensation of Greek and Roman knowledge into the Seven Liberal Arts: *Trivium* (Grammar, Dialectic, and Rhetoric) and *Quadrivium* (Arithmetic, Geometry, Music, and Astronomy). (Manacorda, 2006)

However, the culture that the coenobia offered to the oblates and the bishoprics and parishes to the clergy and monks were small compared to the Greco-Roman period. And it was not uncommon for there to be illiterate bishops and priests.

According to Aranha (2005), scholasticism was a movement that emerged during the Middle Ages and was concerned with demonstrating and teaching the agreement of reason (Greco-Roman culture) with faith (Christian culture). St. Thomas Aquinas was the greatest exponent of Scholasticism, he took advantage of the contributions of classical authors for the benefit of faith. His work, the *Summa Theologica,* is the apex of this movement.

According to Aranha (2005, p 73) "in the golden period of Scholasticism (twelfth and twelfth centuries), theologians seek to support faith in reason, in order to better justify beliefs, convert non-believers and even combat infidels".

In the cities, parishes and coenobia are the new schools for children of humble origins. The most qualified are sent to the canonical colleges (episcopal schools) responsible for the formation of the clergy.

At the end of the 7th century, Charlemagne, King of the Franks, acclaimed Emperor of the West by the pope, welcomed intellectuals into his court and promoted a rapid cultural renaissance, assuming education as a duty of the State, despite being exercised by the Church. Charlemagne entrusted the education of his sons to learned clerics to be instructed in letters, but he did not neglect to train them in hunting and horseback riding, an education reserved for nobles.

As for the artisanal trades: goldsmiths, tailors, carpenters, carpenters, shoemakers, etc..., they continue to exist in the period, but their teachings continue to be transmitted from father to son (master to disciple).

With the Crisis of the Carolingian Empire, the Church began to have control over the right to school, extending education to the poorest in the parishes. If not the letters, at least in Christian doctrine. It also allowed clerics to teach outside the walls of cities, castles and monasteries, which helped to free the masters from feudal rule. These wandering masters are the ancestors of the goliards.

The free masters taught the Seven Liberal Arts of the *trivium* and *quadrivium*. But schools of other disciplines emerged, such as Medicine, Jusrisprudence, and Theology in the monasteries.

Goliards were traveling clerics who gathered to hear other masters give lectures on their art. Initially they were condemned by the Church, as they often left the monasteries without authorization. Later they began to be protected, both by the Imperial Power and by the Church.

At the end of the Middle Ages, Universities appeared, with the initial name of *Studium generale*. At the end of the fourteenth century they are called *universitas litterarum*. Naples, Paris, Bologna, Salermo, Oxford, Vienna, and Salamanca are important universities that emerged during this time. They were the first examples of truly democratic organizations.

EDUCATION IN THE PROTESTANT REFORMATION AND THE COUNTER-REFORMATION

Religious reform and modern science contributed to the disruption of the existing political balance between Church and State, as a result of the emergence of new ideas and new educational facts that heralded modern times.

The religious reform divided Christians into Catholics and Protestants, provoking political, social, cultural, and educational changes, accelerating the renewal of the Catholic Church, which reacted with the Council of Trent, the Tribunal of the Holy Inquisition, and the Society of Jesus.

In Protestant Germany, Luther contributed to the liberation of education from the Church, expanding access to school and making attendance compulsory. The instruction was not only aimed at continuing studies, but also at work.

Luther advocates a new school that is capable of carrying out in three years an educational program that the clerical school carried out in a lifetime. He encouraged the use of the vernacular language. The objective of education is centered on its social utility, that is, to train men capable of governing and women capable of taking care of the house. A realistic education focused on practicality. He tries to reconcile productive manual labor and intellectual labor. According to Manacorda (2006, p. 196) for Luther "even if there were neither soul nor hell, we should still have schools for the things of this world".

The Catholic Church did not remain immobile to Protestant advances. The Counter-Reformation is characterized by the uncompromising defense of Catholics over the privileges and right to education. The Council of Trent condemned various kinds of books, including heretical ones (Luther, Calvin, Zwingli, and the like). *The Index librorum probitorum* prevented any possibility of the books being printed.

The Council of Trent also tried to reorganize the schools of cathedrals, monasteries and convents, regularizing the study of grammar, Sacred Scriptures and theology. As for the Jesuit School, it was made up of an efficient educational system, especially secondary and higher education, aiming at the formation of clergy and leaders

EDUCATION OF THE BOURGEOIS MAN

The bourgeois revolutions and the consolidation of industrial capitalism brought about profound changes in the political, economic and social life of Europe at the beginning of the nineteenth century. However, alongside the bourgeois class there is another, the modern industrial proletariat.

With the advent of the Industrial Revolution, the ways of producing material goods transformed society. Large masses of workers are moved from the countryside to the cities to work in the factories, provoking social strife and the extinction of the old arts and crafts guilds.

The workers lose all the knowledge of the handicraft trades that they obtained through apprenticeship (master-disciple) of the old guilds and start to occupy themselves with only a part of the productive process (division of labor). But the pace of change and progress in factories required skilled labor. Such a need will be the dominant theme of modern pedagogy: the instruction of the technical-professional, provoking the emergence of a school for the poor, alongside the schools of the rich. Thus, children's schools emerged in England, next to the factories. Initially of a welfare nature and later of a basic education character.

In Germany, Froebel created the *Kindergarten*, the first kindergartens) with educational activities, forms of expression and great importance to children's self-activity. These schools spread to Europe and the United States.

Elementary schools are divided into two: those of mutual teaching (popular class) and those of Pestalozzian tendencies (bourgeois class).

Pestalozzi understood education as the main means of social reform, as long as the nature and development of the student were respected.

As for technical and professional education, the first Mechanical Institutes began to be created in England. Alongside the Universities, there are the Higher Schools of Engineering. We are also witnessing the rebirth of physical education taught in gymnasiums and military schools, which culminated in the emergence of the modern Olympics.

In the second half of the nineteenth century, the entire education system, from elementary to higher, was already state-owned in most of Europe. Meanwhile, in the countryside and in industry, education gradually moved from private to state-owned, demonstrating the State's concern with the training of qualified labor and meeting the demands of the working classes who wanted to study.

This system of general education develops first in Germany, and then appears in France. In England and the United States, education took a little longer to be transferred from religious congregations to state power.

The single school for all is beginning to take hold in Europe. Education becomes public, free and compulsory, also meeting the needs of the working classes. However, there were still two schools, one of quality for the bourgeoisie and one precarious for the proletariat

SOCIALIST EDUCATION

At the beginning of the nineteenth century, a new wave of educational utopias emerged, which were closely related to the industrial and political revolutions. All of them deal with the division of labor in the factory, the terrible living conditions of the workers, the opposition between manual and intellectual labor.

Saint-Simon, in 1825 speaks of a new "Christianity" and his school is constituted into a church. It is the typical example of a utopia of strong religious inspiration. Fourier proposes a harmonious education that exalts spontaneity, play and the diverse experiences of children. He also defends the coincidence between individual and collective interest. Etienne Cabet, in 1840, defended an elementary education that would encompass all the knowledge to achieve a specialized education. Robert Owen, an English industrialist and philanthropist, instituted a system of instruction and organization of work, with the aim of restoring culture and human dignity to the workers. (PONCE, 2005).

Marxist socialism, unlike the utopians above, presents itself as the antagonist and heir of the bourgeois tradition. For Marx, socialism does not reject, but appropriates, all the ideal and practical conquests of the bourgeoisie in the field of education. He adds, however, the criticism of the inability of the bourgeoisie to carry out its programs.

In the Communist Manifesto of 1848 the union of education-work and free public education for all children is explicit. Marx did not think, however, of a vocational education for the children of the working class, but of a universal vocational education. An education in scholastic structures and productive structures and a technological instruction that could provide a knowledge of the sciences and practical capacity in all areas of production.

Marx seeks the union between education and industrial work, seeking to transform the old social reality, creating a new reality where its individuals develop all their capacities, that is, the omnilateral man.

In 1897, Lenin already said that it was not possible to conceive the ideal of a new society without combining the instruction of the work of a new generation with the isolated instruction of work.

In October 1917, the Soviet Union became the first country to have a socialist experiment. With the establishment of revolutionaries in power, the world is divided into two blocs: the capitalist one led by the United States and the socialist one led by the Soviet Union. Socialist parties emerged in several countries around the world, concerned with transforming society, making it more just and egalitarian.

During the socialist revolution, Lenin and his wife Krupskaja developed a "single school of work" to guide the entire development of the education system of the Soviet Union and other socialist countries.

However, it was up to Makarenko, who elaborated an original, anti-Rousseauian pedagogy, to reform Soviet education, based on productive work and the supremacy of the "collective" over the individual, discipline and human solidarity.

After the 2nd World War, we witnessed technological progress and the maturation of the consciousness of the working classes, especially on the part of students, as well as inequalities in educational relations and the social oppression of capital over workers.

CONCLUSION

During this brief "journey" through the History of Education throughout some periods of human history, we realize how much it was used as a symbol and source of power. Education has always been characterized by its elitist character.

In primitive societies, education was reserved for a small group of people (shamans, sorcerers, etc.) who used it in magical-religious ceremonies (animism), transmitting the customs of the tribes to the next generations. Generally the practices of these rituals were transmitted from parents to children. For the other members of the tribe, the only education was the imitation of the activities performed by adults (hunting, fishing, etc.).

In Greece, despite the great intellectual development (Philosophy and art), rationality and political and moral freedom, we find that education continues to be exclusive to the dominant classes, since only free men had the right to it, that is, only 10% of the population. The rest of Greek society had only a training to perform manual and agricultural work, usually through observation and imitation.

The division between intellectual work, reserved for members of the polis (free men), and manual work, reserved for the poor, slaves and foreigners, becomes evident. However, with the expansion of Alexander's Empire (which went from Greece to India and from

Macedonia to Egypt), and its subsequent disintegration, it provided the expansion of Hellenic culture throughout the territory of the Empire, causing the emergence of many libraries, including that of Alexandria. Instruction from that moment on will not only affect free children, but girls, the poor and even slaves. Greek knowledge becomes universal.

With the fall of the Western Roman Empire, culture and classical knowledge (Greco-Roman) began to decline in Europe. There was a cultural impoverishment of the whole society. However, classical culture survives in the monasteries that preserve it in the Seven Liberal Arts (*Trivium and Quadrivium).* However, most of the population did not have access to letters and received only an education in religious doctrines.

The Church began to instruct the children of the rulers, the feudal lords, also concerned with the morals of the members of the clergy. Education remains reserved for a small portion of the population, destined for the government and administration of feudal society. There was, however, a greater appreciation of manual work in the monasteries, through the monk-craftsmen, however, this work was still reserved for the subaltern classes and their instruction was of a family nature passed from father to son.

Due to the development of the sciences, scholasticism emerged, which sought to unite classical knowledge for the benefit of Christianity, keeping education under the exclusive tutelage of the Church. But history is dynamic and education begins to free itself from the shackles of the Church and feudal lords, to the extent that monks are allowed to teach outside monasteries and city walls. Thus, at the end of the Middle Ages, the first universities emerged through these traveling monks who taught the Seven Liberal Arts.

With the end of the Middle Ages, science and the discovery of new continents accelerated the religious reform of the Catholic Church. Faith was no longer the spring that drove society. Gunpowder, the printing press and the caravels provided the enrichment of a class of merchants who allied themselves with the sovereigns of the new European kingdoms.

In Protestant Germany, education freed itself from the "shackles" of the Catholic Church and gradually passed under the tutelage of the State. Education began to have a practical objective, books began to be printed in the vernacular language (German and other languages), greater freedom for the propagation of new discoveries in the sciences and the valorization of profit (forbidden by the Catholic Church). Access to schools is expanded and attendance becomes compulsory, providing great development to Protestant countries.

The Catholic Church reacted to Protestant advances with the Counter-Reformation, the Council of Trent, the Society of Jesus and the Tribunal of the Holy Inquisition. The Jesuit

School was a model of education in Catholic countries, emphasizing secondary and higher education. The Catholic Church also reorganized the cathedral schools, convents and monasteries.

Bourgeois revolutions and the consolidation of industrial capitalism bring about profound political, economic and social changes, but good quality education remains the prerogative of the ruling classes. At the end of the eighteenth century, the bourgeois ideals of universality, gratuitousness, statehood and cultural renewal were still restricted to a small portion of the population. The workers, who comprise the great majority of the population, are now deprived of the knowledge of their handicraft and agricultural trades, and are now occupied with only a part of the production process of the factories.

The great mass of workers lives in absolute misery, but on the other hand, the demand for qualified labor increases, leading to the emergence of schools for the poor, alongside the schools of the rich. Thus, the first elementary schools in England emerged. In Germany, kindergartens spread across Europe and the United States. Technical-professional education is boosted with the creation of the Mechanical Institutes. And alongside the Universities are the Higher Institutes of Engineering. By the end of the 19th century, almost the entire education system in Europe was state-owned. The single school becomes public, free and compulsory. The Catholic Church loses much of its influence in the educational area.

In the first half of the nineteenth century, a wave of new utopias emerged in Europe that addressed the division of labor in factories and the living conditions of workers, but it was with Marx that socialism presented itself as an antagonist of the bourgeoisie.

Marx did not reject the conquests of the bourgeoisie in the field of education, but launched criticism of its inability to carry out its programmes. It seeks the union of scholastic instruction with the instruction of work, creating a new reality, capable of developing all the potentialities of its individuals, the omnilateral man.

However, the first socialist experience only really occurred in 1917, with the arrival of revolutionaries to power in the Soviet Union. It is up to Makarenko to elaborate a pedagogy that will reform education in the Soviet Union and other socialist countries, based on productive work and the supremacy of the collective over the individual.

We had the opportunity to verify the various characteristics that education acquires through the various historical periods addressed, but we believe it is of fundamental importance to question the school model that predominates in our current society.

We observed that the school for a long time developed a role of forming the majority of citizens for the world of work, able to occupy their space in a static and finished society,

where education should only be passed on, taught, without the possibility of a new (re)reading of History. This is the model of school that predominates in Brazil, committed to the interests of the dominant classes, reactionary and ideologically controlled to reproduce the inequalities present in the bourgeois ideals of the nineteenth century.

History is not static, it is constantly changing. Paradigms that were fiercely defended, today give way to new paradigms, to new worldviews, which question the relationships between the various systems that make up our society. These cultural, social, economic and political changes end up being directly reflected in the school, as it is considered an agent that enables the transformation of man as a social being, through education.

Faced with a world characterized by constant and rapid changes, it is necessary to change the school and education, based on two central ideas: the student as the center and subject of education itself and the active methods in which the student himself builds knowledge. In this way, enabling the full development of the human personality, strengthening respect for human rights and individual and collective fundamental freedoms, as well as tolerance and friendship between peoples and respect for minorities.

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THE IDENTITY OF RURAL PRODUCER AND THE INFLUENTIAL CATEGORIES IN THE SUCCESSION PROCESS

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ABSTRACT

The objective of this study was to identify, in the literature, the categories related to the identity of rural producers that can influence the succession process of rural properties. To this end, a systematic review of 32 scientific articles selected from the Scopus, Science Direct, and Web of Science databases was carried out. The results showed that the identity of rural producer has been related to the agricultural profile; rural tourism; gender in agriculture; health care; agricultural practices; successor identity; attachment to the land; and aging of the farmer and manifest resistance to changes in their own lives and in the property. In addition, the categories gender in agriculture, identity of successor; attachment to the land; and aging of the farmer presented more relevant elements for a rural succession process, in which the difficulties and obstacles of the process can be explained by the strong identity of rural producer present in the event.

Keywords: Identity in agriculture. Rural succession. Rural successor. Rural success.

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INTRODUCTION

Agriculture is an activity that has been created, recreated, adapted and developed over four thousand years, the last two centuries have been marked by major changes for society, which has given this activity a social and economic importance for countries (JONES; GARFORTH, 1998). The United Nations projects that by 2050 the world population will reach approximately 10 billion people, which points to sustainable growth as an agenda for strategic discussions (Food and Agriculture Organization of the United Nations – FAO, 2018).

Land use is based on the relationship between economic development and environmental conservation, which demands a balance between current performance and preservation for future generations (dos Santos, et al, 2024). In this context, farmers play an important role in planning the implementation of sustainable practices and continuing food production (FAO, 2019). However, transformations that should not be ignored are social changes, with the joining of minority groups in important spaces and the impact of technology on new generations (Moraes, Salvador and Jacometti, 2024). Agriculture faces worldwide, in addition to population growth, impasses such as changes in dietary patterns, industrial development, climate change, urbanization and consequently migration (FAO, 2017).

Osawa et al. (2016) claim that the discontinuity of rural properties may affect food production in the future, compromising global demand. Strategies for farmers to remain in the business are related to inserting the rural property in a production system that contributes to global and local development, which reflects a desire to maintain traditional cultures based on socially constructed identity (STENBACKA; BYGDELL, 2018).

However, continuing production and maintaining rural property traditions is linked to the need to identify an individual who later goes through the process of rural succession, that is, takes over the management of the property (Cassidy; McGrath, 2014). The authors add that keeping the farm in the family 'goes deep' into identities characterized by strong emotional bonds.

Thus, the process of rural succession is marked by the influence of social and economic factors (LEONARD et al, 2017); psychological factors (BURTON; WALFORD, 2005); patterns of behavior and attitudes (CONWAY et al., 2016); pressure from people close to them (MORAIS et al., 2018); identity created by the successor (Cassidy; McGrath, 2014). Therefore, it must be developed in the long term, so as not to cause a critical event for the families (FISCHER; BURTON (2014). In addition, because they operate in a unique context that differs from family businesses in other branches, it opens space for research

that brings results regarding future strategies and success of rural properties (SUESS-REYS; FUETSH, 2016).

In order to better investigate the relationship between the identity of rural producer and the succession process, this review has the following research question: What are the categories, present in the literature, that are related to the identity of rural producer? The objective is to identify, in the literature, the categories related to the identity of rural producers that can influence the succession process of rural properties.

METHODOLOGICAL PROCEDURES

This article consists of a systematic review of the literature, adapted from Brereton et al. (2007) who defined three major processes: the plan, the conduction and the documentation. For this, some main steps were followed: define the research question and objective; determine databases; define search terms/descriptors; establish search criteria; identify pre-selected studies; initial analysis and; final analysis of the selected articles.

The searches were carried out in (1) databases: Scopus, Web of Science and Sicence Direct. Searches (2) were performed on the title of the article or abstract or keywords (*Article title, Abstract, Keywords)*. The terms used in the searches (3) were: *"farming identities"; "farmer identity"; "successor identity" and farm; "identity related" and farm; "identity formation" and farm; "identity related" and farmer; "identity formation" and farmer;* and *"self-identity" and farmer*. Only (4) scientific articles, articles in English, were chosen, there was no determination of the time period and rigor and relevance were valued (SUESS-REYS; FUETSH, 2016).

The selection of databases (1) for the searches was based on their relevance to science, highlighting the role of bringing together peer-reviewed productions from the most diverse areas. The criteria adopted for the searches (2) were to ensure that the terms/descriptors were clearly present and easy to identify. The defined terms/descriptors (3) are the ones that best match the theme and objective of the article. In addition, the use of quotation marks (") ensured that the terms were side by side in searches. The initial results indicated 275 articles according to the database and term/descriptor. A total of 126 articles were pre-selected, for this, the abstracts of each one were explored in an attempt to classify those that showed content for the proposed objective. The pre-selected articles were listed followed by the flagging of duplicate articles, by access to these articles in full. For the initial analysis, 58 articles were selected, based on titles, abstracts and keywords. A previous reading was carried out to fit the articles into categories of analysis. In this phase, 26 articles were excluded due to unavailability or the focus on the theme not being

significant or because they did not present rigor and relevance previously defined as criteria. The research then had 32 articles for reading, interpretation and categorization

The searches were carried out from 04/18/19 to 05/04/19. The analysis was carried out on the results/discussion/final considerations of the articles. To aid in the analysis, the VOSviewer and Excel® software were used.

DISCUSSION AND ANALYSIS OF DATA

In possession of the 32 articles on the identity of rural producers, a division into categories was carried out, an interpretation was made to group the findings and the identification of categories that can influence the succession process. Chart 01 gathers information from the articles analyzed in the review, indicates the categories in which they fit, and then presents the discussion of their results.

Chart 01: Conceptual framework of the analyzed articles

Article	Author(s)	Categoria (s)	Study Location
Beyond the Economic: Farmer Practices and Identities in Central Illinois, USA	Wilson *et al.* (2003)	• Agricultural Practices	USA
Injecting social psychology theory into conceptualisations of agricultural agency: Towards a post-productivist farmer self-identity?	Burton e Wilson (2006)	• Agricultural Profile	United Kingdom
Tracing the process of becoming a farm successor on Swiss family farms	Mann (2007)	• Successor Identity	Switzerland
Public perceptions of hybrid poplar plantations: trees as an alternative crop	Neumann *et al.* (2007)	• Attachment to the Earth	Canada
Farm diversification into tourism e Implications for social identity?	Brandth e Haugen (2011)	• Rural tourism	Norway
Farming and tourism enterprise: Experiential authenticity in the diversification of independent small-scale family farming	By Domenico and Miller (2012)	• Rural tourism	England
The Emergence of Rural Support Organisations in the UK and Canada: Providing Support for Patrilineal Family Farming	Price (2012)	• Healthcare • Gender in Agriculture	United Kingdom and Canada
Succession planningand temporality: The influence of the past and the future	Gill (2013)	• Ageing of farmers • Attachment to the Earth	Australia
Healthy ageing: Farming into the twilight	Rogers *et al.* (2013)	• Ageing of farmers	Australia
Expand or exit? Strategic decisions in milk production	Fergunson e Hansson (2013)	• Agricultural Practices	Sweden
Decoupling farm, farming and place: Recombinant attachments of globally engaged family farmers	Cheshire *et al.* (2013)	• Successor Identity • Attachment to the Earth	Australia
Reconstructing the good farmer identity: shifts in farmer identities and farm management practices to improve water quality	McGuire *et al.* (2013)	• Agricultural Practices	USA
Capturing the Multiple and Shifting Identities of Farm Women in the Northeastern United States	Brasier *et al.* (2014)	• Gender in Agriculture	USA

Farmer Identity in Multifunctional Landscapes: using a collective identity construct to explore the nature and impact of occupational identity	Groth *et al.*, (2014)	• Attachment to the Earth	Australia
Farmer identity, ethical attitudes and environmental practices	Sulemana and James (2014)	• Agricultural Profile • Agricultural Practices	USA
In search of legitimacy under institutional pressures: A case study of producer and entrepreneur farmer identities	Stenholm and Hytti (2014)	• Agricultural Profile	Finland
Tillage practices and identity formation in High Plains farming	Strand *et al.* (2014)	• Agricultural Practices	USA
Understanding Farm Succession as Socially Constructed Endogenous Cycles	Fischer e Burton (2014)	• Successor Identity	Scotland
The development and validation of a collective occupational identity construct (COIC) in a natural resource context	Groth *et al.* (2015)	• Attachment to the Earth	Australia
Performing Gender and Rurality in Swedish Farm Tourism	Cassel e Pettersson (2015)	• Rural tourism • Gender in Agriculture	Sweden
Farmer identities and responses to the socialebiophysical environment	McGuire *et al.*, (2015)	• Agricultural Profile	USA
A Social Identity Analysis of Climate Change and Environmental Attitudes and Behaviors: Insights and Opportunities	Fielding and Hornsey (2016)	• Agricultural Practices	Not specified
Soil as a key criteria in the construction of farmers' identities: The example of farming in the Austrian province of Burgenland	Wahlhütter *et al.* (2016)	• Agricultural Practices	Austria
A good farmer pays attention to the weather	Morton *et al.* (2017)	• Agricultural Profile	USA
Assessing Managerial Efficiency of Educational Tourism in Agriculture: Case of Dairy Farms in Japan	Ohe (2017)	• Rural tourism	Japan
I Would Go if My Arm Were Hanging off": A Qualitative Study of Healthcare-Seeking Behaviors of Small Farm Owners in Central New York State	Droullar *et al.* (2017)	• Healthcare	USA
No one to fill my shoes: narrative practices of three ageing Australian male farmers	O'Callaghan e Warburton (2017)	• Healthcare • Ageing of farmers • Attachment to the Earth	Astray
The 'Good Farmer': Farmer Identities and the Control of Exotic Livestock Disease in England	Naylor *et al.* (2018)	• Agricultural Practices	England
Joint Farming Ventures in Ireland: Gender identities of the self and the social	Cush *et al.* (2018)	• Gender in Agriculture	Ireland
Educational tourism in agriculture and identity of farm successors	Ohe (2018)	• Rural tourism • Successor Identity	Japan
Empowered by stigma? Pioneer organic farmers' stigma management strategies	Let's go to the hill *et al.* (2019)	• Agricultural Practices	Finland
Harnessing the power of identity to encourage farmers to protect the environment	Lequin *et al.* (2019)	• Agricultural Practices	Not specified

Source: Prepared by the authors (2019)

An initial reading to differentiate the articles into categories allowed us to relate the identity of rural producer with the agricultural profile; rural tourism; gender in agriculture; health care; agricultural practices; successor identity; attachment to the land; and ageing of the farmer. 'In general, the articles present different findings on the identity of rural

producers, in various parts of the world, which made it possible to interpret them in different realities and also, according to the category framed (an article can appear in different categories). The main results and the discussion of these categories are presented in the following subsections.

CATEGORIES RELATED TO RURAL PRODUCER IDENTITY

Agricultural Profile

The agricultural profiles were defined in the literature according to the mode of production adopted in the rural properties. McGuire *et al*. (2015) state that farmers' identity is a way of understanding how their beliefs deduce the practices that are employed and their involvement in improving and protecting systems inside and outside the farm. And yet, according to Morton *et al*. (2017) influence management decisions, how they adapt in relation to environmental conditions and the type of management employed, that is, in the strategies used in rural properties.

Farmers' identities are constructed based on each person's attitudes, beliefs, and experiences, based on family, community patterns, education, previous agricultural practices (MCGUIRE *et al*., 2015), and geographical, cultural, structural, and economic factors of a location (BURTON: WILSON, 2006). The social context can also affect identity and this situation awakens multiple identities in farmers (STENHOL; HYTTI, 2014; MCGUIRE *et al*., 2015).

With the analysis of the articles, the profiles presented by the authors were: 1) Productivist: farmers prioritize production efficiency to obtain high yields and profits in view of the way rural properties operate (STENHOL; HYTTI, 2014; MCGUIRE *et al*., 2015; MORTON *et al*., 2017); and use chemical technology and up-to-date equipment (MCGUIRE *et al*., 2015). 2) Conservationist: farmers have values that reflect long-term goals and actions (MORTON *et al*., 2017), offering protection and resilience to the resources used, while keeping the land productive and profitable (MCGUIRE *et al*., 2015; MORTON *et al*., 2017). 3) Civic: farmers have a leadership role and responsibility in the community, help friends and neighbors, and share knowledge and equipment, to be an active, civic, and engaged member (MCGUIRE *et al*., 2015). 4) Naturalists: are farmers who they balance agricultural production with a strong interest in wildlife (flora and fauna), being hunters/fishermen or even observers of nature (MCGUIRE *et al*., 2015). 5) Entrepreneur: farmer seeks to become bigger and better, regardless of social norms and the institutional environment. They use the experiences of others to evaluate the best practice to achieve

growth, and as they do not follow the same path as other farmers, they consider achieving a competitive advantage for the rural property (STENHOL; HYTTI, 2014).

Sulemana and James (2014) established that identities can be contrasted between conservationists (protecting the environment) *versus* productivists (economic growth and job creation); optimists (bright future) *versus* pessimistic (bleak future); and technologically oriented (utilization of new technologies) *versus* Focused on tradition (emphasizes tradition), this representation is due to the vision they provide of the environment, the future and technology.

The renowned research by Burton and Wilson (2006) identified changes in agricultural regimes, with a transition from the productivist mode to the post-productivist mode and to multifunctionality. In the productivist mode, there was a growing dependence and intensification of agriculture and conviction in technical approaches to land management, the role of production is emphasized and is constituted by the identity of agricultural producer and agribusiness person; in the post-productivist mode, there was a growing consideration of environmental factors and diversity of approaches to land management, the role of the environment is emphasized and it is constituted by the identity of conservationist and diversifier; while in the multifunctional mode farmers can maintain all identities simultaneously and when a certain situation arises choose the most appropriate one, it is emphasized that all identities can exist simultaneously (BURTON: WILSON, 2006).

In short, it was possible to perceive that the types of identities of farmers are formed by the elements that make up the social context in which they are inserted, reflected in the way of conducting the rural property. In addition to monitoring changes in agriculture, personal and economic interests and environmental concerns.

Health Care

For the discussion of the identity of rural producer linked to health care, O'Callaghan and Warburton (2017) identified that farmers are emotionally tough, resistant and independent, which makes up traits of a masculine strength that can result in isolation, difficulties and poor mental and physical health. Price (2012) adds that because farmers consider agriculture as their home, their lifestyle, involving their family and all their experience, men can harm their mental health and even transmit stress to their wives.

The act of a farmer seeking health treatment can indicate a factor that compromises identity and is capable of hurting the pride of being a farmer. In addition, pressures and commitments to protect agriculture take precedence over other priorities, including how to

use their time and money. The effective search for medical care often occurs due to the worsening of perceived symptoms; by the insistence of their spouses; and, by increasing age, so that prevention is allied to the long-term continuity of the rural property (DROULLARD *et al*., 2017).

With these findings, it was possible to identify that health care issues are delicate for farmers, as they represent a way of hurting a masculine identity based on traits of strength and pride.

Rural Tourism

Rural tourism is considered a relatively new activity in agriculture, which aims to awaken the development of tourism practice (OHE, 2017), be a new opportunity for rural producers (OHE, 2018) and enable innovation and competitiveness in the agricultural sector (CASSEL; PETTERSSON, 2015).

Ohe (2017) identifies that this change in activity presents obstacles that are related to the identity of rural producer and can affect more traditional agricultural identities (DI DOMENICO; MILLER, 2012). There are farmers who consider the diversification of activity as a betrayal of the agricultural profession, which puts them in a struggle with their identity (BRANDTH; HAUGEN, 2011). This makes it essential, then, that there is a change in the identity of conventional rural producer, for a management innovation to occur, that is, a change from the subject immersed in the agricultural production environment, to the subject who conducts a new activity (OHE, 2018).

Ohe (2017) investigates educational tourism in agriculture, highlighting that there is an association between managerial efficiency and farmers' identities, since these motivate different behaviors, use of agricultural resources and acquisition of necessary skills. Ohe (2018) lists measures such as professional training, focusing on learning administrative skills, building a social learning network, and involving women in activities because they are able to promote the necessary identity change in young people.

The way farmers rebuilt themselves with rural tourism as work and sustained their identities was identified by Brandth and Haugen (2011) exposing that the importance of the service that will be offered on the rural property lies in taking good care of the guests, telling stories of their lives, sharing knowledge about agriculture, the type of food served (homemade food), in the decoration of the place, in the activities available (fishing, hiking), in the clothing used, among other actions that contain rooted agriculture. Thus, the previously built agricultural identity, heritage and culture, becomes the product and main attraction and also reinforces rural tourism.

Cassel and Pettersson (2015) point out that the separation between tourism and agricultural production is reinforced by gender differences (discussion in section 3.3.4). In addition, they point out that the connection between agriculture and tourism becomes important to provide a high-quality tourist experience, which transforms the rural property into a place of consumption of experiences and develops the rural identities of rural owners, conclusions similar to those of Brandth and Haugen (2011).

The enthusiasm that farmers feel for diversification presented a few reasons: the influence of economic issues as the main reason for accepting that there is really a need to diversify; and lifestyle as a way of keeping agriculture alongside the activity they are involved in, that is, the transmission of the farmers' lifestyle characterizes what they do as important. However, there are farmers who, because they choose to diversify their activity, show resentment, where tourism is seen as inferior and less important. Thus, even though the need for diversification has been verified, the identities previously created in the families of farmers see rural tourism as an unwanted activity (DI DOMENICO; MILLER, 2012).

The discussion around rural tourism has shown that the activity can be a way to transmit the rural lifestyle to people. However, a change in the activity carried out on the rural property can affect the identity of rural producers because, in addition to the difficulty in the preparation necessary to manage a new business, farmers feel unmotivated and resentful in leaving activities carried out and built by previous generations.

Gender in Agriculture

To verify the disparity between the roles played by men and women in agriculture, the articles presented discussions about the performance and space that both have already achieved. When linked to identity, Cush *et al*. (2018) point out that the farmer identity is usually composed of the male figure, who has control of agricultural capital and a position as head of the family.

There seems to be a tendency to recognize and respond to the dominant identity on the farm to a male farmer. These men can adopt a posture of exchanging experiences only with those they sympathize with and have the same way of life. The role of women, on the other hand, often includes working outside the home, helping on the farm, having domestic and maternal responsibilities and even creating an image of 'emotional caregiver', hiding their own needs (PRICE, 2012). In other words, there is a predominance of men as dominant farmers exercising the main activity, while women perform a secondary activity, being unpaid helpers on rural properties, being something natural and incorporated into the culture (PRICE, 2012; CASSEL; PETTERSSON, 2015).

On the other hand, establishing partnerships between men and women on rural properties can be a way for both to own the business. However, for women there is more struggle to gain recognition as farmers in society, because in the face of the rural culture traditionally constituted of patriarchal and patrilineal norms, desire and persistence must be constant. Although the path for women is more arduous, they demonstrate equal capabilities, conquering spaces, sharing efforts and work and also committing themselves within family farming. Women's determination, persistence, work and resilience were the factors that made the necessary change possible (CUSH *et al*., 2018). Brasier *et al*. (2014) They added that women on rural properties can develop various roles, such as working on the rural property, outside it, entrepreneurship, among other activities that allow them to act at different levels and types of involvement, that is, plurality roles on the rural property. Which can put them in a more egalitarian role, sharing business management and decision-making tasks.

The authors identified that for men and women to play a role in agriculture, the paths are different. For men, there is a tradition within families to designate rural property for their care, while women need to conquer space and recognition and also maintain a positive image in society.

Agricultural Practices

The association of farmers' identity with agricultural practices involved a diversity of articles on environmental conservation themes. It was noticed that this discussion takes place due to the conduct of farmers in society, since good agricultural practices of environmental management and conservation are essential for sustainable development (SULEMANA; JAMES, 2014).

In this way, even though they are essential for food production, farmers have come to be perceived as responsible for the negative impacts caused to the environment by their businesses (McGUIRE *et al*., 2013) and as influencers in environmental results and policies dedicated to agri-environmental issues (LEQUIN *et al*., 2019),

Fielding and Hornsey (2016) indicated that conflicts related to environmental issues or resources are associated with the identity of farmers, because, in addition to constituting their values and beliefs (WILSON *et al*., 2003), it is also related to the functioning of the business on the rural property (FERGUSON; HANSSON, 2013) and the adoption of the practices used (WILSON *et al*., 2003),

Among the factors that determine the continuation of non-conservation practices are the guarantee of efficacy, control and yield (WILSON *et al*., 2003); the desire for profit

(WILSON *et al*., 2003; McGUIRE *et al*., 2013); believing that their actions have ethical implications (SULEMANA; JAMES, 2014); and considering that changes are uncertain for business (FERGUSON; HANSSON, 2013);

The adoption of an identity of a farmer concerned with the environment, for McGuire *et al*. (2013), corresponds to the construction of a good rural landowner style, being able to encourage other farmers and share knowledge about the risk taken and necessary attempts, until they gain enough confidence to also incorporate environmental conservation practices on the rural property.

Fielding and Hornsey (2016) add that there is a greater possibility for farmers to act in an ecologically correct way when a group presents norms and people with whom they identify, as social identity will influence attitudes, beliefs and pro-environmental actions.

Regarding the conversion to organic agriculture, the contributions related to the identity of farmers showed the change from conventional agriculture to organic agriculture as a way of establishing a new agricultural identity that involves leaving behind traditional norms, especially the management practices previously used (STRAND *et al*., 2014; WAHLHÜTTER *et al*., 2016; LÄHDESMÄKI *et al*., 2019; LEQUIN *et al*., 2019).

For Lequin *et al*. (2019), it is up to policymakers to encourage future pro-environmental behaviors, either by encouraging or inciting their commitment, so that there is a change in behavior and a change in customs associated with the identity of farmers.

Regarding the treatment of animals, Naylor *et al*. (2018) found that being a good rural landowner involves a complexity of identities: the good landowner who shows concern for the health and well-being of the animals; the good neighboring rural owner who is concerned with preventing the spread of diseases and with the operation of the business; and the good rural owner public that is concerned with portraying good practices to maintain reputation. Thus, the identity adopted involves individual, collective and those outside the sector.

Thus, the findings showed that agricultural practices are associated with the need for changes in the business already consolidated by farmers. The abandonment or not of conventional practices is linked, in addition to the identity of the farmers, to economic and ethical factors, old customs, social recognition, political pressure or even to future concern for the environment.

Successor Identity

Being born and raised on the family's farm strengthens attachment to the land and determines a farmer's identity (CHESHIRE *et al*., 2013). Fischer and Burton (2014) define

involvement in agriculture from an early age as the main factor that contributes to the construction of an agricultural trajectory and the development of a rural successor identity.

Ohe (2018), by emphasizing that experience on the property is a decisive factor for the formation of a successor identity, highlights the learning opportunity as a way to form skills that are necessary for agricultural management.

For a young person to choose to work on the rural property, the introductory phase of this choice presents the predominance of identity in any decision. The identity in favor of agriculture is related to factors such as autonomy, the opportunity to work outdoors, enjoy agricultural work, work with animals, perform non-standard tasks, willingness to work with parents, continue the family tradition, size of the property, number of children, educational level, income potential, sales potential, and attractiveness. These factors are perceived more positively with increasing age, highlighting the willingness to take over, the willingness to work with parents and considering the house on the rural property attractive, as the main reasons (MANN, 2007).

In addition, interest in agriculture is built in the long term, considering family history, sense of place and attachment to rural property as important for the construction of a successor identity. The practice of involving children in the rural property allows them to become aware of the execution of tasks, the importance of each task, the way of carrying it out, the possibility of proposing changes, which indicates a commitment and can build the identity of the successor. In addition, it awakens a feeling of ability to maintain the rural property and of commitment to continue the family tradition (FISCHER; BURTON, 2014).

It can be seen that the construction of a farmer's identity is related to the individual's involvement with the rural property, as early as possible, either by aiming to continue family traditions and/or by considering work in agriculture attractive.

Ageing Farmers

The insertion of farmers in the environment and in the agricultural culture, in addition to shaping their lives, restricts and limits their ability to deal with contemporary changes, pointing to aging as a focus (O'CALLAGHA; WARBURTON, 2017). In the relationship between identity and aging of farmers, retirement itself is a great challenge in everyone's life, however, it becomes more difficult when it involves leaving their home, their land, their community (ROGERS *et al*., 2013). Gill (2013) also points out that the family's past is an important record of its identity, an affirmation of itself and a way to strengthen its place in history, which is why farmers express the desire and need to keep the rural property in the family.

However, the decision to sell or not a rural property symbolizes a challenge that involves a lifetime dedicated to the land and the identity created, which is built by deeply rooted ideological beliefs and social norms of rural masculinity. Finding an alternative for the future causes farmers to feel fear, loss of identity and values. In addition, the lack of a next generation to hand over the management leaves them disappointed, but even so, they show hope for family farming for the future. In short, farmers aim to maintain their identity, even in the face of aging and generational succession challenges (O'CALLAGHA; WARBURTON, 2017).

For elderly farmers, it is complicated to sell the rural property or leave agriculture, as the decision-making related to the management of the rural property is supported by identities deeply rooted in the values that link farmers to the land and to agricultural occupation (ROGERS *et al*., 2013). In addition, the future of rural property comes up against questions about whether agriculture is considered a viable option and who will actually want to take over the rural property (GILL, 2013).

Aging is therefore a challenge, because in addition to the physical wear and tear it causes on farmers, it also makes it difficult for them to manage technological, commercial and market issues in the business world. The search for healthy aging must be based on government support, provoking a cultural change that helps families to assess risks, consider realities and have access to services offered by the government (ROGERS *et al*., 2013).

It was possible to verify that, over the years, management difficulties and the aging of farmers cause concerns about how to continue the business, and they consider the process of leaving the rural property difficult and even so, they want to pass it on to the next generations of the family. It is noted that keeping the rural property in the family is important for its identity and to preserve traditions.

Attachment to the Earth

The construction of a strong connection between farmers and the rural property represents an influential origin of the farmer's identity (CHESHIRE *et al*., 2013). The connection between the identity of the place and the identity of the farmer involves a link with the conquered land and the agricultural landscape (NEUMANN *et al*., 2007; GROTH *et al*., 2015). There is also the influence of factors such as the hours worked on the rural property, the performance of work outside the property, being a member of organizations related to agriculture and considering that the profit obtained by being a farmer is greater

than not by being (GROTH *et al*., 2014) and also by the use of the land and the mode of management (GROTH *et al*., 2014; GROTH *et al*., 2015).

For farmers, their land represents the mode of production for past, present and future generations. A change in land use can affect power relations and thus threaten their identity (NEUMANN *et al*., 2007). Consequently, developing an attachment and sense of belonging to the land makes farmers question how to find an alternative for the future of the rural property (O'CALLAGHA; WARBURTON, 2017). For Gill (2013), succession decisions include considering the past and the strong connection that the family may have with the land; the present, marked by environmental, social and economic pressures; and the future marked by uncertainties.

O'Callaghan and Warburton (2017) point out that the decision to sell or not a rural property symbolizes a challenge that involves a lifetime dedicated to the land and to ideological beliefs deeply rooted in agriculture and social norms of rural masculinity. Gill (2013) then emphasizes that farmers express a desire to keep the rural property in the family, due to the attachment to the land and the need to affirm the family and the place in history, configuring a domination of the past over the present.

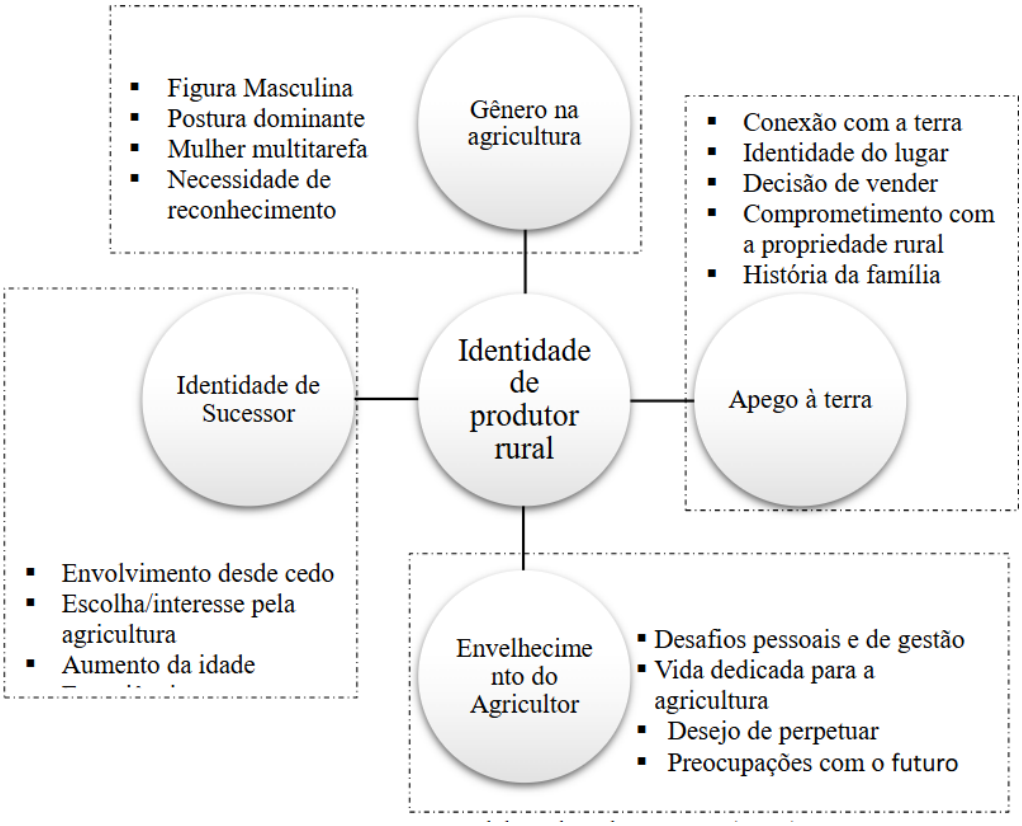
The act of wanting to keep the rural property in the family is also configured in a feeling of commitment assumed by the farmers. Where, even though they are not continuously present on the rural property, the bonds created with the place are intrinsically linked to the history of the family. It is not about spending their entire lives on the same farm, but about the essential part of who they are and how to pass on family traditions between generations (CHESHIRE *et al*., 2013).

It was possible to verify that the attachment that farmers develop for their lands strengthens their identity as farmers and reflects on the desire to maintain and perpetuate the land in the family.

IDENTITY OF RURAL PRODUCER AND THE SUCCESSION PROCESS

Through literature discoveries, it was possible to verify which topics related to the identity of rural producer can be part of the rural succession process, the most relevant were: gender in agriculture, identity of successor, aging of the farmer and attachment to the land, such indications are exposed in Figure 01.

Figure 01: Relevant aspects of the farmer's identity for the rural succession process



Source: Prepared by the authors (2019)

Based on the aspects highlighted in each category, in Figure 01, it can be seen that when relating the identity of the rural producer with the succession process in the properties, there is room for discussions regarding the opportunities of succession in the rural property according to the sex of the individual; the aspects that help individuals to become successors; the impact that the identity of the place and the connection with the land causes in the succession process; and how the The aging of the farmer may or may not characterize an obstacle in the succession process.

FINAL CONSIDERATIONS

The research question of this review was to verify which issues are related to the identity of rural producers in the literature, aiming to identify the points related to the identity of rural producers that can influence the succession process of rural properties. The results showed, among all the findings, that the identity of rural producer can be considered influential in the succession process.

The identified categories highlight that issues related to health care, agricultural practices adopted on the property, rural tourism and types of identity are influenced by the identity of the rural producer, in which the strong traits created and rooted in agricultural

customs hinder actions that involve change, whether on the rural property or in their own lives.

Regarding the categories that can most intervene in a rural succession process, attachment to the land, the aging of the farmer, gender in agriculture and the identity of successor include discussions that pointed out difficulties and obstacles that a strong identity of rural producer can create for the process, such as the resistance to accept a woman on the property, aging and attachment to the land prolonging the process and the need to identify a successor determined to take over.

The findings in the literature presented evidence from studies carried out in different parts of the world, so the results could not be generalized to farmers around the world. However, there were similar indications that may highlight a similar behavior among farmers, thus generating the possibility of replicating these findings in other realities.

As a limitation, subjectivity in the inclusion and exclusion of the articles used was identified. As a future suggestion, studies could investigate, through empirical work, the formation of identity in properties that are passing through or are discussing the succession process, thus making it possible to better understand the presupposed relationships

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TOXICOLOGICAL EVALUATION AND IN SILICO PHARMACOKINETICS OF CEFTIOFUR IN HUMAN AND ENVIRONMENTAL HEALTH

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ABSTRACT

Ceftiofur is a broad-spectrum cephalosporin, effective against Gram-positive and Gram-negative pathogens. This antibiotic works by inhibiting the synthesis of the bacterial cell wall. Antibiotics, used in both human and veterinary medicine, are drugs of concern when found in the environment. This is due to the fact that, even at low concentrations, prolonged exposure to these residues can lead to the emergence of resistant bacteria, compromising human health and environmental balance. Direct or indirect contact, whether through the food chain, water resources or animal excreta, represent the main routes of contamination.

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In the present study, *in silico* methodologies were employed to predict the molecular properties of the antibiotic Ceftiofur. The *in silico* environmental toxicology study showed that Ceftiofur is not toxic to bees, but is toxic to fish and crustaceans, and its chemical structure does not degrade in the environment. ADME in *silico* analysis indicated that the antibiotic does not present a favorable prediction for oral bioavailability, due to violations of the Lipinski criteria and has a moderate intestinal absorption rate and absence of permeability across the blood-brain barrier. In addition, the *in silico* pharmacokinetic study revealed that Ceftiofur has no inhibitory capacity on any of the five hepatic isoenzymes of cytochrome P450 complex (CYP450). The human *in silico* toxicology study showed promising results, demonstrating that the antibiotic is non-toxic (non-mutagenic) in the AMES test, has no carcinogenic properties, and is classified in category IV for acute oral toxicity, indicating low toxicity.

Keywords: Antibiotic. Ceftiofur. Environmental in *silico* toxicology. Human in *silico toxicology and* human in silico pharmacokinetics.

INTRODUCTION

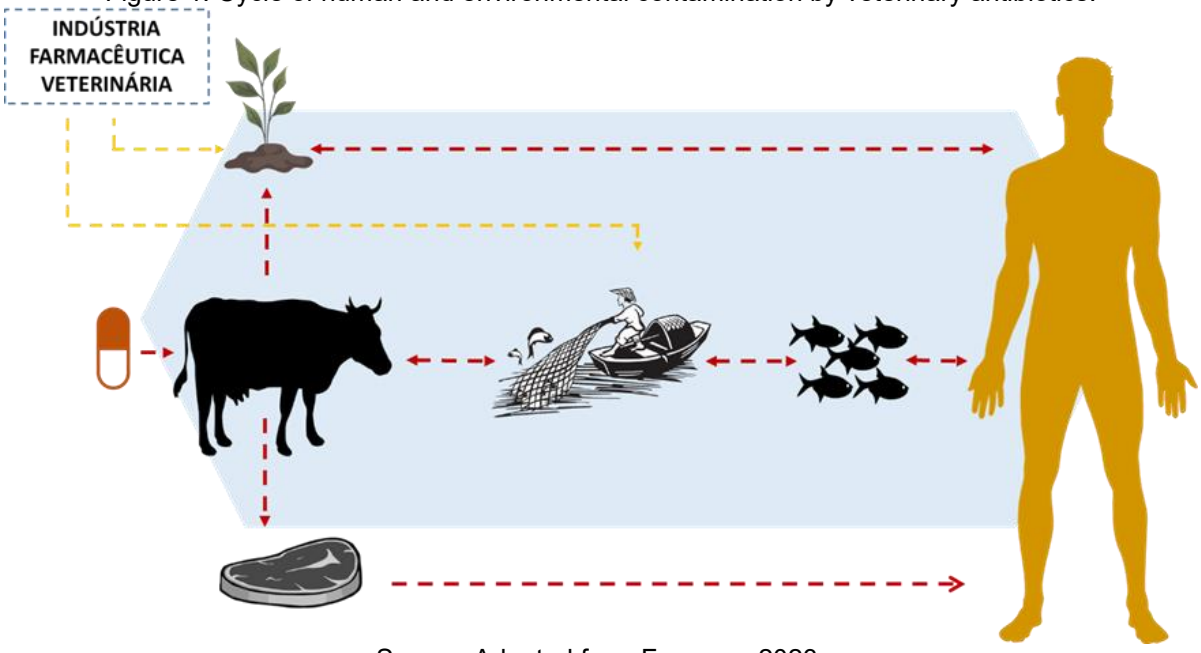
Cattle ranching plays an essential role in the context of Brazilian agribusiness, since Brazil has the second largest commercial herd in the world, estimated at around 200 million animals, which significantly boosts the development of the production chain. However, health challenges still result in losses, and antibiotics occupy the third position in the national ranking of veterinary products, behind only antiparasitics and vaccines. The widespread introduction of antibiotics in agriculture began in the 60s, being recognized as an effective solution to improve intensive agricultural production (OLIVEIRA et al., 2011), (BROWN et al., 2017).

However, antibiotics are considered potentially harmful, since they trigger a process of metabolic resistance and are subject to bioaccumulation and biomagnification phenomena. In addition, they are widely disseminated in the environment, with waste being discarded in significant quantities without prior treatment (MONTAGENERA et al., 2017), (FENT et al., 2006). The inappropriate use of veterinary antibiotics can result in a high concentration of antibiotic residues in products of animal origin, leading to several direct and indirect impacts on consumers, as evidenced in the case of the antibiotic under analysis, ceftiofur (DE SOUZA et al., 2013).

Ceftiofur is a broad-spectrum cephalosporin, effective against Gram-positive and Gram-negative pathogens. This antibiotic works by inhibiting the synthesis of the bacterial cell wall. It is indicated for the treatment of bacterial respiratory infections associated with *Pasteurella multocida*, *Mannheimia haemolytica* (formerly *Pasteurella haemolytica*) and *Haemophilus somnus* (AMARANTE, et al., 2018).

Antibiotics, used in both human and veterinary medicine, are drugs of greatest concern when found in the aquatic environment. This is due to the fact that, even at low concentrations, prolonged exposure to these residues can lead to the emergence of resistant bacteria, compromising human health and environmental balance (HERNANDEZ et al., 2007). Drug contamination can occur in different ways, affecting both humans and the environment. Direct or indirect contact, whether through the food chain, water resources or animal excreta, are the main routes of contamination, as illustrated in figure 1.

Figure 1: Cycle of human and environmental contamination by veterinary antibiotics.



Source: Adapted from Fonseca, 2023.

Contamination of the ecosystem by drugs is manifested due to the incomplete metabolization of antibiotics administered to animal organisms, resulting in the excretion of these compounds by urine and feces, both in the original form and partially metabolized (HALLING-SORENSEN et al., 1998), (SARMAH et al., 2006) and (KEMPER, 2008). Once in the environment, antibiotic residues can accumulate in the soil, leach or be transported to water bodies through surface runoff (DÍAZ-CRUZ et al., 2003). In addition, some of these residues in the soil can be absorbed by plants and accumulate in tissues, posing a risk to human health during harvesting and consumption of foods of plant origin (MIGLIORE et al., 2003) and (BOXALL et al., 2006). This problem is not highlighted in studies that address the environmental and health impacts associated with the presence of antibiotic residues in soil and water.

Despite the crucial relevance of animal production for Brazilian agribusiness, the lack of comprehensive research in this area is remarkable. In this context, the integration of *in silico* methodologies for descitor prediction assumes a strategic position, offering valuable data on human and environmental contamination. Therefore, the present study aims to evaluate, through chemoinformatics, with the aid of *in silico methodologies*, the toxicological impacts on environmental and human health, as well as to predict the pharmacokinetic profile of the antibiotic Ceftiofur on human health.

MATERIALS AND METHODS

To carry out this research, computer programs and online databases of international chemoinformatics platforms were used to obtain the molecular properties (molecular descriptors) of the chemical structure of the antibiotic Ceftiofur.

MOLECULAR MODELING

Initially, the chemical structure of the antibiotic was drawn two-dimensionally (2D) and visualized three-dimensionally (3D) with the aid of the ACD/ChemSketch® Freeware version 2021 program (*Advanced Chemistry Development, Inc*., 2021), then the steric energy of the chemical structure of ceftiofur was tabulated. Subsequently, the steric energy of the three-dimensional chemical structure of the antibiotic was tabulated, the SMILES (*Simplified Molecular Input Line Entry Specification)* code was obtained and exported to international database platforms. Finally, the chemical structure of the antibiotic molecule was saved in a file of the type MDL molfiles (.mol) for further studies.

IN *SILICO* ENVIRONMENTAL TOXICOLOGICAL STUDY

Through the computer program ACD/ChemSketch® Freeware version 2021 (*Advanced Chemistry Development, Inc., 2021*) and the use of the file's source code (.mol), the SMILES (*Simplified Molecular Input Line Entry Specification*) code was obtained. Subsequently, the SMILES code was exported to the online database platform. The environmental in *silico* toxicology study of Cefquinoma was carried out to predict environmental biodegradation, toxicity in fish, bees and crustaceans. This prediction was made with the help of the Chinese international platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/) coordinated by Professor Yun Tang, Leader of the Molecular Modeling and Design Laboratory (LMMD), School of Pharmacy of the East China University of Science and Technology (YANG, et al., 2018).

IN SILICO PHARMACOKINETIC STUDY FOR ORAL BIOAVAILABILITY

After performing the Molecular Modeling, the SMILES (*Simplified Molecular Input Line Entry Specification) code was obtained* and exported to the international database platform. The human in silico pharmacokinetic study to evaluate the oral bioavailability profile of the antibiotic under study was carried out through the Molinspiration Cheminformatics® (https://www.molinspiration.com) database (GROB, 1986). This database predicts molecular properties in order to evaluate oral bioavailability based on the

Rule *of Five* through interactive calculations of molecular properties, as well as to obtain data tables that can be used in QSAR (Quantitative Structure–Activity Relationship) studies.

PHARMACOKINETIC STUDY *IN SILICO* HUMANO (ADME *IN SILICO)*

The ADME *in silico* (ADME) *study* of the antibiotic ceftiofur was conducted with the aim of predicting the molecular descriptors: Human Intestinal Absorption (HIA), Blood-Brain Barrier (BBB) Permeability), P-glycoprotein inhibition and antibiotic distribution in the human body. Subsequently, the ADME in *silico study was performed* in order to predict the inhibition and interaction with the hepatic isoenzymes of the cytochrome P450 complex (CYP450) of the antibiotic. The ADME in *silico study* was conducted with the help of the Chinese platform admetSAR® (http://lmmd.ecust.edu.cn/admetsar2/) (YANG, *et al*., 2018).

IN *SILICO* HUMAN TOXICOLOGICAL STUDY

Through the computer program ACD/ChemSketch® Freeware version 2021 (Advanced Chemistry Development, Inc., 2021) and the use of the file's source code (.mol), the SMILES (*Simplified Molecular Input Line Entry Specification*) code was obtained. Subsequently, the SMILES code was exported to the online database platform.

A human in silico toxicological study was carried out for the antibiotic in order to predict toxicity by the AMES test (T: toxic; NT: non-toxic), carcinogenicity (C: carcinogenic; NC: non-carcinogenic) and Acute Oral Toxicity subdivided into categories also using the admetSAR® platform (http://lmmd.ecust.edu.cn/admetsar2/) (YANG, *et al*., 2018).

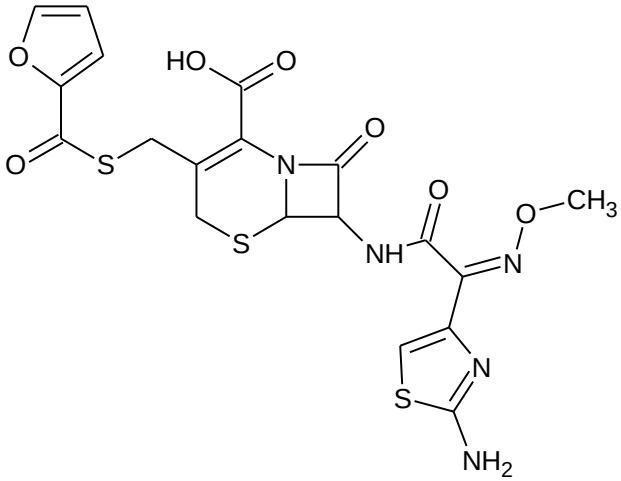
RESULTS AND DISCUSSION

MOLECULAR MODELING

The biological activity of the ligand (antibiotic) is correlated with the intermolecular interactions between the ligand (antibiotic molecule) and the biomacromolecule (biological receptor = biological target). This study is known as SBDD (*Structure Based Drug Design*), in which the free energy of the ligand-receptor intermolecular interactions in the active cleft (active binding groove) of the biological receptor is determined by means of physicochemical parameters (MORRIS and LIM-WILBY, 2008). The energy minimization of the chemical structure consists of the process in which the atomic coordinates of the ligand molecule will be altered in order to reduce the steric energy of the molecular chemical structure that corresponds to its local minimum (more stable chemical structure) (SANT'ANNA, 2009).

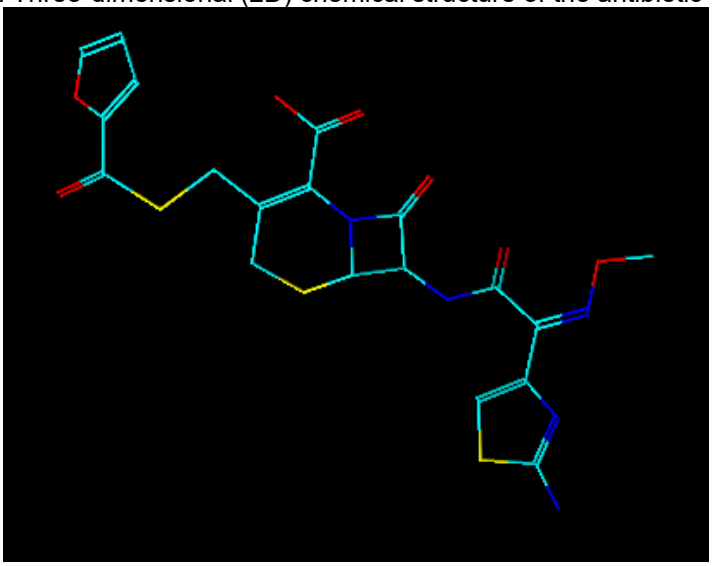
In the Molecular Modeling stage for the chemical structure of the antibiotic Cefquinoma, the minimized chemical structure was saved in a MDL molfiles (.mol) file and the steric energies were tabulated for further studies. Figures 2 and 3 represent, respectively, the chemical structure of the two-dimensional (2D) and three-dimensional (3D) drawings and the molecule of the Ceftiofur antibiotic.

Figure 2: Two-dimensional (2D) chemical structure of the antibiotic Ceftiofur



Source: Author himself, (2024) – ChemSketch® Freeware program version 2021.

Figure 3: Three-dimensional (2D) chemical structure of the antibiotic Ceftiofur



Source: Author himself, (2024) – ChemSketch® Freeware program version 2021.

IN *SILICO* ENVIRONMENTAL TOXICOLOGICAL STUDY

The study of the in *silico* environmental toxicity of antibiotics is of great importance for the rational planning of new drugs, as it allows predicting the impact of these drugs on ecosystems. In this work, parameters such as environmental biodegradation capacity, toxicity in bees, aquatic toxicity in crustaceans and aquatic toxicity in fish were evaluated.

The preliminary results are presented in Table 1, qualitatively [(Q – P: positive or N: negative)] and quantitatively (P = probability).

Table 1: Evaluation of the Environmental Toxicological Profile

Antibiotic	Environmental biodegradation		Testing on bees		Toxicity in crustaceans		Toxicity in fish	
	Q	P	Q	P	Q	P	Q	P
Ceftiofur	N	0,993	N	0,620	P	0,941	P	0,868

Source: Author's own, (2024) - admetSAR® Platform Version. 2.0.
Q – Qualitative: (Negative: N), (Positive: P); P: Probability

The environmental toxicological evaluation (Table 1) showed that the antibiotic Ceftiofur presents toxicity in fish and crustaceans, while in relation to bees, it did not present toxicity. The study also revealed that the chemical structure of the antibiotic does not undergo environmental biodegradation, so it remains unchanged in the environment, thus contaminating the aquatic ecosystem and the entire food chain, including humans through contaminated food.

IN SILICO PHARMACOKINETIC STUDY FOR ORAL BIOAVAILABILITY

The analyses to evaluate the oral bioavailability profile are based on the Lipinski rule (Rule of Five). A good drug is expected to have a high rate of human intestinal absorption, solubility in tissue fluids, and permeability across biological membranes. Antibiotics that violate the criteria of Lipinski's Rule do not have good bioavailability when administered orally (VEBER et al., 2002).

Table 2 presents the following molecular descriptors: 1) miLogP: Logarithm of the partition coefficient (measure of molecular hydrophobicity/hydrophilicity); 2) TPSA: Polar surface topological area (Å2); 3) PM: Molecular weight (Da), equivalent to molar mass (g/mol); 4) SALH: Hydrogen Bond Acceptor Sites; 5) SDLH: Hydrogen Bond Donor Sites; 6) Violations: Number of violations of the Lipinski rule. It is important to emphasize that the complementation of Lipinski's Rule can also be performed through two other molecular descriptors for human oral bioavailability by Veber's Rule: 7) NLR: Number of rotatable bonds; 8) VM: Molecular volume.

Table 2 reveals that ceftiofur violates three Lipinski parameters that refer to molecular weight (PM), Hydrogen Binding Acceptor Sites (ALH) and Polar Topological

Surface Area (TPSA), so the antibiotic should not be administered orally by human route, but can still be administered by intravenous or intramuscular administration.

Table 2: Evaluation of the Oral Bioavailability Profile.

Antibiotic	miLogP	PM	DEBT	ALH	TPSA	Violations *	NLR**	VM***
Ceftiofur	0,31	523,57	4	12	177,43	3	9	402,06

Source: Author himself, (2024) - Molinspiration Cheminformatics® Platform.
* Violations: Violations of the Lipinski Rule; ** NLR: Number of Rotatable Links; VM: Molecular Volume.

For a better understanding of the criteria of Lipinski's Rule for the prediction of the human oral bioavailability profile, we have:

1) Logarithm of the octanol-water partition coefficient (Log P = miLogP) 5: molecular descriptor of hydrophilic/hydrophobic nature. This molecular property is related to the intestinal absorption of the antibiotic, bioavailability when administered orally by the human route, hydrophobic/hydrophilic ligand-receptor interactions and also to the process of molecular metabolization. Cefquinoma had a value lower than five (5), which means that the compound did not violate Lipinski's rule. ≤

2) Molecular Weight (PM) 500 Da (Dalton): the antibiotic has a molecular weight greater than 500 Da, so it represents a violation of Lipinski's rule. In addition, this parameter is ≤associated with the absorption and permeation capacity of biological membranes. Therefore, absorption, permeability and bioavailability decrease with the increase in molecular mass.

3) Hydrogen Bond Donor Sites (SDLH)5: the antibiotic has a value lower than five (5), so it did not violate Lipinski's Rule. ≤

4) Hydrogen Bond Acceptor Sites (SALH)10: the antibiotic has a value greater than ten (10), so it represents a violation of Lipinski's rule. This property is extremely important for the evaluation of the biological activity of drugs and xenobiotics, since many intermolecular interactions are represented by hydrogen interactions. Therefore, it is ≤ unfavorable for a drug to perform many hydrogen interactions, since this would inversely affect the degree of permeability and also absorption (BARBOSA, 2020).

5) Polar Surface Topological Area (TPSA) 140: a related descriptor as the sum of the polar surfaces of the atoms bonded to the hydrogens in the molecule (usually fluorine, oxygen, and nitrogen). The antibiotic under study has a TPSA value greater than 140 , therefore, as this is a physicochemical descriptor related to hydrogen bonding, high TPSA values (>140) are indicative of reduced permeability and bioavailability. In addition, such a

result also expresses a violation of Lipinski's rule (MOTTA et al., 2023), ≤ Å² Å² Å²(ARAUJO et al., 2022).

PHARMACOKINETIC STUDY *IN SILICO* HUMANO (ADME *IN SILICO)*

The first parameter described in table 3 refers to the BBB (*blood-brainbarrier*), a molecular property related to permeability via endothelial cells and which indicates the restriction of the compound regarding the passage of the bloodstream to the Central Nervous System (CNS) (SHARMA et al., 2016), (DOLABELA et al., 2018). It is a descriptor used to evaluate permeability by the blood-brain barrier (BBB). The blood-brain barrier (BBB) has high impermeability and selectivity, regulating the transport of chemical substances between the blood and the Central Nervous System (CNS). BBB is essential for normal brain function, as it protects the CNS from potentially neurotoxic substances present in the blood (BASTOS et al., 2020). The value found in the present study for Ceftiofur was 0.988 (98.80%), indicating that the drug crosses the BBB in a very small way, so it does not act on the central nervous system, corroborating the safety of its use, since it is interesting that a drug does not cross the BBB easily, since this permeability can cause the appearance of adverse effects in the CNS (FELICE et al., 2020).

Evaluation of the molecular descriptor HIA (*human intestinal absorption*) quantitatively demonstrates intestinal absorption of the drug. This parameter is classified according to the intestinal absorption rate: 0 to 20% low absorption rate, 20 to 70% moderate absorption rate, and 70 to 100% high absorption rate (YAKAIAH et al., 2015).

The HIA value for ceftiofur was positive, with a moderate absorption rate, 50.8%, indicating the sum of the intestinal absorption rate with the bioavailability of the unchanged fraction of the analogue that reaches the systemic circulation, i.e., the percentage of the dose that was administered orally and that reaches the hepatic portal system (WANG et al., 2015). The ideal value of IAH will depend on the pharmaceutical purpose of the drug used and the needs of the pathology studied (DOLABELA et al., 2018). However, in the case of drugs administered orally, the ideal is that it has good intestinal absorption.

As Human Intestinal Absorption (IAH), describes the combination of the absorption rate and the absolute bioavailability of the drug that reaches the systemic circulation, when administered orally, the concentration of the drug rarely reaches 100% due to incomplete absorption and elimination resulting from the first-pass effect in the liver (hepatic biotransformation) (FONSECA, 2023), (HOU, 2008), (ARAUJO et al., 2022), (MOTTA et al., 2023). 3

Glycoprotein P (Gp-P) is a selective descriptor related to the entry of xenobiotics into the tissue, being responsible for the efflux of chemical compounds from the intracellular medium to the extracellular medium, with the function of preventing the entry of drugs into the cell or promoting their elimination, depending on their location. (AMIN, 2013; GOLAN et al., 2017; SANTOS et al. 2022). P-Gp, present in epithelial cells, has the primary function in the excretion and reduction of the bioavailability of several analogues. Gp-P, on the other hand, found in the capillaries of brain vessels, acts as a defense mechanism with the ability to return xenobiotic chemicals to the blood that could cross the BBB (CARREÑO, 2015). Based on the results obtained, it is found that Ceftiofur does not inhibit P-GP with a rate of 86.6%. According to KÖNIG et al., (2013) the induction of P-Gp expression is linked to a decrease in the bioavailability of drugs, while the use of inhibitors of this efflux pump leads to increased plasma levels (ARAUJO et al., 2022).

It is possible to study the transport pathways of a drug using the Caco-2 cell line, human colon adenocarcinoma, because these cells, when differentiated, have morphological and biochemical characteristics that produce functional similarities with the small intestine (spontaneous differentiation into cells that mimic erythrocytes), which makes its applicability viable, mainly because it enables the identification of possible permeability problems of substances, as well as predicting oral absorption and the absorption mechanisms that may be involved (ARTURSSON et al., 2021; CHEN et al., 2012).

Caco-2 epithelial cell permeability, which is an estimating parameter of intestinal permeability as a function of morphophysiological similarity with human enterocytes. This in *vitro method* allows the evaluation of the intestinal absorption capacity of drugs and drugs (FONSECA, 2023) and (MOTTA et al., 2023). In this study, the permeability of Caco-2 was 0.756, which represents low oral absorption. Distribution occurs via the plasma membrane, with a probability of 34.9%.

Table 3: Evaluation of the human in silico Pharmacokinetic Profile (ADME *in silico*).

Antibiotic	**BBB**		**HIA**		**Distribution**		**Glycoprotein-P inibiter**		**Caco-2**	
	Q	**P**	**Q**	**P**	**Or**	**P**	**I**	**P**	**Q**	**P**
Ceftiofur	**N**	**0,988**	**P**	**0,508**	**cell membrane**	**0,349**	**N**	**0,866**	**N**	**0,756**

Source: Author's own, (2024) - admetSAR® Platform Version. 2.0.
Q – Qualitative: (Negative: N), (Positive: P); P: Probability.

The human ADME *in silico* study on hepatic metabolism aims to predict the inhibitory capacity of cytochrome P450 complex isoenzymes (CYP450) by providing information on whether the antibiotic inhibits any isoenzyme (I: S = yes or N = no) and the likelihood of this inhibition (P). Table 4 presents the predictive evaluation of the *in silico pharmacokinetics* of the antibiotic Ceftiofur, detailing its potential inhibition and interaction with hepatic isoenzymes of the CYP450 complex.

Table 4: Evaluation of the inhibitory *Human in silico* Pharmacokinetic Profile (ADME *in silico*) of cytochrome P450 complex (CYP450) isoenzymes.

	CYP450 1A2		CYP450 2C9		CYP450 2D6		CYP450 2C19		CYP450 3A4	
Antibiotic	**I**	**P**	**I**	**P**	**I**	**P**	**I**	**P**	**I**	**P**
Ceftiofur	**N**	**0,784**	**N**	**0,786**	**N**	**0,886**	**N**	**0,760**	**N**	**0,714**

Source: Author's own, (2024) - admetSAR® Platform Version. 2.0.
Q – Qualitative: (Negative: N), (Positive: P); P: Probability
I: Inhibition – (Negative), + (Positive); P – Probability.

Drug metabolism involves a set of chemical reactions that modify molecules and, in general, convert them into a more soluble molecule so that it can be excreted more easily. This process is also known as liver biotransformation. The liver is the organ responsible for metabolizing a drug, due to the presence of a large amount of metabolic enzymes, which transform the drug into active and inactive metabolites and/or facilitate their elimination (GUIMARÃES; SOARES, 2006).

Most human pharmaceuticals are excreted from the body through metabolic reactions catalyzed by the cytochrome P450 (CYP450) and uridine-5'-diphospho-glucuronosyltransferase (UGT) enzyme systems (FROMM et al., 2013). The cytochrome complex (CYP450) belongs to the family of proteins that metabolize endogenous and exogenous substances, making them more polar and water-soluble. Drugs and other substances can induce or inhibit this enzyme, which can result in interactions between drugs, which consequently can decrease the efficacy or increase the toxicity of a substance (AKRAM et al., 2024).

There are isoenzymes of the cytochrome P-450 complex, which act in the metabolism of drugs and other substances, such as CYP1A2, CYP2D6, CYP2C19, CYP2D6, CYP2E1 and CYP3A4, thus contributing more frequently to the metabolism of most drugs. In the study in question, it was observed that Ceftiofur does not have the ability to inhibit any of the five isoenzymes of the cytochrome P450 complex (CYP450) analyzed.

Therefore, the antibiotic does not interfere with hepatic metabolism, promoting the excretion of xenobiotic and/or lipophilic compounds from the body (GALLI & FEIJOO, 2002; DIBAEI et al., 2024). Chemical compounds that can inhibit some hepatic isoenzyme can trigger a series of biochemical processes and adverse effects, affecting the hepatic metabolism of other drugs, leading to the formation of toxic metabolites and causing genetic alterations in the formation of several enzymes (DEVLIN, 2002).

IN *SILICO* HUMAN TOXICOLOGICAL STUDY

The human in silico *toxicology study* was conducted with the objective of predicting antibiotic toxicity, considering the three main tests: mutagenicity test (Ames test - T: toxic; NT: non-toxic), carcinogenicity test (C: carcinogenic; CN: non-carcinogenic) and acute oral toxicity testing in categories (I, II, III and IV). The AMES test is a bacterial assay that uses the *Salmonella typhimurium strain* (TA100 and TA1535) to evaluate the mutagenicity of the antibiotic Ceftiofur (MIRANDA et al., 2021).

In the development of a new drug, several tests are carried out to ensure that its composition meets the necessary requirements to be used by the population, in order to provide quality, efficacy and pharmacological safety. Among the analyses, the evaluation of the relationship between mutagenicity and genotoxicity stands out, where it is possible to detect the possible genetic damage associated with human diseases. The AMES test (mutagenicity test) must be applied to any new substance before it reaches the population (OECD, 1997).

The AMES test was developed by Dr. Bruce Ames and collaborators and plays an important role in genetic toxicology by evaluating the mutagenic/carcinogenic potential of the tested substance and for this purpose, strains of *Salmonella typhimurium* auxotrophic for histidine are used, capable of detecting gene mutations in the evaluated substances (GONÇALVES, 2016). Obtaining a positive result by the AMES test represents an obstacle, as it suggests that the analyzed substance has carcinogenic potential. However, negative results provided the basis for the study of genotoxicity in a single dose (BRASIL, 2013; GONÇALVES, 2016).

Toxicity that occurs rapidly after single exposure to the chemical is considered acute oral toxicity, in which contact with the compound occurs within a period of less than 24 hours. This toxicity is classified according to the United States Environmental Protection Agency (EPA *:* https://www.epa.gov) and classifies the antibiotic into four distinct categories, according to the LD50 (median lethal dose): 1) Category I: LD50 ≤ 50 mg/Kg; 2) Category

II: 50 < LD50 < 500 mg/Kg; 3) Category III: 500 < LD50 < 5,000 mg/Kg; 4) Category IV: LD50 > 5,000 mg/kg (GONÇALVES, 2011).

Table 5: Evaluation of the Human in *Silico Toxicological* Profile.

Antibiotic	AMES	P	Carcinogenic	P	Acute oral toxicity	
Certiofur	**NT**	91,32%	**NC**	87,00%	**IV**	53,69%

Source: Author's own, (2024) – admetSAR® Version. 2.0.
Q: Qualitative; P: Probability; C: Category.

The results of the human *in silico* toxicology profile of Ceftiofur shown in table 5 demonstrate that the test antibiotic is non-toxic (non-mutagenic) based on the AMES test and also has no carcinogenic properties. This means that, in toxicity classification systems, category IV has low toxicity, suggesting that, when ingested in a single dose, Ceftiofur has a relatively low risk of causing serious adverse effects (GONÇALVES, 2011).

CONCLUSION

Ceftiofur was selected for study with the purpose of deepening the understanding of its pharmacokinetics and toxicity, due to its wide use and recognition in cattle breeding. In the present study, *in silico* methodologies were employed to predict the molecular properties of the antibiotic Ceftiofur. The *in silico* environmental toxicology study showed that Ceftiofur is not toxic to bees, but is toxic to fish and crustaceans, and its chemical structure does not degrade in the environment. Thus, in addition to polluting aquatic environments, affecting crustaceans and fish, the chemical structure of the antibiotic remains unchanged in the environment, contaminating the food chain and, eventually, humans through food. ADME in *silico* analysis indicated that the antibiotic does not present a favorable prediction for oral bioavailability, due to violations of the Lipinski criteria related to molecular weight (PM), the number of hydrogen bond acceptor sites (ALH) and polar superficial topological area (TPSA), with a moderate intestinal absorption rate and absence of permeability across the blood-brain barrier. In addition, the *in silico* pharmacokinetic study revealed that Ceftiofur has no inhibitory capacity on any of the five hepatic isoenzymes of cytochrome P450 complex (CYP450). The human *in silico* toxicology study showed promising results, demonstrating that the antibiotic is non-toxic (non-mutagenic) in the AMES test, has no carcinogenic properties, and is classified in category IV for acute oral toxicity, indicating low toxicity. In addition, it is important to highlight that the results indicate that the antibiotic Ceftiofur contributes to environmental and human contamination.

Therefore, it is essential to conduct further studies on the drug to assess its additional impacts on humans and ecosystems. The continuity of this research is necessary to deepen the understanding of these effects.

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IN SILICO EVALUATION OF THE ENVIRONMENTAL, HUMAN AND PHARMACOKINETIC TOXICITY OF THE VETERINARY ANTIBIOTIC CEFQUINOMA

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ABSTRACT

The research developed in this work evaluated, through *in silico methodologies,* the environmental and human toxicity, the human oral bioavailability and pharmacokinetic parameters for the veterinary antibiotic Cefquinoma. Cefquinoma is a broad-spectrum antibiotic, classified as a fourth-generation cephalosporin. Currently, its use is intended for the treatment of clinical mastitis in lactating cows, caused by bacteria sensitive to it. Currently, the economic losses arising from the pathology result in several additional costs, such as a decrease in production and loss of the animal. Water and soil contamination are topics of high focus nowadays due to the possible impacts that antibiotic residues can cause in the environment. In view of this context, an *in silico* environmental toxicological study of Cefquinoma was carried out. The study revealed that the antibiotic is not toxic to bees and crustaceans, but it is toxic to fish, its chemical structure does not undergo environmental biodegradation, presenting a total removal rate of only 1.89%, resulting in contamination of the food chain and humans through food. Because the veterinary antibiotic promotes environmental, food and human contamination, it is mandatory to carry out the Toxicological and Pharmacokinetic study *in silico* human. This study indicated that the antibiotic is not available well via human oral use, as it violated three molecular descriptors of Lipinski's Rule. The ADME *in silico study* revealed that the antibiotic has a low intestinal absorption rate, does not have permeability through the blood-brain barrier, and does not inhibit P-glycoprotein. The ADME *in silico* study also indicated that the antibiotic did not inhibit hepatic isoenzymes of the cytochrome P450 complex. The human *in silico* toxicological study revealed that the antibiotic is not mutagenic in terms of the AMES test, does not present carcinogenicity and in terms of acute oral toxicity it falls into category III (low toxicity), but presents respiratory toxicity, reproductive toxicity, mitochondrial toxicity and human nephrotoxicity.

Keywords: Antibiotic. Cefquinoma. Environmental in *silico* toxicology. Human in *silico toxicology and* human in silico pharmacokinetics.

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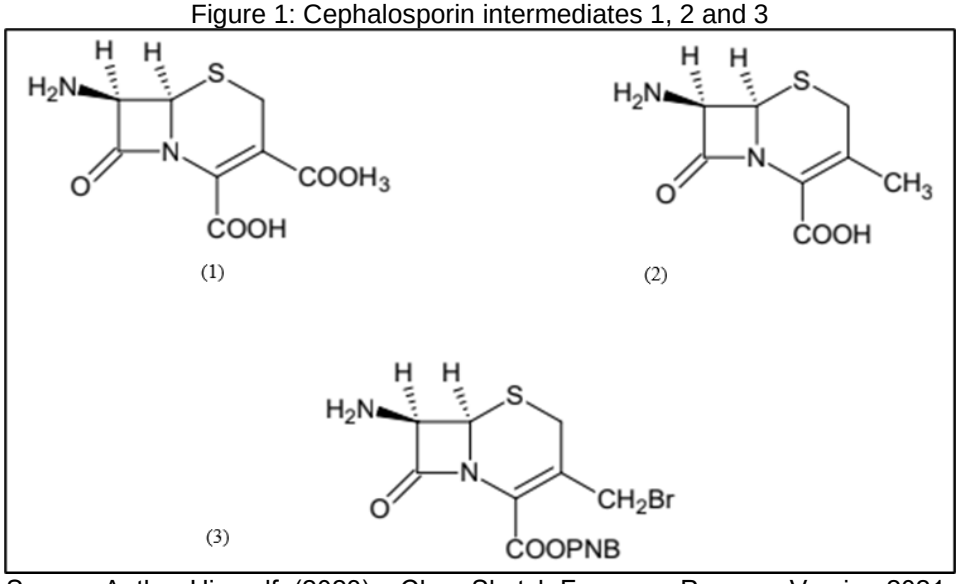
INTRODUCTION

In recent years, the pharmaceutical industry has undergone a major transformation, which has led the sector to considerably expand its production. Several factors have caused this positive scenario, such as technological innovations, resulting in a greater demand for drugs, especially in the field of antimicrobials. Antimicrobials are chemical substances responsible for inhibiting the growth or eliminating microorganisms. Therefore, they are used in order to prevent or treat a certain infection. In this sense, the cephalosporin class has a prominent position.

Cephalosporins are a class of antibiotics belonging to the beta-lactam group and stand out for their characteristics of broad spectrum of action, low toxicity, favorable pharmacokinetic profile, and ease of use. As for the chemical structure, it has two rings: beta-lactam and dihydrothiazine (SOUZA, 2008). They are derived from three important intermediates, 1) 7-aminopenicillamic acid (7-APA), 2) 7-aminodeacetoxycephalosporanic acid (7-ADCA) and 3) 7-methoxybenzyl ester of phenylacetamide-3-chloro-methyl-4-cephalosporanic acid (GCLE), as shown in Figure 1 (AZEVEDO, 2019). In addition, all of them in clinical use are semi-synthetic derivatives of 7-aminocephalosporanic acid (7-ACA), which was initially obtained from a natural antibiotic (FELICIANO, 2016).

Figure 1: Cephalosporin intermediates 1, 2 and 3



Source: Author Himself, (2023) – ChemSketch Freeware Program Version 2021.

Cephalosporins are also classified according to their spectrum of action, compared to Gram bacteria in the first, second, third, fourth and fifth generation. An example of an antimicrobial derivative belonging to the fourth generation is the antibiotic Cefquinoma.

The antibiotic Cefquinoma stands out for its high efficiency in combating Gram-positive and Gram-negative bacteria, and is for veterinary use only. Its main indication is for

the treatment of clinical mastitis caused by bacteria of the type *Salmonella spp*; *Haemophilus spp*; *Pasteurella spp*; *Klebsiella spp*; *Corynebacterium pyogenes*; *Escherichia coli*; *Staphylococcus aureus*; *Streptococcus dysgalactiae* and *Streptococcus uberis* (MANTILLA, 2020).

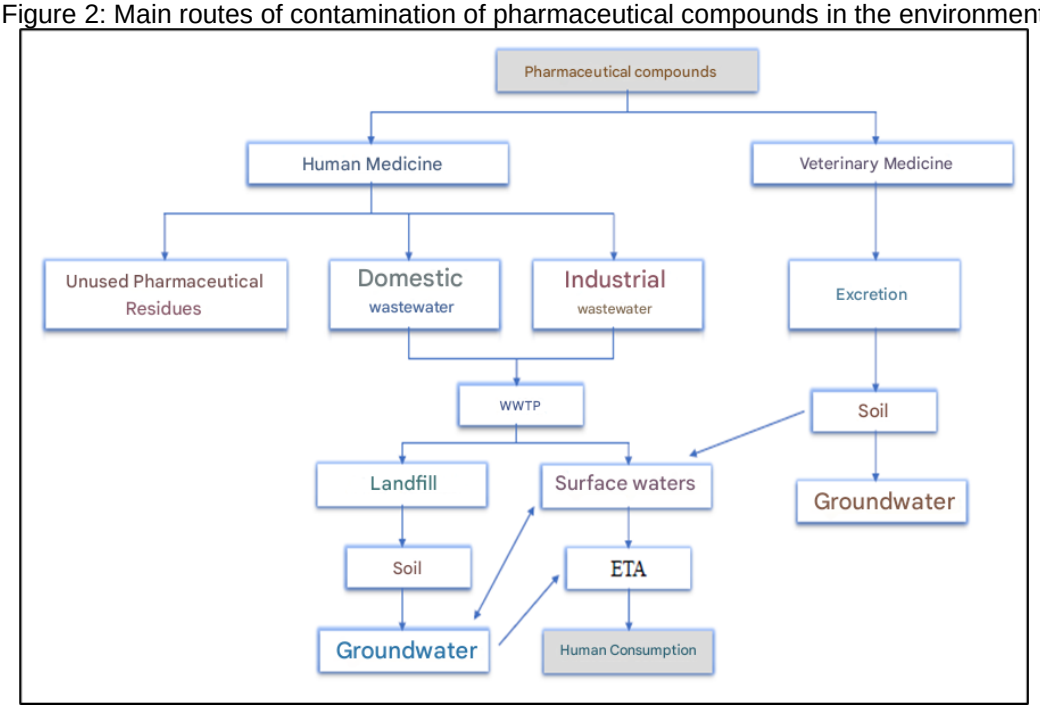
In this context, Brazil occupies a leading place in the large-scale production chain in the various branches of livestock, as well as in the use of widely disseminated veterinary medicines. Thus, the demand for quality products and consequent strict control has required adequate measures in order to ensure process safety, especially with regard to environmental contamination and contamination of the food chain by antimicrobials (LOBATO; DE LOS SANTOS, 2019).

With regard to drugs, there is special concern regarding antibiotics. Studies have shown that such contaminants, when disposed of in the environment inappropriately and without going through any specific treatment process, can result in negative effects, such as biological toxicity, induction of antibiotic resistance in pathogenic bacteria, and genotoxicity (LIMA et al., 2017).

Part of this problem occurs due to the basic sanitation system, which has not kept up with the advance of the pharmaceutical sector, nor the exponential use of it by the population. The presence of these drugs in the aquatic environment results from several parameters, among which refers to their physicochemical characteristics (solubility, polarity, biodegradation, among others) as well as their inadequate management and/or elimination in the environment. There are other forms of contamination as illustrated in Figure 2 (IRIA, 2018).

Through these characteristics and specificities, most of these compounds are not degraded in the conventional treatment systems of the Water Treatment Plants (WTP) and consequently return to the watercourse without adequate treatment. However, in recent years this scenario has been changing, due to more specific analysis and detection techniques, such as liquid chromatography coupled to mass spectrometer (CARVALHO, 2020).

Figure 2: Main routes of contamination of pharmaceutical compounds in the environment



Source: Iria, (2018).

Therefore, the study of contaminants in this category of drug is necessary, in order to evaluate their impact on human health (human toxicity), as well as the implementation of appropriate techniques for water treatment systems. One way to reduce such contaminants is through the use of advanced water treatment techniques (DICK, et al., 2022). However, these techniques are expensive and require specialized professionals with specific knowledge in analytical chemistry, instrumental analysis and organic chemistry. Therefore, an investment is necessary in order to achieve promising results.

The objective of the present work is to perform, through Chemoinformatics, the Environmental and Human in *silico Toxicological study* and Human in silico Pharmacokinetic study in order to predict parameters of Environmental Toxicity, Human Toxicity, Oral Bioavailability, Absorption, Distribution, Metabolization and Excretion (ADME *in silico*) for the antibiotic Cefquinoma with the aid of *in silico methodologies*.

LITERATURE REVIEW

This chapter presents the relevant theoretical definitions of the present work. In addition, the factors that motivated such a proposal in terms of technological innovation will be pointed out. In the literature review, statistical data listed by regulatory agencies, such as MAPA and SINDAN, were presented, emphasizing the importance of the sectors in the country and the consequent rational use of the antibiotic Cefquinoma.

LIVESTOCK IN BRAZIL - GENERAL ASPECTS

In recent years, with the advent of globalization and technological advances, the livestock sector in Brazil has achieved record growth in production and increased productivity. One of the factors responsible for such a feat is due to the expansion of research in genetics, advances in pest control and the effectiveness of drugs in controlling diseases that affect animals.

According to data from Embrapa (2022), from the 80s onwards, poultry meat production increased 22 times, pork, milk and beef production quadrupled, beef cattle production doubled (from 11% to 22%) and annual milk production doubled from 2002 onwards, due to the expansion of the herd and the productivity of the cows.

Also, in the last report of 2022 presented by Brazilian agriculture, livestock activity corresponded to about 369.15 billion and the gross value of production corresponded to 1,207.41 billion. The herds of livestock and livestock products (updated at the end of each year, in reference to the previous year) are shown in Table 1 (MAPA, 2022).

Table 1: Total herds and production of animal origin: Brazil

Herds and production	Total Brazil	Annual Change (%)
Cattle (head)	218.150.298	1,5%
Buffaloes (heads)	1.502.482	4,8%
Horses (head)	5.962.126	1,9%
Pigs - total (head)	41.124.233	1,4%
Swine breeders (head)	4.839.630	1,0%
Goats (heads)	12.101.298	7,1%
Sheep (head)	20.628.699	4,6%
Chickens – total (head)	1.479.363.352	0,9%
Chickens (heads)	252.570.646	1,4%
Quails (heads)	16.512.169	-5,2%
Milk (thousand liters)	35.445.059	1,7%
Chicken eggs (One thousand dozen)	4.767.388	3,3%
Quail eggs (One thousand dozen)	295.904	-6,2%
Bee Honey (Kilograms)	51.507.862	12,0%
Silkworm cocoons	2.742.372	-10,3%
Wool (kg)	7.978.317	-4,4%

Shrimp (Kilograms)	63.169.853	16,3%
Oysters, scallops and mussels	14.297.623	-6,0%
Total peixes (Kg)	551.873.845	4,2%
Fingerlings (Milheiros)	1.369.446	1,6%
Shrimp larvae and powders	12.541.720	4,5%
Mollusk seeds (Milheiros)	26.486	-42,6%

Source: Author – adapted from MAPA data, (2022).

BOVINE MASTITIS AND THE USE OF ANTIMICROBIALS

Brazil is among the largest markets for veterinary products. In 2020, there was a total turnover of 7.586 billion reais in the veterinary products market, highlighting medicines for ruminants, poultry and pigs, which are equivalent to 51%, 14% and 12%, respectively, of the sector's total revenue (PAULA, 2017). In addition, antimicrobials continue to occupy a prominent position in the national market for veterinary products, accounting for the third place in demand (14%), behind only antiparasitic (27%) and biological (22%) (SINDAN, 2020).

Following the numbers mentioned above, it can be seen that the livestock sector represents a significant portion of the country's economy and it is noted that the infectious diseases that affect it generate morbidity and mortality, thus resulting in several losses. It is estimated that more than half of all antimicrobials produced in the world are used in the treatment of animals (MAGALHÃES; SOUZA, 2012).

Antimicrobials correspond to the class of agents responsible for eliminating or inhibiting the growth of microorganisms, whether they are of natural or synthetic origin. Depending on the nature of the active ingredient, it can also be denoted as an antibiotic or chemotherapy (AFONSO, 2008).

Antibiotics are drugs that have the ability to act with selective toxicity, when in low concentrations against other microorganisms. Generally, they are produced by the microorganisms themselves, higher plants, and even by the animal organism itself (MACHADO, et al., 2019).

Although only five classes (penicillins, tetracyclines, macrolides, aminoglycosides, and amphenicols) represent the group of antibiotics, other synthetic drugs (sulfonamides, quinolones, nitrofurans, and nitroimidazoles) and natural products of high molecular weight (polyether antibiotics) are also usually included (PAULA, 2017).

In Brazil, one of the main infections that affect the herd is mastitis, which consists of inflammation of the animal's mammary gland. It is usually caused by infection by several

species of microorganisms, and the bacteria *Staphylococcus aureus* and *Streptococcus agalactiae* are considered to be pathogens of greater relevance, due to their high incidence and resistance rate (ACOSTA, et al., 2016). The economic losses arising from this pathology are due to several additional costs, such as decreased production, loss of the animal, among others. However, the reduction in milk production is considered the main loss.

> Studies conducted in Brazil have shown that mammary quarters with subclinical mastitis produced an average of 25 to 42% less milk than normal mammary quarters. In the United States, it is estimated that the cost per cow/year due to mastitis is approximately US$ 185, which corresponds to an annual cost of US$ 1.8 billion. This amount corresponds to approximately 10% of the total milk sold by producers. Of these, about two-thirds correspond to the reduction in milk production due to subclinical mastitis (Embrapa, 2021, p.1).

This infectious disease still has impacts on public health, since it represents the main cause of the emergence of antibiotic resistance, as well as in the transmission of pathologies in humans as a result of antibiotic residues and resistant bacteria (LOBATO; DE LOS SANTOS, 2019). Due to this scenario, it is essential to better understand the drugs used in the treatment of this pathology, as well as its effective control.

CEFQUINOMA

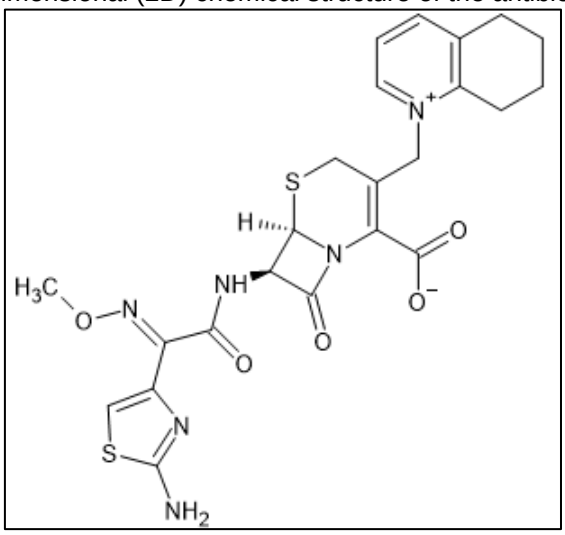
Among the main groups of antibiotics, β-lactams stand out with significant importance in the treatment of several pathologies. This group includes cephalosporins, cefamines, and penicillins, and together they account for more than half of all antibiotics produced and used in the world (HARTWIG et al., 2014).

Cephalosporins are classified as first, second, third, fourth and fifth generation, depending on their biological spectrum of action. Thus, 1st generation cephalosporins have a satisfactory response against Gram-positive organisms, while higher generations (2nd, 3rd, 4th) have a broader spectrum against aerobic Gram-negative bacilli. Finally, the last generation (5th) is active against methicillin-resistant *Staphylococcus aureus* (WERTH, 2022).

New antimicrobials, such as Cefquinoma, are available in the Brazilian market and are widely used in the treatment of mastitis. Cefquinoma is an amino-thiazole-type antibiotic, of the cephalosporin class, with action similar to that of other β-lactam antibiotics. Currently, its use is exclusive in veterinary medicine. In addition, Cefquinoma is a fourth-generation cephalosporin and has different active groups in its chemical structure, with emphasis on the quaternary ammonium group at position C-3 of the aminocephalosporanic

acid nucleus, according to the two-dimensional (2D) structure of the molecule represented in Figure 3 (HARTWIG et al., 2014).

Figure 3: Two-dimensional (2D) chemical structure of the antibiotic Cefquinoma



Source: Author Himself, (2024) - ChemSketch Freeware Program version 2021.

The quaternary ammonium group in the chemical structure of the antibiotic provides a wide range of biological activities against microorganisms and high biological activity against third-generation cephalosporin-sensitive bacteria, mainly Gram-negative bacteria. The explanation for the broad spectrum of action is due to resistance to beta-lactamases produced by chromosomal mutation or induced by bacterial plasmids and high affinity for penicillin-fixing proteins (PBPs) (LITTERIO, 2013).

As for the Pharmacokinetic and Pharmacodynamic properties, it is possible to mention the fact that they are used as bases orally or for parenteral use, as salts in aqueous solution, as well as low intestinal absorption when administered orally and tissue distribution. In addition, they also have ease in crossing the blood-brain barrier during inflammatory processes, time-dependent activity and excretion occurs predominantly via the renal route. However, recent studies show that their use should be avoided in order to prevent super-resistant bacteria and because they are considered antimicrobials listed by the World Health Organization (WHO) as of critical importance for human use (ROSSI, 2017).

ENVIRONMENTAL CONTAMINATION BY ANTIBIOTICS

Currently, the number of pharmaceutical compounds detected in the environment is vast, since the most common drug residues are antibiotics, hormones, anesthetics, anti-inflammatories, among others. Studies corroborate the idea that the rate that is absorbed,

as well as the rate of metabolization and excretion govern the total waste load (SOUZA, 2012).

In general, the main studies obtained in the literature indicate that wastewater is the main source of contamination of other environmental matrices. In addition, antibiotics continue to lead the drugs present in water bodies, such as pharmaceutical contaminants. Much of this situation is justified by the current model of the water treatment process of wastewater treatment plants (WWTPs). The unit operations present in the conventional system (e.g., decantation, flotation, flocculation, coagulation, among others), are insufficient for the removal of more polar drugs (SILVA, et al., 2023).

Another environmental concern refers to the way the drug is found in the environment. When released into the effluent or disposed of inappropriately, it can remain in its original form or be converted into by-products of transformation via photolysis, oxidation, among others. Therefore, these substances can be bioactive and cause toxic effects on humans, aquatic organisms, among others (SOUZA; AQUINO; SILVA, 2020). Despite several studies, it is not known precisely about the fate and behavior of these drugs in the aquatic environment, as well as the degree of impact on organisms.

Antibiotics can have numerous effects on the environment, but the development of resistant bacteria has increased significantly. Generally, they arise due to continued exposure to the drug, even at low concentrations. Additionally, studies show that in aquaculture, there are reports of a population of resistant bacteria in marine sediments. Other authors point to the development of certain human pathologies, such as breast, testicular and prostate cancer, polycystic ovaries and reduced male fertility due to exposure to drugs (BILA; DEZOTTI, 2003).

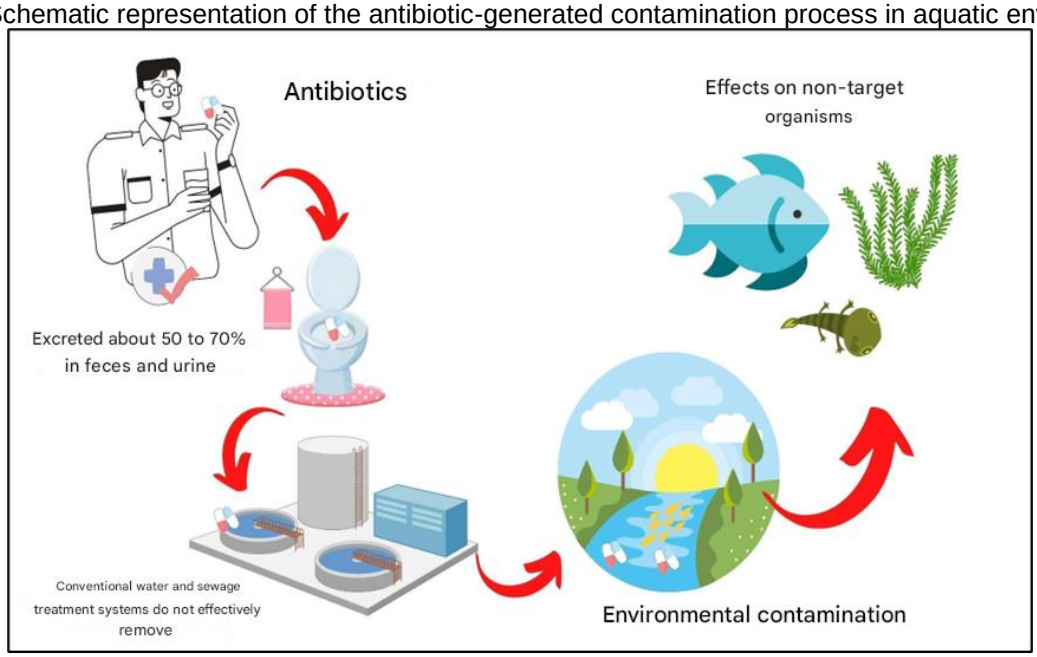
Regarding the idea to define what constitutes toxicity or not, the consequences for human health are taken into account. In Brazil, for example, there are three legislations regarding the presence of contaminants in water. According to Monteiro, (2018), the first legislation refers to the environment and the classification of waste in the aquatic environment, as well as the concentration limits for the safe disposal of treated effluents in water bodies, governed by Conama Resolution No. 357 of 2005. The second establishes the reference standard for effluent discharges into receiving water bodies, described in Conama Resolution No. 430 of 2011 (BRASIL, 2011). Finally, the third presents the standards of potability of water for human consumption, by Ordinance No. 672914 of 2011, of the Ministry of Health. However, these laws do not contain the established limits for antibiotics in the water supply.

Another publication on the disposal of medicines, Silva et al. (2023) explain that Decree No. 10,388, published on June 5, 2020, establishes guidelines on the reverse logistics system for expired or unused household medicines. The flowchart of the process establishes that pharmacies (primary storage) must have collection points for the disposal of medicines. Then, the distributors (secondary storage) forward the waste to manufacturers and importers. The latter, according to the logistics chain, would be responsible for the environmentally appropriate final destination of the waste. However, most of the items that make up the aforementioned guideline are not yet executed.

Despite the high consumption of antibiotics and the fact that they are found in surface waters, it is not yet clear whether the contamination comes from effluents and/or waste from animal production. By law, veterinary pharmaceutical products have not yet been included in the list of priority compounds. However, with the growing knowledge about the occurrence, ecotoxicity and efficiency of antibiotic elimination processes, it is expected that it will be possible to establish legal limits for such compounds (HOMEM, 2011).

Regarding the routes of antibiotic contamination in the aquatic environment, there are several ways, but the main ones occur through excreta and effluents from manufacturing processes. Another detail is that, in rural areas, where there is not always a sanitation system, excreta is dumped into septic tanks and there is also cross-contamination of soils and consequently surface water (HOMEM, 2011). Figure 4 represents the aforementioned process and the respective chain of contamination resulting by antibiotics in the aquatic environment (KITAMURA, 2022).

Figure 4: Schematic representation of the antibiotic-generated contamination process in aquatic environments



Source: Kitamura, (2022).

In this context, a key scientific area that evaluates the effects between the environmental and human relationship is environmental toxicology. In antiquity, reports on the subject were already found, as is the case of records of the use of toxic plants around 600 BC by Athenian society. In environmental toxicology, the study of chemical substances and the harmful effects produced by the interaction of environmental contaminants is considered. To determine the adverse effects of a given chemical compound, the phases of intoxication, elucidation, toxicokinetic and toxicodynamics are studied. Thus, it is commonly defined as the science responsible for analyzing and understanding the harmful effects of environmental chemical contaminants on living organisms (SILVA; SILVA; KITAMURA, 2022).

With the implementation of environmental practices and discussions about the relationship between pharmaceutical technological development and environmental management, it became essential that companies carry out the development of their activities, along with sustainable actions about the proper disposal of drugs. Therefore, in view of all the bibliographic surveys, the importance of conducting the present study is reaffirmed, as well as the confirmation or not of the toxicity of the antibiotic Cefquinoma by means of *in silico methods.*

CHEMOINFORMATICS AND *IN SILICO METHODOLOGIES*

Chemoinformatics, according to Abreu et al. (2013), is the area of study in which computational methods are used in order to solve problems related to Chemistry. Another commonly used definition consists of an interdisciplinary science that, through information and computational technology resources, transforms a set of chemical data (data matrix) into knowledge applicable to society (ALVES et al., 2018).

Historically, the term chemoinformatics was coined in 1998 by Frank Brown as a "blend of resources to transform data into information and information into knowledge, in order to make efficient and faster decisions to identify and optimize lead *compounds* or prototypes".

Initially, it dealt only with representations and manipulations of chemical structures. Currently, it is recognized as an interdisciplinary area of knowledge with emphasis on the exploration of chemical and biological databases, the discovery and development of new prototypes (*lead compounds*) with promising biological activity and desirable molecular properties (molecular descriptors), estimation of environmental toxicity of existing chemicals on the market and *virtual* screening of a possible chemical structure of promising chemical compounds (SILVA, 2020).

The term *in silico* refers to the methodologies of computer simulation and obtaining molecular descriptors (molecular parameters = molecular properties) in international database platforms. The importance lies in numerous positive points, such as reduced chemical and biological experimental costs, greater efficiency in processes and speed in results, as well as the unavailability of data to assess (predict) risks and restrictions regarding the use of animals (*in vivo methodology*) (DIAS, 2018).

The rationale of *in silico* methodologies takes into account the assumption that compounds that have similar chemical structures behave in a similar way in terms of human and environmental biological, pharmacokinetic, pharmacodynamic, and toxicological activity, therefore, it should be used as a predictive tool to obtain various information (molecular parameters). Currently, there are several international software and platforms on the market with constant updating of the database (ALVES; STREIT; PIZZOLATO, 2023).

In *silico* approaches have become widely used in preclinical studies for various applications. In addition, there is evidence in the literature for drug modeling and biological performance studies, for application in different pathways (HINES, 2021 apud COSTA, 2022). In addition to these applications, there are also molecular modeling studies, using advanced computational techniques of "molecular docking" and "molecular dynamics", to evaluate the potential inhibitors of proteins associated with different pathologies and analysis of the bioactivity of a chemical compound (ABREU et al., 2013).

In the area of toxicology, *in silico* methods have been widely disseminated in the pharmaceutical industry, since mathematical calculations have proven effectiveness in predicting the possible effects of the pharmaceutical, pharmacokinetic and pharmacodynamic phases. In this context, the U.S. Environmental Protection Agency (EPA) presents the definition of in *silico toxicity* as being the junction of two areas: integration of computing/information technology with cellular, tissue and molecular biology, with the objective of predicting the risk potential of chemical compounds (BRITO, 2010).

The pharmaceutical phase is related to the route of administration of the drugs and the pharmacotechnical way of preparing them, while the Pharmacodynamics phase focuses on the study of the biochemical effects on the molecular target (biological receptors = biological targets), as well as the mechanism of action of the drugs. However, the qualitative and quantitative evaluation of the processes of absorption, distribution, metabolism, excretion and destination of drugs in the body through *in silico* methodologies is evaluated by the study of Pharmacokinetics. In addition, toxic agents and adverse drug reactions are addressed by Toxicology (DELUCIA et al., 2016).

With regard to the route of drug administration, most of these compounds occur orally. Therefore, it seeks to understand how the drug reacts in the body and what its local and systemic effects are. Thus, the route it follows when ingested is to follow the gastrointestinal tract and later to the blood (via intestinal absorption), to the site of action (distribution), to undergo biotransformation in the liver (metabolism) to eliminate xenobiotics and finally, to be eliminated by the body (via renal excretion). This set of steps is known as ADME in *silico assessment* (MODA, 2007).

Among the numerous studies of ADME *in silico* available, the prediction of pharmacokinetic properties stands out, such as CYP450-mediated metabolism (hepatic isoenzymes of the cytochrome P450 complex), intestinal absorption rate, oral bioavailability, passage via the blood-brain barrier to the Central Nervous System (CNS), among others (OLIVEIRA, 2021).

An important application of ADME in *silico* evaluation refers to the prediction of oral drug bioavailability, commonly known as the "Rule of 5" or Lipinski's Rule (LIPINSKI et al., 2004), (FARIA et al., 2023). In this rule, the following relevant molecular descriptors are considered to evaluate the drug molecule:

> molecular mass less than 500 Daltons (molar mass less than 500 g/mol), number of hydrogen bond acceptor sites (SALH) less than or equal to 10, number of hydrogen bond donor sites (SDLH) less than or equal to 5, miLogP (n-octanol/water partition coefficient) less than or equal to 5, and polar topological surface area (TPSA) less than 140 $(A°)^2$. Molecules that violate more than one of the criteria may present oral bioavailability problems (PEREIRA, A. L. D. C, 2019, p.38).

Due to the numerous advantages, the ADME *in silico* evaluation, when compared to traditional approaches (*in vivo and in vitro),* stands out for its greater applicability and speed of results during large-scale virtual screening of molecules.

MATERIALS AND METHODS

In the present work, computer programs and databases of international online chemoinformatics platforms were used in order to predict molecular properties (molecular descriptors) of the molecular chemical structure of the antibiotic Cefquinoma.

COMPUTATIONAL MOLECULAR MODELING

First, the chemical structure of the antibiotic Cefquinoma was drawn two-dimensionally (2D) and visualized three-dimensionally (3D) using the ACD/ChemSketch® Freeware computer program version 2021 (Advanced Chemistry Development, Inc., 2021) and the energy of the three-dimensional chemical structure of the antibiotic was tabulated.

Finally, the chemical structure of the antibiotic molecule was saved in a file of the type MDL molfiles (.mol) for further studies.

TOXICOLOGICAL PREDICTION *IN SILICO* AMBIENTAL

Through the computer program ACD/ChemSketch® Freeware version 2021 (Advanced Chemistry Development, Inc., 2021) and the use of the file's source code (.mol), the SMILES (*Simplified Molecular Input Line Entry Specification*) code was obtained. Subsequently, the SMILES code was exported to the online database platform. The environmental in *silico* toxicology study of Cefquinoma was carried out to predict environmental biodegradation, toxicity in fish, bees and crustaceans. The present study was carried out with the help of the Chinese international platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/) coordinated by Professor Yun Tang, Leader of the Molecular Modeling and Design Laboratory (LMMD), School of Pharmacy of the East China University of Science and Technology (YANG, et al., 2018).

HUMAN IN SILICO PHARMACOKINETIC PREDICTION FOR ORAL BIOAVAILABILITY

Through the computer program ACD/ChemSketch® Freeware version 2021 (Advanced Chemistry Development, Inc., 2021) and the use of the file's source code (.mol), the SMILES (*Simplified Molecular Input Line Entry Specification) code was obtained*. Subsequently, the SMILES code was exported to the online database platform. The human in silico pharmacokinetic study was carried out with the objective of predicting the molecular descriptors of the antibiotic Cefquinoma with the aid of the Molinspiration Cheminformatics® (https://www.molinspiration.com) database (GROB, 1986). The database predicts the molecular properties in order to evaluate the oral bioavailability of the antibiotic molecule based on Lipinski's Rule, known as the *Rule of Five*.

HUMAN PHARMACOKINETIC IN *SILICO* PREDICTION (ADME *IN SILICO)*

Through the computer program ACD/ChemSketch® Freeware version 2021 (Advanced Chemistry Development, Inc., 2021) and the use of the file's source code (.mol), the SMILES (*Simplified Molecular Input Line Entry Specification*) code was obtained. Subsequently, the SMILES code was exported to the online database platform.

The first stage of this research was the ADME *in silico* (ADME) *study* for the antibiotic Cefquinoma, to predict the molecular parameters: Human Intestinal Absorption Rate (HIA), Blood-Brain Barrier Permeability (BBB): *blod-brain barrier*), P-glycoprotein inhibition, Caco-2 epithelial cell permeability, and Cellular distribution of the antibiotic in the

human body. In the next step, the ADME in *silico study was performed* to predict the inhibition of hepatic isoenzymes of cytochrome P450 complex (CYP450) in the process of Hepatic Metabolization (Hepatic Biotransformation) of Cefquinoma. This study was carried out with the help of the Chinese international online platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/), coordinated by Professor Yun Tang, Leader of the Molecular Modeling and Design Laboratory (LMMD), School of Pharmacy of the East China University of Science and Technology (YANG, et al., 2018).

In order to validate the molecular descriptors obtained from the Chinese online platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/), an advanced in silico study was carried out with the aid of the Swiss online database platform SwissADME® The Swiss platform SwissADME® (http://www.swissadme.ch) was developed by Diana, Michielin and Zoete (2017) and also allows the predictive study of the pharmacokinetic descriptors and oral bioavailability of the antibiotic Cefquinoma. The molecular descriptors obtained are: Intestinal Absorption Rate (GI), Blood-Brain Barrier Passage (BBB Permeation), P-Glycoprotein Inhibition (P-gp) and inhibition of hepatic isoenzymes of the cytochrome P450 complex (CYP1A2 Inhibitor, CYP2C19 Inhibitor, CYP2C9 Inhibitor, CYP2D6 Inhibitor and CYP3A4 Inhibitor).

HUMAN IN *SILICO* TOXICOLOGICAL PREDICTION

Through the computer program ACD/ChemSketch® Freeware version 2021 (Advanced Chemistry Development, Inc., 2021) and the use of the file's source code (.mol), the SMILES (*Simplified Molecular Input Line Entry Specification*) code was obtained. Subsequently, the SMILES code was exported to the online database platform.

The human in silico *toxicological study* of the antibiotic Cefquinoma was carried out with the objective of predicting the toxicity of the drug by the AMES test (T: toxic; NT: non-toxic), carcinogenicity test (C: carcinogenic; NC: non-carcinogenic) and its acute oral toxicity. The study was carried out with the help of the Chinese international online platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/), coordinated by Professor Yun Tang, Leader of the Molecular Modeling and Design Laboratory (LMMD), School of Pharmacy of the East China University of Science and Technology (YANG, et al., 2018).

In order to complement the study of the human in *silico toxicological profile* , in addition to the three molecular descriptors obtained via the Chinese online platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/), other advanced molecular properties were determined using the same online data platform. The descriptors determined are correlated with: ocular corrosion, eye irritability, hepatotoxicity (liver), dermal

sensitivity (skin), respiratory toxicity (airways and lungs), reproductive toxicity (gonads), nephrotoxicity (renal), and mitochondrial toxicity (mitochondria – functional organelle for cellular respiration).

ADVANCED ENVIRONMENTAL IN *SILICO* TOXICOLOGICAL PREDICTION

Through the computer program ACD/ChemSketch® Freeware version 2021 (Advanced Chemistry Development, Inc., 2021) and the use of the file's source code (.mol) the code SMILES (*Simplified Molecular Input Line Entry Specification*) was obtained. Subsequently, the SMILES code was exported to the online database platform.

The advanced environmental in silico *toxicological evaluation* was performed with the aid of the computer program EPI Suite™ version 4.1. The EPI (Estimation Programs Interface) Suite™ developed by the United States Environmental Protection Agency (EPA) and Syracuse Research Corp (SRC) (EPI Suite™, 2023), robustly calculates environmental and physicochemical properties. Taking into account the calculations obtained in the program, a more advanced environmental toxicological prediction of the antibiotic Cefquinoma will be carried out, the molecular descriptors calculated are: prediction of aquatic biodegradation, total removal, total biodegradation, total sludge adsorption and total air removal.

RESULTS AND DISCUSSION

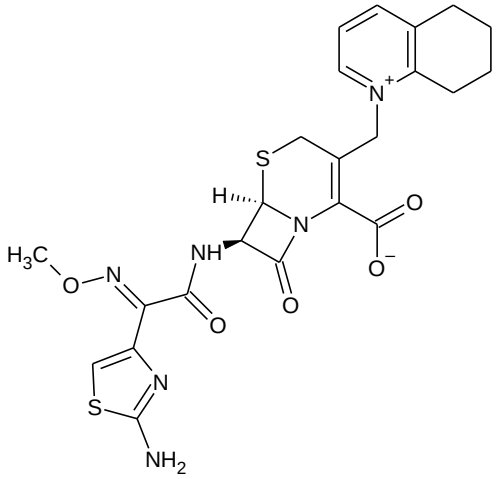
COMPUTATIONAL MOLECULAR MODELING

The molecular stability and biological activity of the ligand (antibiotic) is closely correlated with the intermolecular interactions between the ligand (antibiotic molecule) and the biomacromolecule (biological receptor = biological target). This study is known as SBDD (*Structure Based Drug Design*), in which the free energy of the ligand-receptor intermolecular interactions in the active cleft (active binding groove) of the biological receptor is determined by means of physicochemical parameters (MORRIS and LIM-WILBY, 2008). The energy minimization of the chemical structure consists of the process in which the atomic coordinates of the ligand molecule will be altered in order to reduce the steric energy of the molecular chemical structure that corresponds to its local minimum (more stable chemical structure) (SANT'ANNA, 2009).

In the Molecular Modeling stage for the chemical structure of the antibiotic Cefquinoma, the minimized chemical structure was saved in a MDL molfiles (.mol) file and the steric energies were tabulated for further studies. Figures 5 and 6 represent,

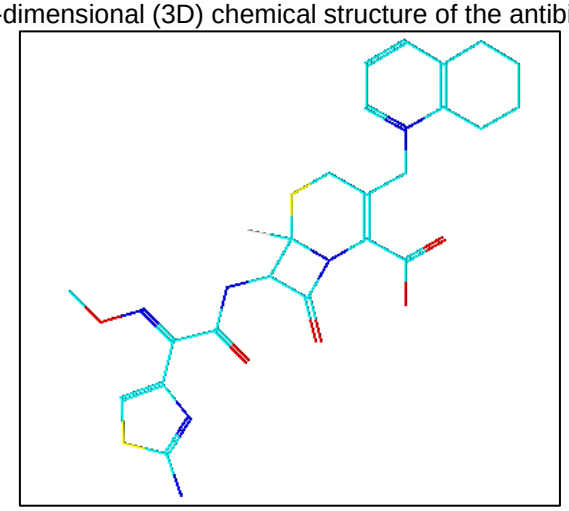
respectively, the chemical structure of the two-dimensional (2D) and three-dimensional (3D) drawings and the molecule of the antibiotic Cefquinoma.

Figure 5: Two-dimensional (2D) chemical structure of the antibiotic Cefquinoma



Source: Author himself, (2024) – ChemSketch® Freeware program version 2021.

Figure 6: Three-dimensional (3D) chemical structure of the antibiotic Cefquinoma



Source: Author himself, (2024) – ChemSketch® Freeware program version 2021.

EVALUATION OF THE *IN SILICO* ENVIRONMENTAL TOXICOLOGICAL PROFILE

After having carried out the molecular modeling with the help of the computer program ACD/ChemSketch® Freeware version 2021 (Advanced Chemistry Development, Inc., 2021) and using the source code of the file (.mol), it was possible to generate the SMILES (*Simplified Molecular Input Line Entry Specification*) code and, through it, to carry out the Environmental in *silico* Toxicological study with the help of the Chinese international online platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/).

The information generated by the platform occurs through the database system of each specific compound, in order to predict the profile of *in silico* Environmental Toxicity of

the antibiotic Cefquinoma, in which the following molecular descriptors were evaluated: environmental biodegradation, toxicity in fish, bees and crustaceans, as shown in Table 2.

Table 2: Toxicological Profile Assessment *in silico* Environmental

Biodegradation Environmental		**Toxicity in bees**		**Toxicity in Crustaceans**		**Toxicity in Fish**	
Q	**P**	**Q**	**P**	**Q**	**P**	**Q**	**P**
N	100,0%	**N**	**80,9%**	**N**	**54%**	**P**	**99,0%**

Source: Author's own, (2024) - admetSAR® Platform Version. 2.0.
Q – Qualitative: (Negative: N), (Positive: P); P: Probability

The analysis of table 2 reveals that the antibiotic Cefquinoma is not toxic to bees or crustaceans, but is toxic to fish and the drug does not undergo environmental biodegradation, that is, its chemical structure remains unchanged in the environment, contaminating the food chain and consequently the human being.

IN *SILICO EVALUATION* OF THE ORAL BIOAVAILABILITY PROFILE

After performing molecular modeling with the aid of the ACD/ChemSketch® Freeware version 2021 computer program (Advanced Chemistry Development, Inc., 2021) and using the file's source code (.mol), it was possible to generate the SMILES (*Simplified Molecular Input Line Entry Specification)* code and, through it, determine the molecular properties of the antibiotic in the international online database platform Molinspiration Cheminformatics® (https://www.molinspiration.com) (GROB, 1986). The molecular descriptors determined in order to analyze the human oral bioavailability of the study drug (Cefquinoma) are shown in Table 3.

The analysis of table 3 reveals that the antibiotic Cefquinoma violates Lipinski's Rule, so it does not have a good prediction regarding the human oral bioavailability profile. Table 3 presents the following molecular descriptors: 1) miLogP: Logarithm of the partition coefficient (measure of molecular hydrophobicity/hydrophilicity); 2) TPSA: Polar surface topological area; 3) PM: Molecular weight (Da), equivalent to molar mass (g/mol); 4) SALH: Hydrogen Bond Acceptor Sites; 5) SDLH: Hydrogen Bond Donor Sites; 6) Violations: Number of violations of the Lipinski rule. It is important to emphasize that the complementation of Lipinski's Rule can also be performed through two other molecular descriptors for human oral bioavailability (Veber's Rule): 7) NLR: Number of rotatable bonds; 8) VM: Molecular volume.

Table 3: Evaluation of the Human Oral Bioavailability Profile

Molecular Descriptions	
miLogP	**- 5,19**
TPSA	**153,93**
PM	**528,62**
SALH	**11**
SDLH	**3**
Violations	**3**
NLR	**7**
VM	**436,08**

Source: Author himself, (2024) - Molinspiration Cheminformatics® Platform.

For a better understanding of the criteria of Lipinski's Rule for predicting the human oral bioavailability profile, we have:

1) Octanol-water Partition Coefficient Log P (miLogP) 5: molecular descriptor of hydrophilic/hydrophobic nature. This molecular property is related to the intestinal absorption of the antibiotic, bioavailability when administered orally by the human route, hydrophobic/hydrophilic ligand-receptor interactions and also to the process of molecular metabolization. Cefquinoma presented a value lower than five (5), which means that the compound is more hydrophilic and did not violate this criterion of Lipinski's rule. ≤

2) Molecular Weight (PM) 500 Da (Dalton): the antibiotic has a molecular weight greater than 500 Da, so it represents a violation of Lipinski's rule. In addition, this parameter is ≤associated with the absorption and permeation capacity of biological membranes. Therefore, absorption, permeability and bioavailability decrease with the increase in molecular mass.

3) Hydrogen Bond Donor Sites (SDLH)5: the antibiotic has a value lower than five (5), so it did not violate Lipinski's Rule. ≤

4) Hydrogen Bond Acceptor Sites (SALH)10: the antibiotic has a value greater than ten (10), so it represents a violation of Lipinski's rule. This characteristic is extremely important for evaluating the biological activity of drugs and xenobiotics, as many intermolecular interactions involve hydrogen bonding. Therefore, it is ≤ unfavorable for a substance to make too many hydrogen bonds, since this would inversely affect the degree of permeability and also absorption (BARBOSA, 2020).

5) Polar Surface Topological Area (TPSA) 140: a related descriptor as the sum of the polar surfaces of the atoms bonded to the hydrogens in the molecule (usually fluorine, oxygen, and nitrogen). The antibiotic under study has a TPSA value greater than 140 , therefore, as this is a physicochemical descriptor related to hydrogen bonding, high TPSA

values (> 140) are indicative of reduced permeability and bioavailability. In addition, such a result also expresses a violation of Lipinski's rule (MOTTA et al., 2023), ≤ Å²Å² Å²(ARAUJO et al., 2022).

Taking into account the results presented in Table 3, it is noted that there were 3 violations of molecular descriptors regarding Lipinski's Rule, i.e., the molecule of the antibiotic Cefquinoma does not have good human oral bioavailability.

It should be noted that in addition to the properties discussed by Lipinski, other parameters were evaluated to predict human oral bioavailability. Veber's Rule is related to molecular flexibility, determined through the number of rotational bonds (NLR) (VEBER et al., 2002), (CEZÁRIO et al., 2022), (MOTTA et al., 2023). Therefore, the greater the flexibility of the molecule, the less likely the chemical structure will have human oral bioavailability (RODRIGUES et al., 2021).

EVALUATION OF THE PHARMACOKINETIC PROFILE *IN SILICO* (ADME *IN SILICO).*

Similarly, from the Chinese online database platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/), the ADME in silico study was carried out *to evaluate the human* in silico *pharmacokinetic parameters* , through the variables Human Intestinal Absorption Rate (IAH), Blood-brain Barrier Permeability (BBB), Caco-2 epithelial cell permeability, P-glycoprotein inhibition and Distribution cellular antibiotic in the human body, as shown in Table 4.

Table 4: Evaluation of the Pharmacokinetic profile *in silico* Human (ADME) *in silico*)

	BBB		HIA		Distribution		Glicoproteína P		Caco-2		
	Q	Ꝑ	Q	Ꝑ	Q	Ꝑ	Q	Ꝑ	Q	Ꝑ	
	N	95%	N	85%	Mitochond.	59%	N	74%	N	88,8%	

Source: Author's own, (2024) - admetSAR® Platform Version. 2.0.
Q – Qualitative: (Negative: N), (Positive: P); Ꝑ: Probability

The analysis of Table 4 indicates that the antibiotic has a low intestinal absorption rate (15%), since the evaluation of the molecular descriptor HIA takes into account the following parameters for intestinal absorption as a reference:

1) 0 to 20% low absorption rate;
2) 20 to 70% moderate absorption rate;
3) 70 to 100% high absorption rate.

Even if the intestinal absorption rate is low, it is still possible to detect the antibiotic in blood plasma, as intestinal absorption occurs (YAKAIAH et al., 2015). It is also noted that the antibiotic Cefquinoma is not permeable via the blood-brain barrier (95%), that is, the drug has no impact on the Central Nervous System.

The molecular property of glycoprotein P was also evaluated because it is a selective descriptor regarding the entry of xenobiotics into the tissues. Glycoprotein P (present in epithelial cells) has a primary role in excretion and consequently reduces the absolute bioavailability of the antibiotic. The P-glycoprotein present in the endothelia of the capillaries of brain vessels acts as a "defense mechanism", as it has the ability to return xenobiotic chemical substances to the blood that could eventually cross the blood-brain barrier (GOLAN et al., 2014). With regard to its distribution, it can be stated that the antibiotic has the mitochondria as its cellular target, that is, the organelle responsible for cellular respiration.

From the Chinese online database platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/), the ADME in *silico study was performed* to predict the inhibition of hepatic isoenzymes of cytochrome P450 complex (CYP450) in the process of Hepatic Metabolization (Hepatic Biotransformation) of the antibiotic Cefquinoma.

The analysis of table 5 indicates the inhibitory prediction of cytochrome P450 complex isoenzymes by the antibiotic. It is observed that the drug does not inhibit hepatic isoenzymes, that is, the antibiotic does not interfere with hepatic metabolism (biotransformation), facilitating the elimination of xenobiotic and lipophilic molecules from the human body, resulting in no adverse effects in hepatic (liver) terms.

Table 5: Evaluation of Pharmacokinetic Profile *in silico* Human (ADME) *in silico*) inhibitory of cytochrome P450 complex isoenzymes (CYP450)

CYP4503A4		**CYP4502C9**		**CYP2C19**		**CYP4502D6**		**CYP4501A2**		
I	**P**	**I**	**P**	**I**	**P**	**I**	**P**	**I**	**P**	
N	**50%**	**N**	**69,1%**	**N**	**63,3%**	**N**	**85,9%**	**N**	**67,2%**	

Source: Author's own, (2024) - admetSAR® Platform Version. 2.0.
Q – Qualitative: (Negative: N), (Positive: P); P: Probability
I: Inhibition – (Negative), + (Positive); P – Probability

In addition to the molecular descriptors presented in tables 3 and 4, an advanced in silico pharmacokinetic study was also carried out , with the aid of the Swiss international online platform SwissADME® (http://www.swissadme.ch), aiming to validate the molecular

descriptors obtained by the Chinese online platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/). The molecular descriptors obtained with the aid of the Swiss online platform SwissADME® (http://www.swissadme.ch) were: Intestinal Absorption Rate (GI Absorption), Passage through the Blood-Brain Barrier (BBB Permeation), P-glycoprotein inhibition (P-gp) and inhibition of hepatic isoenzymes of the cytochrome P450 complex (CYP1A2 Inhibitor, CYP2C19 Inhibitor, CYP2C9 Inhibitor, CYP2D6 Inhibitor, CYP3A4 Inhibitor), as shown in Table 6.

From the analysis of the results presented in the table above, it is possible to infer that the antibiotic Cefquinoma does not violate any of the parameters determined with the help of the Swiss online platform SwissADME® (http://www.swissadme.ch). Therefore, it also revealed that the drug under study is not permeable by the blood-brain barrier (BBB), there is low gastrointestinal absorption and does not inhibit P-glycoprotein (P-gp). It should be noted that the largest fraction of glycoprotein P in the human body is found in the columnar epithelial cells of the lower gastrointestinal tract. P-gp is also correlated with drug excretion into the lumen of the gastrointestinal tract. In addition, it is also located in the endothelial cells of the blood-brain barrier (BBB), exerting a protective function and helping in the transport of substances by transepithelial or transendothelial route from epithelial cells and endothelial cells of the capillaries of the blood vessels of the blood-brain barrier (ARAÚJO, 2015).

Table 6: Evaluation of Pharmacokinetic Profile *in silico* Human (ADME) *in silico*)

GI absorption	**Low**
BBB Permeation	**No**
P-gp	**No**
Inhibitor CYP1A2	**No**
Inhibitor CYP2C19	**No**
Inhibitor CYP2C9	**No**
Inhibitor CYP2D6	**No**
Inhibitor CYP3A4	**No**

Source: Author himself, (2024) - SwissADME® platform.

The analysis of Table 6 also indicates that the antibiotic Cefquinoma does not inhibit any of the isoenzymes that make up the cytochrome P450 complex (CYP1A2, CYP2B6, CYP2C19, CYP2D6, CYP2E1 and CYP3A4). Hepatic enzymes of the cytochrome P450 complex are the ones that contribute most frequently and significantly to the metabolism of most drugs (BRAZ et al., 2018).

EVALUATION OF THE *IN SILICO* HUMAN TOXICOLOGICAL PROFILE

From the Chinese online database platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/), a human in silico *toxicological study was carried out* with the objective of evaluating the toxicity parameters of the antibiotic Cefquinoma taking into account the three primary tests: mutagenicity test (Ames test - T: toxic; NT: non-toxic), carcinogenicity test (C: in carcinogenic; CN: non-carcinogenic) and acute oral toxicity test for classification into categories (I, II, III and IV).

When evaluating the human toxicity profile, Table 7 indicates that the antibiotic has no toxicity taking into account the AMES test (mutagenicity), is not carcinogenic and as for acute oral toxicity it falls into category III (low toxicity).

The AMES test is an assay that identifies whether a certain chemical substance is capable of causing nitrogenous base pair substitution, that is, it evaluates the mutagenic capacity of the antibiotic. Therefore, it is an extremely important parameter to be investigated, in order to assess the safety of its use (GONÇALVES et al., 2016).

Acute oral toxicity testing classifies chemical compounds against the four categories of the U.S. Environmental Protection Agency (EPA), classifying them according to their LD50 value (known as the median lethal dose). Therefore, category I compounds have LD50 values less than or equal to 50 mg/kg. In category II, compounds have LD50 values above 50 mg/kg and below 500 mg/kg. Category III includes compounds with LD50 values above 500 mg/kg and below 5000 mg/kg. In category IV, compounds have LD50 values higher than 5000 mg/kg (PALMEIRA et al., 2018). Finally, for carcinogens (carcinogenicity), the test indicated that the antibiotic molecule does not have carcinogenic effects in a systemic way.

Table 7: Toxicological Profile Assessment *in silico* Human

Tested by AMES		**Acute Oral Toxicity**		**Carcinogenic**	
Q	**P**	**C**	**P**	**Q**	**P**
NT	**59.0%**	**III**	**51.0%**	**CN**	**83.0%**

Source: Author's own, (2024) – admetSAR® Version. 2.0.
Q: Qualitative; P: Probability; C: Category

To complement the study of the human *in silico toxicological profile* , in addition to the three molecular descriptors obtained from the Chinese online platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/), other advanced molecular parameters were also determined using the same international online database platform. The parameters determined for a more robust evaluation of the human toxicity profile were:

ocular corrosion, eye irritability, hepatotoxicity (liver toxicity), dermal sensitivity (skin toxicity), respiratory toxicity (airway and pulmonary toxicity), reproductive toxicity (gonad toxicity), nephrotoxicity (renal toxicity), and mitochondrial toxicity (mitochondrial toxicity: functional organelle of cellular respiration).

The molecular parameters used to evaluate the advanced human toxicity profile are presented in Table 8. The analysis of Table 8 shows that the antibiotic Cefquinoma has a positive profile for four toxicological parameters: Respiratory Toxicity, Reproductive Toxicity, Mitochondrial Toxicity and Nephrotoxicity. The parameters evaluated are extremely relevant in pathophysiological terms for the proper functioning of the human organism.

Table 8: Toxicological Profile Assessment *in silico* Advanced Human

Toxicological parameters Q probability (%)		
Ocular Corrosion N		**0,9847**
Eye irritability N		**0,9599**
Hepatotoxicidade	**N**	**0,6066**
Skin sensitivity N		**0,8345**
Respiratory Toxicity	**P**	**0,9778**
Reproductive toxicity	**P**	**0,8667**
Mitochondrial Toxicity	**P**	**0,9750**
Nephrotoxicity	**P**	**0,5491**

Source: Author's own, (2024) – admetSAR® Version. 2.0.
Q: Qualitative; P: Positive; N: Negative

The toxicity of a chemical substance refers to its ability to cause some negative damage to a particular organ, as well as alter biochemical processes and enzyme systems. Thus, respiratory toxicity refers to the presence of substances that affect the respiratory tract. While reproductive toxicology evaluates the damage caused to sexual performance and fertility as a result of exposure to certain substances (FRIEDRICH et al., 2015).

Another important parameter refers to mitochondrial toxicity. The mitochondria correspond to an intracellular structure (organelle) responsible for converting energy from food into another energy with added value and transportable to cells and tissues, through the molecule adenosine-triphosphate (ATP). As a result, mitochondria, which are considered the primary source of ATP, are essential for the maintenance and life of eukaryotic cells. Because it has such functionalities, mitochondrial toxicity induced by xenobiotics is being addressed/researched in the pharmaceutical industry (PEREIRA et al., 2012).

Finally, with regard to nephrotoxicity, its incidence varies according to the functionalities employed and the kinetic characteristics of the drugs. In this sense, the most

commonly related drugs Renal tissue is vulnerable due to some factors, as it is responsible for receiving 25% of cardiac output, exposing the different renal cells to plasma flow. In addition, the rate of circulation of drugs in the kidney is much higher than in other tissues and protein-bound drugs are also released in the kidneys (MARTINS; IBRAHIM, 2022).

ADVANCED *IN SILICO* ENVIRONMENTAL PROFILE ASSESSMENT

The most robust environmental in silico *toxicological evaluation* was performed with the aid of the computer program EPI Suite™ version 4.1. The Estimation *Programs Interface (PPE*) Suite™ is a Windows® program that predicts physicochemical and environmental properties developed by the Environmental Protection Agency (EPA) and Syracuse Research Corp (SRC) (EPI Suite™, 2023). Based on the data determined in the program, it was possible to predict the most advanced environmental toxicology of the antibiotic Cefquinoma, as shown in Table 9.

Table 9: Toxicological Profile Assessment *in silico* Advanced Environmental

Molecular Descriptions	Percentage (%)
Aquatic Biodegradation	**No**
Total Removal	**1.89 %**
Total Biodegradation	**0.09 %**
Total Sludge Adsorption	**1.80 %**
Total Air Removal	**0.00 %**

Source: Author, (2023) – EPI Suite™ Program version 4.1.

The molecular descriptors presented in table 9, prediction of aquatic biodegradability, total removal, total biodegradation, total sludge adsorption, and total air removal are essential parameters in the evaluation of the environmental behavior of chemical substances. According to the data obtained computationally, it is possible to assess that the antibiotic Cefquinoma does not suffer environmental biodegradation, since its total removal is only 1.89%, corroborating the *in silico* environmental toxicological evaluation carried out with the help of the Chinese online platform admetSAR® version 2.0.

The biodegradability prediction characterizes whether the antibiotic will undergo natural decomposition and its total environmental removal, which reflects on the efficiency of the treatment processes in order to eliminate the antibiotic residues from the environment and the total biodegradation indicates the complete transformation of the antibiotic through biological processes into other harmless products.

The computer program EPI Suite™ provides for the removal of a certain chemical in a typical sewage treatment plant based on activated sludge. To this end, total removal

values and three processes that can contribute to removal are provided: total biodegradation, sludge adsorption and air removal.

It is noted that in the treatment, the antibiotic Cefquinoma is removed from the sludge at a rate of only 1.80%. Total sludge adsorption highlights a compound's affinity with sludge particles, influencing its mobility and potential impact on aquatic ecosystems. Finally, the total air removal assessment is null (0%), addresses the dispersion and fate of chemicals in the air, and is crucial in understanding the potential atmospheric effects. Through the results presented, it is inferred that it is quite inert and cumulative and the joint consideration of these properties, provides a comprehensive view of the interaction of the antibiotic under study with the environment, helping in the process of sustainable management.

CONCLUSION

The antibiotic Cefquinoma was chosen as the object of research because it is a veterinary antimicrobial in which little is known about its environmental, human and human pharmacokinetic toxicity. In this research, *in silico* methodologies were used in order to predict molecular descriptors for the antibiotic Cefquinoma.

The in silico environmental *toxicological study* revealed that the veterinary antibiotic does not have toxicity for bees and crustaceans, but it is toxic for fish and its chemical structure does not suffer environmental biodegradation. Therefore, in addition to contaminating the aquatic environment and fish, the chemical structure of the antibiotic remains unchanged in the environment because it does not undergo environmental biodegradation, presenting a total removal rate of only 1.89%, resulting in contamination of the food chain and humans through food.

The ADME *in silico study* indicated that the antibiotic does not have a good prediction regarding human oral bioavailability, has a low intestinal absorption rate, does not have permeability by the blood-brain barrier, and does not inhibit glycoprotein P. The in silico pharmacokinetic study also revealed that the antibiotic does not inhibit hepatic isoenzymes of the cytochrome P450 complex, that is, there will be no biochemical alteration in the metabolization process in the liver, which facilitates the excretion of xenobiotic and/or lipophilic compounds from the human body.

Initially, the human in *silico* toxicological study indicated promising data, since the antibiotic does not have mutagenic toxicity with regard to the AMES test, does not present carcinogenicity and as for acute oral toxicity it falls into category III, that is, it has low toxicity. However, a more robust human in *silico toxicology study* revealed that the

veterinary antibiotic has respiratory toxicity, reproductive toxicity, mitochondrial toxicity and nephrotoxicity. As a result of the present research, it was possible to evaluate the environmental and human toxicity, the human oral bioavailability and the evaluation of pharmacokinetic descriptors in humans of the antibiotic Cefquinoma.

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INTRAPRENEURSHIP IN PUBLIC ORGANIZATIONS AS A MECHANISM FOR GENERATING VALUE: A LITERATURE REVIEW

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ABSTRACT

This study examined how the principles of entrepreneurship can promote intrapreneurial behavior in the public sector, analyzing the impact of these practices on the innovation and efficiency of public organizations. The main objective was to investigate how entrepreneurial ideals can be integrated into the public environment to improve the quality of services provided to the population. The results indicate that intrapreneurship can transform the public sector by encouraging a more innovative and proactive mindset among employees. The adoption of entrepreneurial practices within public organizations can lead to the reevaluation and improvement of processes and services, resulting in greater efficiency and effectiveness in public management. The study reveals that creating a culture of innovation, where creativity and initiative are valued, can help overcome bureaucratic rigidities and increase employee engagement. Finally, the application of entrepreneurial methods can also improve public perception of the administration, strengthening community trust and support for government initiatives. In summary, intrapreneurship offers a promising path for continuous improvement and innovation in the public sector.

Keywords: Entrepreneurship. Intrapreneurship. Public Management. Innovation.

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INTRODUCTION

The concept of entrepreneurship is central to innovation and competitiveness in a globalized market. In a scenario of constant technological evolution and fierce competition, companies have turned to the continuous improvement of their products and services. This improvement often involves the adoption of new production methods, the exploration of new markets and organizational restructuring. Entrepreneurship, by transforming knowledge into new products and generating profit, adds value to both the company and the customer. Thus, it becomes an essential component for the growth and development of societies.

Historically, the role of entrepreneurs has been fundamental to the progress of societies. However, formal entrepreneurship education is relatively recent. Accelerated technological advancement and the resulting demands have forced a reassessment of traditional approaches. The need to formalize knowledge, which was previously acquired empirically, became evident with the increasing complexity of the economy and production methods.

Dornelas (2011) observes that the emphasis on entrepreneurship emerged as a response to rapid technological changes and global competition. These factors have forced entrepreneurs to adopt new paradigms, adapting to new market realities. The sophistication of the economy and production processes has made it essential to formalize knowledge, which was previously informal and based on empirically developed practices.

According to Costa et al. (2007), entrepreneurship is strongly associated with policies to combat unemployment. However, they argue that entrepreneurship is not only a response to the employment crisis, but also a consequence of changing social and political patterns. In a globalized world, entrepreneurship is configured as an adaptive response to new social and economic conditions.

The concept of corporate entrepreneurship has been explored in recent decades, reflecting an expansion of the traditional concept of entrepreneurship into established companies. Dornelas (2011) defines corporate entrepreneurship as the process by which individuals or groups within an existing organization create new initiatives or promote innovation. This concept suggests that innovation can occur at any level of the company, leveraging employee experiences and resources.

The justification for this bibliographic study lies in the growing need to rethink innovation in the public sector from the perspective of entrepreneurship. In a scenario where innovation is essential for the competitiveness and effectiveness of organizations, the public sector, traditionally more rigid and less flexible, faces significant challenges to adopt innovative practices.

The objective of the study is to analyze how the ideals of entrepreneurship can contribute to intrapreneurial behavior, investigating how these methods can positively influence innovation and efficiency within public organizations. In view of the above, how can intrapreneurship contribute to improving the value of services provided in the public sector?

LITERATURE REVIEW

AN ANALYSIS OF ENTREPRENEURSHIP

The concept of entrepreneurship is often described as complex, as it encompasses several aspects and dimensions. Falcone and Osborne (2005) point out that defining entrepreneurship is not a simple task, given its multifaceted nature and the diversity of factors involved. The difficulty in pinpointing a single definition is due to the intersection of personal characteristics, economic contexts, and social influences, requiring a comprehensive approach to capture the full essence of the phenomenon.

Simon (2002) describes entrepreneurship as a dynamic process that involves identifying, developing, and realizing a vision. This process is intrinsically linked to innovation, as it requires the creation of new opportunities and the management of risks and uncertainties. Thus, entrepreneurship is not limited to the generation of ideas; It also involves the ability to turn these ideas into concrete realities, facing challenges and adapting to changes along the way.

Filion (1999) argues that the study of entrepreneurship is enriched by diverse academic disciplines, including economics, psychology, history, and sociology. Each of these areas contributes with a unique perspective, offering a more complete and diversified view of the phenomenon. While economics can focus on opportunities and resources, psychology can explore the individual motivations and characteristics of entrepreneurs, reflecting the importance of an integrated approach to understanding entrepreneurship.

The role of scholars such as Cantillon (1755), Say (1832), Schumpeter (1934) and Shapero (1980) in shaping the concept of entrepreneurship is fundamental. Cantillon introduced the idea that the entrepreneur takes risks in pursuit of profit, while Say and Schumpeter broadened this view by emphasizing innovation and the role of the entrepreneur as agents of economic change. These contributions have helped shape the modern understanding of entrepreneurship as a key driver of development and economic transformation.

According to Hisrich et al. (2009), the entrepreneur is the one who combines resources efficiently to create value, promoting changes and innovations. This economic

definition underlines the importance of not only pooling resources but also utilizing them in a way that generates new products, services, or processes that can bring significant benefits to the market. The entrepreneur plays a crucial role in creating economic and social value through the introduction of innovations.

McClelland's (1987) contribution to the behavioral approach in the study of entrepreneurship is significant. McClelland identified common behavioral traits among entrepreneurs, such as the need for success and the desire for control, that influence their decisions and actions. These traits help explain why certain individuals are more likely to seek out and explore entrepreneurial opportunities, highlighting the importance of personal characteristics in entrepreneurial success.

McClelland revealed that entrepreneurs tend to set challenging goals and actively seek responsibility for solving problems. These behaviors are indicative of a willingness to face challenges and seek creative solutions, characteristics that are essential for success in entrepreneurial environments. Studying these traits offers valuable insights into the motivational and behavioral factors that drive entrepreneurial behavior.

Filion (1999) notes that, after McClelland's contributions, the behavioral approach dominated the field of entrepreneurship for approximately two decades. During this period, the focus was to identify and understand the characteristics and behaviors of entrepreneurs, establishing a methodological consensus on how to study these individuals. This behavioral domain helped refine the understanding of the factors that contribute to entrepreneurial success.

Teodoro and Oliveira (2006) suggest that the entrepreneur seeks to create conditions that provide a tangible return on his actions and behaviors. This return can be financial, but it also includes personal and professional benefits, such as developing skills and achieving personal goals. The motivation to obtain a positive return drives entrepreneurial behavior and influences how entrepreneurs approach and manage their initiatives.

Cunningham and Lischeron (1991) identify six schools of thought on entrepreneurship, each offering a distinct perspective on the phenomenon. These schools include the Bibliographic, Psychological, Administration, Leadership, Corporate and Intrapreneurial School. Each school addresses different aspects of entrepreneurship, from innovation to management and leadership, offering a more complete and diverse view of the role of the entrepreneur.

Timmons (1994) identifies three essential factors for the success of entrepreneurship: opportunity, team and resources. The opportunity is crucial to the viability

of the venture, while the team must have the right profile and skills to support the initiative. The resources are necessary to start and sustain the business. These interdependent factors are critical to the success of any venture and must be managed effectively.

The School of Intrapreneurs and the discussions on corporate entrepreneurship, as presented by Cunningham and Lischeron (1991), show that entrepreneurship can occur within established organizations. The intrapreneur is the one who adopts an entrepreneurial mindset within the corporate structure, seeking to innovate and improve existing processes. This type of entrepreneurship can bring new challenges and opportunities to existing companies.

Hashimoto (2009) proposes three classifications of corporate entrepreneurship: formal or induced, informal or autonomous, and aligned with organizational strategy. Formal corporate entrepreneurship involves initiatives facilitated by the organization, while informal entrepreneurship occurs spontaneously, without the explicit support of the company. Alignment with organizational strategy reflects a more formal integration of entrepreneurial practices into the company's goals and objectives.

Baron and Shane (2007) highlight the importance of human resources for the success of any enterprise. The selection of partners and employees should be based on their skills and knowledge, reflecting the need for a well-prepared team capable of contributing to the success of the business. Choosing proper team members is essential to ensure that the venture can thrive and achieve its goals.

Garcia et al. (2008) and Pin et al. (2010) emphasize that intrapreneurial competencies, such as creativity, innovation, and leadership, have a significant impact on the performance of organizations. The development of these skills within companies can promote sustainable growth and strengthen competitiveness. Intrapreneurship, therefore, not only facilitates innovation but also contributes to the efficiency and success of organizations.

INTRAPRENEURSHIP IN THE PUBLIC SECTOR

Intrapreneurship in the public sector is a concept that has gained relevance in recent years, as organizations look for alternatives to improve their services and increase efficiency. Tavares (2010) points out that public institutions, which have the responsibility of providing services to society, function as dynamic and complex systems. These systems are interdependent and interrelated, involving information flows, organizational structures, people, and technologies. Although the Federal Constitution of 1988 establishes efficiency as a constitutional principle, many of these organizations still operate in a bureaucratic and

mechanistic manner. This scenario demonstrates a pressing need for transformation to overcome existing obstacles and limitations.

In this context, Marques (2014) analyzes the impact of entrepreneurship and innovation on the survival of public organizations. The author suggests that these processes are crucial to add value to the services provided to society. Marques highlights the importance of innovative practices that can address bureaucratic rigidity and promote a more efficient public administration. He points out that flexibility and a systemic vision are fundamental for entrepreneurial practices to be effective in the public sector.

Coelho (2010) also has this perspective when he observes that intrapreneurship is emerging as a positive trend in public organizations. According to the author, the fact that intrapreneurship is becoming a common practice, even among employees who do not occupy formal leadership positions, reflects a significant change in the public sector, evidencing a potential for transformation.

On the other hand, Festa and Garcia Filho (2013), in their study, critically point out the organizational culture in the public sector, identifying an important obstacle to intrapreneurship. They note that, despite the theoretical understanding of the importance of entrepreneurial characteristics, the reality of public organizations often reflects a traditional culture that discourages innovation. The contrast between the potential for innovation and the conservative reality of employees suggests a gap that needs to be addressed to stimulate intrapreneurship.

Rodrigues' (2014) analysis reveals significant sociodemographic aspects related to intrapreneurship in the public sector. The study identifies that women and individuals with a high salary and high level of education are more likely to engage in entrepreneurial activities. Rodrigues also notes that employees in positions of trust have greater freedom to implement innovative practices. These factors point to a correlation between individual characteristics and the ability to promote change within public organizations.

According to Nienkoetter and Cruz (2012), public administration must continuously develop and bring about changes to achieve sustainability and self-sufficiency. They highlight that the ability to create and innovate is a crucial asset for organizations. The need for an internal cultural change that allows employees to use their creativity for the benefit of the organization is emphasized as an essential step for progress in the public sector.

Similarly, Coelho (2010) highlights that the intrapreneur is a fundamental agent of innovation. It seeks and drives innovation within organizations, playing a crucial role in advancing practices, both in the public and private sectors. The ability to promote changes

and innovations within institutions is essential for the evolution of services provided to society.

In turn, Fontes (2014) addresses the situation of public administration, particularly in the context of crisis and abandonment of public institutions. She argues that, even in a scenario of predominance of bureaucracy and self-indulgence, entrepreneurship can thrive. Fontes suggests that, with a better use of resources and an environment conducive to innovation, it is possible to create an entrepreneurial environment that improves public management.

According to Tavares (2010), despite efforts to promote entrepreneurial practices, resistance to change and centralization remain significant challenges. Lack of awareness and attachment to bureaucracy often inhibit entrepreneurial traits, hindering employee development and the effectiveness of innovative practices.

In contrast, Lacerda et al. (2017) highlight that the focus of intrapreneurship in the public sector should be focused on solutions that improve the services provided to society. The goal is not profit, but rather to improve the quality of care and create an environment favorable to the development of entrepreneurial skills. The implementation of innovative management practices and the integration between theory and practice are suggested as effective strategies to achieve these objectives.

According to Klein et al. (2014), there is a manifestation of public entrepreneurship in activities such as changing institutional rules and creating new public resources. They emphasize that innovation in the public interest occurs when resources are used in new ways, based on innovative ideas. This reinforces the importance of an entrepreneurial approach to addressing challenges and driving improvements in the public sector.

For Festa and Garcia Filho (2013), even with human and financial resources available, the traditional organizational culture often prevents innovation. The presence of a conservative and low-risk culture is identified as a significant obstacle to the development of entrepreneurial practices, suggesting that a cultural shift is needed to harness the innovative potential of public organizations.

According to Rodrigues (2014), women tend to be more intrapreneurial, and individuals in positions of trust are more likely to undertake. These observations highlight the importance of personal and professional characteristics in promoting intrapreneurship and suggest that factors such as salary range and level of education also play a relevant role.

METHODOLOGICAL PROCEDURES

The study was delimited by a literature review and aimed to investigate the harm caused by psychopaths in the public service work environment. It was based on the methodological precepts of Gil (2012), using systematic mapping to gather and analyze relevant studies on the subject. The starting point was the clear formulation of the research problem, focusing on the identification and description of entrepreneurship, but focused on the internal side of public institutions.

The methodology included a search for studies, articles, databases such as Google Scholar and Scielo, digital libraries and relevant scientific publications. Specific search terms were used, related to the following keywords: Entrepreneurship, Intrapreneurship, Public Management, Innovation, Characteristics, Management Training.

Literature Mapping Table 1.

Author	Year	Results	Publication Location
BARON, R. A.; SHANE, S. A.	2007	It explores the process of entrepreneurship, addressing its characteristics and dynamics.	São Paulo: Thomson Learning
CANTILLON, R.	1755	It introduces the concept of entrepreneurship, emphasizing the role of the entrepreneur in the economy.	Paris
COELHO, M. L. G. M. Mota	2010	It analyzes intrapreneurship and innovation in federal public management, highlighting challenges and opportunities.	*Revista do Serviço Público*, v. 61, n. 3, p. 233-249
CUNNINGHAM, J. B.; LISCHERON, J.	1991	It defines entrepreneurship and its fundamental characteristics, exploring different theoretical approaches.	*Journal of Small Business Management*, v. 29, n. 1, p. 45-61
FALCONE, T.; OSBORNE, S.	2005	It discusses the diversity of the concept of entrepreneurship in different cultural and economic contexts.	Annals of the IberoAcademy, Faculty of Economics - New University of Lisbon
FESTA, M. P.; GARCIA FILHO, M. A.	2013	It studies the profile of intrapreneurs in the Brazilian public banking sector, identifying characteristics and behaviors.	*Cadernos UiFOA*, 21 ed.
FILION, L. J.	1999	It examines the differences between entrepreneur management systems and small business operators.	*RAE – Journal of Business Administration*, v. 39, n. 4, p. 6-20
FONTE, V.	2014	It addresses the role of entrepreneurship in public management, discussing its implications and practices.	Federal Board of Directors
GARCIA, U. L.; GIMENEZ, F. A. P.; TOLEDO, A.	2008	Develops a scale to measure intrapreneurial actions and behaviors in companies.	Annals of the V EGEPE
HASHIMOTO, M.	2009	It investigates how intrapreneurial organizations create a link between internal climate and superior performance.	Thesis (Doctorate), School of Business Administration of São Paulo, FGV

HISRICH, R. D.; PETERS, M. P.; SHEPHERD, D. A.	2009	It offers a comprehensive overview of the concept of entrepreneurship and its practices.	Porto Alegre: Bookman
KLEIN, B. L.; FULCO, J. F.; SANTOS, G.; BITTARELLO, K.	2017	It analyzes the integration between incubated companies and universities to generate continuous competitive advantages in dynamic environments.	*NAVUS Journal of Management and Technology*, v. 7, n. 2, p. 78-96
LACERDA, R. T. de O.; KLEIN, B. L.; FULCO, J. F.; SANTOS, G.; BITTARELLO, K.	2017	Similar to the study by KLEIN et al. (2017), focusing on innovative integration and continuous generation of competitive advantages.	*NAVUS Journal of Management and Technology*, v. 7, n. 2, p. 78-96
MARQUES, S. B. V.	2014	Case study on intrapreneurship in the public sector at a federal university, highlighting perspectives and challenges faced by managers.	Dissertation (Master's Degree), Federal Technological University of Paraná, Curitiba
MCCLELLAND, D.	1987	It identifies the characteristics of successful entrepreneurs and the factors that contribute to their success.	*The Journal of Creative Behavior*, v. 21, n. 3, p. 219-233
NIENKOETTER, E. A. S.; CRUZ, H. A. da.	2012	Analysis of intrapreneurship in cultural tourism in the public sector, with a focus on São Bonifácio/SC.	IX SEGeT Symposium of Excellence in Management and Technology
PIN, W. L.; LIE, J.; NAIQIU, L.; ZHENGZHONG, X.	2010	Review of research on human resource management in intrapreneurship, with future projections.	*Advanced Management Science (ICAMS)*, IEEE International Conference
RODRIGUES, D. M.	2014	Multi-case study on intrapreneurship in the public service, analyzing different cases and practices.	Monograph (Administration), University of Brasília - UNB
SAY, J.-B.	1832	It presents an economic theory that addresses the role of the entrepreneur and his influence on the economy.	Paris
SCHUMPETER, J. A.	1983 [1934]	It examines the theory of economic development and the role of innovation and entrepreneurship in the process of economic growth.	São Paulo: Abril Cultural
SHAPERO, A.	1980	It analyzes the social dimensions of entrepreneurship and its impacts on research on the subject.	Entrepreneurship Research Congress, Waco, TX
SIMON, H. A.	2002	Study of decision-making processes in administrative organizations, highlighting behaviors and techniques.	New York: Macmillan
TEODORO, P.; OLIVEIRA, V. C. S.	2006	It discusses entrepreneurship by necessity and the managerial training of the small Brazilian entrepreneur, highlighting challenges and proposals for improvement.	In: ÉSTHER, Â. B.; PAÇO-CUNHA, E.; SANÁBIO, M. T. (orgs). *Small businesses: reflections and perspectives for action*
TIMMONS, J. A.	1994	It explores the creation of new ventures and the critical factors for the success of new businesses.	Boston: Irwin McGraw-Hill
TAVARES, E. V. C.	2010	It examines the use of intrapreneurship in public institutions and the impacts of this	*Legal Content*, Brasília

		approach on efficiency and innovation.	

Source: Own Authorship 2024.

The selection of studies was based on pre-defined inclusion and exclusion criteria, ensuring the relevance and quality of the sources used. The analysis of the collected data was conducted in a critical and interpretative manner, focusing on the identification of similarities with the theme proposed in the study, in which different theoretical and methodological perspectives presented by the selected studies were explored.

The results were presented in an organized and objective manner, highlighting the main findings on the theme proposed in the study. A subtitle was developed for results that summarizes the main links of what the authors highlight in the face of the theme, within a time limit that covers the years between 1755 and 2017. With this, the evolution was delimited in the face of the long period of time.

RESULTS AND ANALYSIS

Entrepreneurship is already a constant throughout the corporate world and in commercial and service environments. In this sense, Falcone and Osborne (2005) highlight that this is a phenomenon that involves not only the creation of new companies, but also innovation and adaptation in various contexts. The broad and complex definition of entrepreneurship reflects the need for a comprehensive approach to understanding the multitude of factors that influence entrepreneurial practice.

For Simon (2002), it is a dynamic process that requires the identification and transformation of opportunities into concrete realities. This process is intrinsically linked to innovation, since entrepreneurship is not limited to creating new ideas, but also involves the ability to manage and adapt them to changes.

Filion (1999) argues that the study of entrepreneurship is enriched by several disciplines, reflecting the complexity of the phenomenon. Integrating economic, psychological, historical, and sociological perspectives can offer a more complete picture of how entrepreneurship can be applied to promote innovation and efficiency.

Schumpeter (1934) and Shapero (1980) demonstrate that the concept of entrepreneurship has evolved over time. Cantillon (1755) introduced the idea of risk, and Say (1832) emphasized the role of innovation. Schumpeter highlighted the entrepreneur as an agent of economic change. These contributions have helped shape the modern understanding of entrepreneurship, which can be applied to improve public administration by embedding innovative and dynamic practices in the public sector.

Hisrich et al. (2009), who see the entrepreneur as someone who combines resources efficiently to create value, underlines the importance of effective resource management. In the public sector, this implies the need to use available resources in order to promote innovations that bring tangible benefits to society. Applying this vision can help create a more efficient and results-oriented environment.

McClelland (1987) offers a behavioral perspective by identifying common traits among entrepreneurs, such as the need for success and the desire for control. These characteristics are essential to face challenges and seek creative solutions, which is particularly relevant for the public sector. Employees with these characteristics can drive change and innovation within institutions, helping to overcome resistance to change and foster a more entrepreneurial culture.

The behavioral approach, dominated by McClelland and observed by Filion (1999), highlights the importance of understanding the traits and behaviors of entrepreneurs. In the public sector, this may mean identifying and cultivating individuals who possess these entrepreneurial traits, providing them with the support they need to implement changes and innovations that benefit the public administration.

Teodoro and Oliveira (2006) suggest that entrepreneurs seek a tangible return on their actions, not only financially, but also in terms of personal and professional development. In the public sector, this can translate into benefits such as improving employee skills and achieving goals that promote more efficient and effective administration. The motivation to obtain a positive return can drive intrapreneurial behavior and contribute to significant improvements.

Cunningham and Lischeron (1991) identify several schools of thought on entrepreneurship, each offering a distinct perspective. This diversity of approaches can be applied to the public sector to explore different innovation and management strategies. Understanding these approaches can help develop practices that encourage intrapreneurship and improve the efficiency of public institutions.

Timmons (1994) highlights three essential factors for the success of entrepreneurship: opportunity, team and resources. In the context of the public sector, identifying opportunities for innovation, building competent teams, and effectively managing resources are crucial to promoting entrepreneurial practices. The integration of these factors can help transform public administration and achieve better results for society.

Hashimoto (2009) classifies corporate entrepreneurship into three types: formal, informal, and aligned with organizational strategy. This classification can be applied to the public sector to understand how entrepreneurial initiatives can be facilitated or

spontaneously arise within institutions. Integrating entrepreneurial practices with organizational strategy can help improve public management and service efficiency.

Baron and Shane (2007) emphasize the importance of human resources for the success of enterprises. In the public sector, this means that the selection and training of employees with entrepreneurial skills is essential to promote change and innovation. A well-prepared team can contribute significantly to the transformation and improvement of the services offered to society.

Garcia et al. (2008) and Pin et al. (2010) emphasize that competencies such as creativity, innovation, and leadership have a positive impact on the performance of organizations. In the public sector, the development of these skills can promote sustainable growth and strengthen the competitiveness of institutions. Intrapreneurship can facilitate innovation and contribute to the efficiency and success of public organizations.

Tavares (2010) points out that public institutions face challenges due to their bureaucratic and mechanical structure. Despite efforts to promote entrepreneurial practices, resistance to change and centralization remain significant obstacles. Overcoming these challenges is essential for the successful implementation of intrapreneurial practices and for improving the efficiency of public services.

Marques (2014) and Coelho (2010) highlight that entrepreneurship and innovation are crucial for the survival and improvement of public organizations. These practices can address bureaucratic rigidities and promote more efficient public administration. The adoption of entrepreneurial practices can help transform public administration and provide better services to society.

Festa and Garcia Filho (2013) observe that the traditional organizational culture in the public sector can discourage innovation. To overcome this barrier, it is necessary to promote a cultural change that allows the development of entrepreneurial practices. Creating a more innovative and proactive environment can help overcome cultural limitations and drive significant improvements.

Rodrigues (2014) reveals that factors such as salary range and level of education influence the propensity to intrapreneurship. Employees with these characteristics may be better positioned to drive change and innovation in the public sector. Identifying and supporting these individuals can contribute to the successful implementation of entrepreneurial practices.

Nienkoetter and Cruz (2012) highlight that public administration must evolve to achieve sustainability and self-sufficiency. The ability to create and innovate is essential for the progress of public organizations. Promoting an internal cultural change that allows the

use of employees' creativity can be an important step to improve public management and the effectiveness of services.

Fontes (2014) argues that, even in crisis scenarios and abandonment of public institutions, entrepreneurship can thrive. With a better use of resources and a favorable environment for innovation, it is possible to create an entrepreneurial environment that improves public management. This perspective suggests that, despite the difficulties, entrepreneurship can be a valuable tool for public sector transformation.

Lacerda et al. (2017) emphasize that the focus of intrapreneurship in the public sector should be aimed at improving the services provided to society. The implementation of innovative management practices and the integration between theory and practice are effective strategies to achieve these goals. Intrapreneurship can contribute significantly to the evolution and efficiency of public institutions.

FINAL CONSIDERATIONS

In view of the objectives and the proposed problem, it was seen that intrapreneurship has the potential to significantly transform the public sector by applying entrepreneurial principles within existing organizational structures. By promoting an innovative and proactive mindset among employees, intrapreneurship can lead to a reevaluation of processes and services, encouraging the search for more efficient and effective solutions. This can result in substantial improvements in the quality of services provided, as employees become more engaged and motivated to find new ways to meet the needs of the population, while also facing and overcoming traditional bureaucratic limitations.

By adding the incentive to intrapreneurship, a culture of innovation can be promoted within public organizations, where creativity and initiative are valued and rewarded. This cultural shift is essential to overcome the rigidity and resistance to change that often characterizes the public sector. When employees are empowered to act as intrapreneurs, they have the freedom and support they need to experiment with new approaches and implement improvements that can lead to more efficient and results-oriented public management.

The positive impact of intrapreneurship, on the other hand, goes beyond operational efficiency; It can also improve public perception of the services offered. By demonstrating a commitment to innovation and continuous improvement, public organizations can earn the trust and respect of the community, resulting in greater acceptance and support for their initiatives.

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AGENCY CONFLICTS IN AGRICULTURAL COOPERATIVES AND THEIR IMPLICATIONS FOR THE PRESIDENT'S SUCCESSION PROCESS

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ABSTRACT

Succession involves the need to replace one manager with another in the most important position in an organization. A transfer of power threatens organizational identity and harms its activities, but if well planned it represents a strategic opportunity for growth and renewal. Formal succession planning in non-profit organizations becomes a vital aspect of their survival. The objective of this article is to relate the main agency conflicts, proposed by Cook (1995), with the succession of the president or CEO in agricultural cooperatives. The presence of these conflicts in seven agricultural cooperatives in Mato Grosso do Sul was analyzed, with regard to the discussions on the succession of the president. Only the current presidents of the cooperatives were interviewed, seeking evidence of the participation of the cooperative members in decisions about succession, the way the president deals with the interests of the principals and the planning of the cooperative's management in the long term. Aspects involving principal (cooperative members) and agent (president) in all the conflicts proposed by Cook (1995) were identified, hitchhiking, horizon, portfolio, control and costs of influence. In this sense, it was identified a lack of dialogue between principal and agent, absence of planning and discussions regarding the succession of the president, the importance of remuneration as retribution for the work performed by the agent, conflict of interest, lack of understanding of the principals when it comes to the interests of the cooperative. They should seek good performance both upstream (on the farm) and downstream (in the cooperative), but they end up abdicating the interests of the cooperative to the detriment of their own interests.

Keywords: Planning, Loyalty, Control, Management.

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INTRODUCTION

Research on succession has often approached the process as a moment of crisis (Dyck et al., 2002; Comini et al., 2013), where there is a need to replace a successful manager with a leader with better performance in the function (Dyck et al., 2002). It can represent a threat to organizational identity and hinder the progress of activities (Gothard; Austin, 2013), but if well planned it can provide opportunities for development and renewal (Allison, 2002; Dyck et al., 2002).

In this way, formal succession planning in non-profit organizations becomes a vital aspect of their survival. Although there is recognition of the importance of this process, concrete actions are not properly elaborated for the preparation of a successor (Froelich et al., 2011). These organizations, also called the third sector (Comini et al., 2013), include, among others, cooperatives and associations (Carrion, 2000).

For the Organization of Brazilian Cooperatives - OCB (2017), agricultural cooperatives aim to generate work and income, seek better technologies and planting, marketing, agro-industrialization and contribute in a shrewd way to the development of agriculture and the Brazilian economy. They are directed by a president who is also a member and rural producer, so he will better understand the needs of the cooperative members, but will tend to adopt more conservative management plans (Bialoskorski Neto, 2012).

This situation leads cooperatives to self-management (Antonialli, 2000) and cooperative members end up taking double risks, because in addition to dealing with environmental threats, they are also subject to the financial risks of the market (Moreira et al., 2016). This link between the ownership and management of the cooperative can lead managers to be influenced by their particular needs when deliberating on strategic decisions (Siqueira; Bialoskorski Neto, 2014), so there is a need for cooperative members to be involved in the governance of cooperatives, decision-making and in the choice of their leaders (United States Department Of Agriculture Rural Development – USDA, 2001).

Discussions about governance have evolved around the agency problems that arise when the company's management starts to privilege its own interests to the detriment of the interests of shareholders. In 1970, the discussions turned to the fact that companies should be concerned not only with the needs of shareholders, but also with other groups are also affected by the board's decisions, including stakeholders, which involve customers, suppliers, employees, the local community and the State (Álvares et al., 2008).

The complexity of agency issues in agricultural cooperatives stems from several factors, including: the various roles played by cooperative members, such as owners,

customers, and managers (Boland et al., 2011); the low involvement of the group that is not in power in discussions and decision-making (Crúzio, 1999) and the difficulty of governance in terms of the exercise of authority and the problems of agency (Álvares et al., 2008). With emphasis on the Brazilian cooperative legislation, which determines that the presidency of these organizations is occupied by an associate member. The objective of this research is to relate the main agency conflicts, proposed by Cook (1995), experienced in agricultural cooperatives with the succession of the president.

NEW INSTITUTIONAL ECONOMICS AND COOPERATIVE MANAGEMENT

Coase (1937) observed that economists overvalued activities related to production and marketing, neglecting the internal processes of organizations that occurred in the intricacies of the production process, highlighting the role of the firm and its management for decision-making in the face of market uncertainties.

Firms seek to minimize uncertainties and avoid conflicts by reducing transaction costs. The New Institutional Economics admits the existence of institutions that define the "rules of the game", whether formal (laws and property rights) or informal (customs and tradition) (North, 1991).

These rules are not able to predict all conducts in exchange relations, due to the limited rationality of individuals and the asymmetry of information. Thus, contracts play an important role in aligning the interests of those involved, aiming to prevent opportunistic behavior, minimize uncertainties, align information and reduce costs (Williamson, 2002). In addition, this relationship can benefit from corporate reputation and the development of trust in order to reduce market risks (Bachmann; Inkpen, 2011).

Within cooperatives, the attitude of cooperative members towards governance practices determines their behavior (Hakelius; Hansson, 2016), and issues related to agency problems are institutional guides of corporate governance, it is therefore essential to align incentives, based on remuneration policies (oriented to conduct and results) and to monitor self-interested behaviors (Shapiro, 2005).

The positions of fiscal council and board members, including the president, are held by members of the cooperative, elected by their peers (Brasil, 1971). These organizations struggle to find individuals who assume responsibilities, the absence of strategic planning and cyclical changes in management hinder their good performance, especially when there is divergence of interests between cooperative members and management, so professionalization can be a way to solve administrative problems (Antonialli, 2000).

Agency problems arise from informational asymmetries between principals and agents, which generates expenses called agency costs, which arise from opportunistic behavior, resulting from recruitment costs, adverse selection, incentives, moral hazard, corruption, monitoring, and self-regulation (Shapiro, 2005).

These costs are related to property rights that lead to conflicts over residual claims and participation in decision-making, all of which arise from five peculiar characteristics of cooperative users, proposed by Cook (1995) and replicated by Zylbersztajn (2002):

1) Hitchhiker problem: when members use the cooperative's resources for their own benefit, property rights are not adequately enforced to ensure that everyone has the same benefits (Cook, 1995), in the same way when they buy products/inputs from the cooperative and sell the production to another organization for a better financial return (Zylbersztajn, 2002).
2) Horizon problem: caused by the lack of liquidity, discouragement of members to capitalize the cooperative, reducing opportunities for growth and new investments in the long term (Cook, 1995).
3) Portfolio problem: this problem is linked to the adversity between issues involving investment decisions and risks (Cook, 1995), difficulty in accessing third-party capital and the discouragement of capitalization by members leads Brazilian cooperatives to opt for short-term projects to the detriment of long-term ones due to the lack of financial support to invest with their own resources (Zylberztajn, 2002).
4) Control problem: it is linked to agency costs, conflicts of interest between associates (principal) and managers (agents), requires monitoring mechanisms the larger and more complex the organization is (Cook, 1995). In Brazilian cooperatives, there is generally no separation between ownership and control, which can be detrimental to these organizations in the sense of having agents specialized in the performance of strategic functions, circumventing problems of inefficiency, monitoring and control exercised by councils and audits (Zylbersztajn, 2002).
5) Problem of influence costs: plurality of objectives among the members of the cooperative (Cook, 1995). It arises from the problem of control, as members are not always chosen for efficiency, but receive an income for the exercise of executive positions, triggering problems of informational asymmetry and, in this way, distancing members from the assemblies and decision-making processes, making it difficult for them to monitor (Zylbersztajn, 2002).

Agency conflicts in cooperatives occur due to the disagreement of ideas between cooperative members and directors, Poppo and Zenger (2002) point to the importance of relational governance, based on trust, where the fulfillment of obligations, promises and expectations takes place through social processes that enable flexibility, solidarity and exchange of information. For Shapiro (2005), organizational structures need to foster reciprocity, cooperation, intercooperation and trust.

Thus, the maintenance of a relationship based on trust is fundamental between managers and cooperative members (Bertolin et al, 2008), this trust is the result of effective institutional measures and regularity in transactions, enhancing the development of a positive reputation (Bachmann; Inkpen, 2011).

The asymmetry of information between agent and principal (associates and managers) hinders the emergence of trust, and may lead associates to seek external sources to meet their needs (Bertolin et al., 2008). In this sense, formal institutions and relational governance complement each other, avoiding opportunistic behavior and ensuring mutuality (Poppo; Zenger, 2002) between cooperative members and managers.

Economic issues - difficulty in accessing resources (Gimenes; Gimenes, 2007) - and institutional - inflexible cooperative legislation - lead agricultural cooperatives to "self-management" with a pattern of selection of internal candidates (Antonialli, 2000). The distrust of cooperative members in the decision-making processes of management is evidence of the need for a change in management (Bertolin et al., 2008).

METHODOLOGY

In the state of Mato Grosso do Sul there are 36 agricultural cooperatives with headquarters in the state (OCB/MS, 2017). A data survey was carried out via telephone to find out the billing and other information to profile 20 of them, as 16 did not respond, it was not possible to make contact or were deactivated.

The cooperatives were classified by size based on their revenues based on the classification of the size of companies of the National Bank for Economic and Social Development (BNDES, 2015), used to fit companies to their lines and programs of financing. Table 1 shows this classification.

Table 1: Classification of the size of cooperatives according to revenue.

Postage	Billing
Microenterprise	Up to 2.4 million
Small Business	Above 2.4 million to 16 million
Medium Enterprise	Above 16 million up to 90 million
Medium-Large Enterprise	Above 90 million up to 300 million
Large Company	Above 300 million

Source: Adapted by the author according to the BNDES company size classification (2015).

Based on the classification in Table 1, the cooperatives were classified as large, medium-large, medium, small and micro cooperative, as shown in Table 2. One cooperative was not classified in this item, as it did not provide information about its revenue.

Table 2: Classification of cooperatives by size.

	Postage	Billing		Postage	Billing
1st	Big	836,48	11th	Small	4,6
2nd	Big	468,0	12th	Small	4,0
3rd	Medium-Large	98,0	13th	Micro	2,0
4th	Average	89,7	14th	Micro	1,5
5th	Average	80,0	15th	Micro	1,15
6th	Average	36,0	16th	Micro	0,53
7th	Average	34,0	17th	Micro	0,30
8th	Small	14,0	18th	Micro	0,14
9th	Small	12,0	19th	Micro	There is none
10th	Small	4,8	20th	-	Not disclosed

Source: Prepared by the authors based on research data (2016).

The second stage was an interview with the presidents of these cooperatives with an on-site visit. The selection criterion was revenue and the availability of the presidents to participate. Seven cooperatives participated and were defined as: CP1 and CP2 (large); PC3, CP4 and CP5 (medium size); CP6 (small) and CP7 (micro).

The option for seven interviews considered the exhaustion of the data, the repetition of the information led to the cessation of the collection. The researcher and the president participated, and in two cases there was the participation of third parties (superintendent and an employee). The interviewees signed a Free and Informed Consent Form, the interviews were recorded with a portable recorder and later transcribed with the aid of the *InqScribe software*.

The questions encompassed topics about the president's entry into the cooperative and the position, average time of permanence of the current president in charge of the cooperative; training and experience of managers; existence of talent management practices; planning of the succession process; involvement of cooperative members in the process; perception of the president; Boards of Directors and Fiscal Council.

This research followed the methodological proposal of Bardin's (2011) content analysis, contemplating the following phases: pre-analysis; exploration of the material; treatment of results, inference and interpretation.

- Pre-analysis: "floating" reading of the documents to survey the variables and build the research instrument.
- Exploration of the material: transcription of the interviews through the *InqScribe* software and exported to the *Nvivo* software, where five nodes were created: Portfolio; Ride; Horizon; Control and Costs of Influence.
- Treatment of results, inference and interpretation: analysis of transcripts, framing of data to variables (*Nvivo*), grouping and interpretation of results.

RESULTS AND DISCUSSION

PROFILE OF THE COOPERATIVE, THE PRESIDENT AND SUCCESSION

Chart 1 presents data on the age and time that the current president has been in charge of the management, in the seven cooperatives visited.

Table 1: Characterization of cooperatives.

	Postage	Age of the president (us)	Time that the current president has held the position
CP1	Big	86	38 years old
CP2		53	9 months
CP3	Average	35	1 year
CP4		40	9 years
CP5		51	2 years
CP6	Small	63	7 years
CP7	Micro	34	6 Months

Source: Prepared by the authors based on research data (2017).

The management times range from six months to 38 years, with the presidents being 34 years old, the youngest and 86 years old, the oldest, respectively. Only CP1 and CP6 have strategic planning. Chart 2 presents some characteristics of its presidents:

Table 2: Characteristics of the presidents.

	CP1	CP2	CP3	CP4	CP5	CP6	CP7
Higher level							
First term							
You have someone you trust in your property							
Fulfills hours in the cooperative							
Receives remuneration							
He is a founding partner							
Supports the renewal of management							
Experience in cooperative management							

Activity in the same branch of the cooperative							

Source: Prepared by the authors based on research data (2017).

In Chart 2, the filled cells reveal the presence of the aforementioned characteristic, so it is observed that the two presidents who do not have higher education are inserted in the only two cooperatives that presented a strategic plan (CP1 and CP6), in addition these two presidents are already more than one term at the head of the cooperative, are founding members and do not support the renewal of management.

The presidents of the four cooperatives with the highest revenues delegated the management of their properties to trusted people, which gives them greater freedom to take care of the demands of the presidency position. Factors that can discourage presidents from remaining in office are not having their rural activity in the same branch in which the cooperative operates (CP6) and not providing remuneration to the president, as in the case of CP7 (cooperative with lower revenue). All the presidents were already in other positions in the management of the cooperative before assuming the presidency.

Cooperatives need qualified agents/managers to deal with human relations and with the capacity to develop and manage monitoring mechanisms due to the complexity involved in the management of cooperatives.

Some points were identified in the seven interviews that characterize the peculiar traits of the users of the cooperatives proposed by Cook (1995) and that influence the succession process of these organizations in the state of Mato Grosso do Sul.

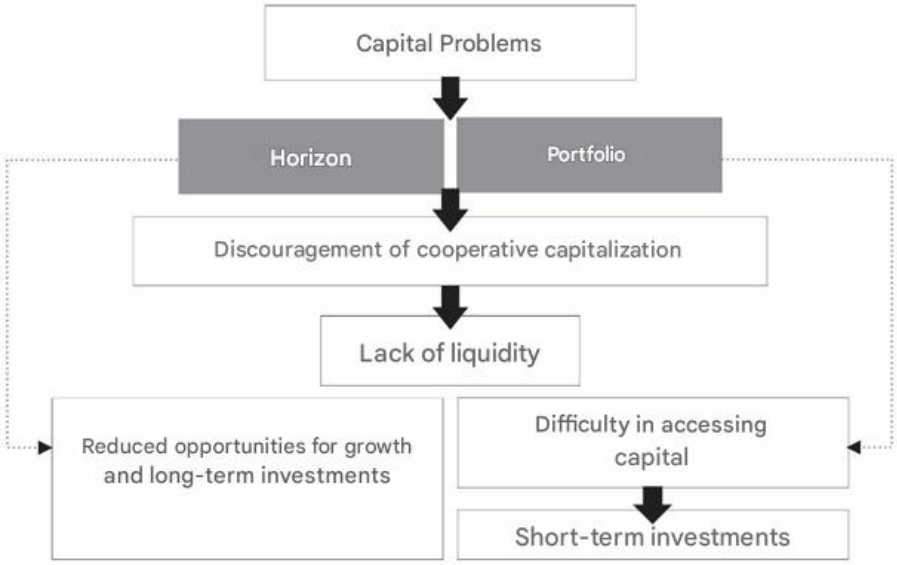
The answers of the interviewees refer to their experience and experience within the cooperatives, this does not mean that the problems reported necessarily existed at the time of the interview, but that at some point they have already experienced or identified these behaviors in the institutional framework.

Thus, the five problems proposed by Cook (1995) were divided into two categories: (1) capital problems; and (2) problems involving individuals.

CAPITAL PROBLEMS

The capital problem involves the difficulty of capitalization and is linked to two of the problems proposed by Cook (1995) as shown in Figure 1:

Figure 1: Capital problems.



Source: Prepared by the authors based on theory and data.

Figure 1 shows that the horizon and portfolio problems are linked to the complexity of capitalization of cooperatives, which makes it difficult to carry out projects with long-term returns (horizon), minimizing their ability to offer new services (portfolio) to improve the support provided to cooperative members and remain competitive in the market in which they are inserted.

The problem of the horizon is present in the cooperatives of MS and impacts on their succession process, because many times (CP1, CP3, CP5, CP6) there is no concern with the replacement of managers in the medium and long term. An aggravating factor is the difficulty in retaining financial resources (CP3) and the resistance of the cooperative members to invest in the cooperative (CP3, CP7), making it difficult to invest in training.

This scenario makes some cooperatives seek survival mechanisms, such as renouncing the pro-labore of the president and board members in favor of the financial balance of the cooperative (CP7), but this situation becomes a disincentive to the development of the permanence of individuals in the position (CP3, CP7).

That is why succession planning is essential to reduce risks and ensure management continuity, with competent professionals who are able to maintain control through a smooth transition (IBGC, 2015). In this sense, the need to train the president and possible successors (CP3, CP5), the early involvement in management (CP4, CP5), the importance of rural succession with a view to renewing the cooperative's membership (CP3, CP4, CP5) were highlighted.

A management with a new executive profile is fundamental (OLIVEIRA, 2011), aiming to achieve growth opportunities and new investments in the long term, which are

profitable upstream, for the cooperative members as customers and downstream for the cooperative and for the cooperative members as partners.

However, cooperatives have a difficulty in remunerating their executives satisfactorily, *"[...]it's not what we receive here as president, [...] which would be an amount that would pay an executive director [...]"* (CP2), thus hindering the professionalization of management, an ideal scenario for the current competitive environment in which cooperatives are inserted (CP2, ANTONIALLI, 2000) as observed by the president of CP5:

"[...] A model that I imagine ideal would be that of professionals hired to run the day-to-day of the cooperative. The board of directors meets [...] to set goals, outline the guidelines, pass it on to the executive area and let the people work. And the board of directors together with the fiscal council create monitoring mechanisms [...]".

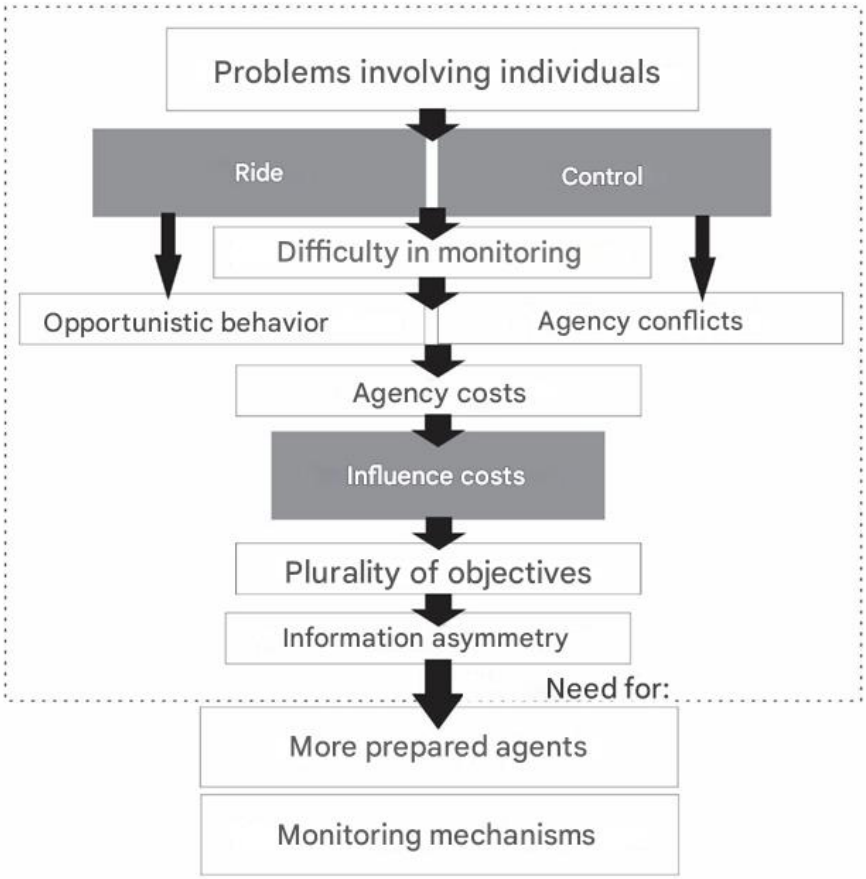
In addition, pecuniary remuneration is also necessary in view of attracting qualified members to take over the management (CP2, CP3, CP7), allowing them to give up part of their time dedicated to the property to engage in the cooperative's projects (CP5), *"the pro-labore will sometimes provide a motivation for someone who is wanting (to take over the management)[...]"* (CP7).

The succession process demands resources, if not well conducted, it will culminate in the election of poorly trained managers, who end up adopting more conservative measures (Bialoskorski Neto, 2012) with regard to investments and innovations in the long term (CP4).

PROBLEMS INVOLVING INDIVIDUALS

The problems involving individuals are the free rider, control and influence costs and are linked to issues involving monitoring, agency costs, plurality of objectives and informational asymmetry, as shown in Figure 2.

Figure 2: Problems involving individuals.



Source: Prepared by the authors based on theory and data.

The problem of the free rider is linked to opportunistic behavior and can involve two links in the cooperative, the cooperative members and the management, occurring when:

1) the cooperative members only approach the cooperative in times of difficulty (they negotiate with it only when they are benefiting and intend to solve their problems primarily to the demands of the other members) – these problems were identified by the presidents of CP2, CP3 and CP6. *"[...] they don't even want to know what's going on (management), they want their product here, to sell it when they want, [...] they don't want to participate [...]" (CP6)* and *"[...]there are cooperatives who want to take advantage of the other cooperative member or over the cooperative, if he is taking advantage [...] he is sucking a little bit of everyone [...] (CP3).* Thus, it is necessary to reassess governance practices, as they are what determine the behavior of members towards the cooperative (Hakelius; Hansson, 2016).
2) management, when the directors take charge with a view to obtaining advantages, such as remuneration/bonuses; meeting the demands of one's own rural business, delegating services/jobs to relatives (CP3), gaining political advantages (CP3, CP4 and CP6), taking over management without preparation (CP2, CP6) and passing the

baton to someone in the family (CP1). These behaviors are identified in the following excerpts:

> *"Practically it's my son who is taking over, right (the presidency). Today he is superintendent and I suffer from kidney [...]so he does almost everything. Practically president (Laughs)." (CP1).*
> *"[...] the cooperative member [...] has to be aware that the business is his[...] because look at the time that the business involves money, he has cooperated that passed here that [...] he was much more concerned with his business than with the cooperative [...]" (CP3).*
> *"[...] He opened branches (speaking of a former president) throughout the state and used the cooperative to get elected as a state deputy and then abandoned the cooperative [...]" (CP4).*

The fragility in the relationship between the cooperative's directors and the cooperative members is attributed to the previous manager's impressions of breach of trust, suggesting the prioritization of individual interests over those of the cooperative. Due to the difficulty of monitoring this behavior, it can be avoided through the moral qualification of managers, as evidenced by the president of CP4: *"[...] it is more moral qualification than technical qualification, because we already have the technical qualification [...]".*

This situation is aggravated by the difficulty in separating the management of the property and the management of the cooperative, leading some managers to be influenced by their particular needs in decision-making (Siqueira; Bialoskorski Neto, 2014), hence the importance of *"[...]search for [...] to have executives here even running the cooperative with goals, with planning and we counselors come just to monitor, execute and charge [...]" (CP2).*

For, *"[...]There are a lot of people with problems, you know, who think they will be president to solve their problem [...] we are not here to solve my problem [...] (CP4),* then adverse selection and the asymmetry of information between associates and managers negatively influences the succession process, highlighting the importance of formal and relational governance to avoid opportunistic behavior (Poppo; Zenger, 2002) and to keep the cooperative members closer to the cooperative, with a relationship based on trust and the search for collective improvements.

The problem of control, on the other hand, generates agency conflicts that, combined with the lack of management succession planning (CP1, CP5, CP6), leads the cooperatives to a conflicting transition (CP2, CP4), as observed by the president of CP2 where, *"The succession took place at a time of a little wear and tear for the cooperative with the previous board [...]"*, in view of this, highlighted the concern of the current board of directors so that in the near future there will be preparation for the president and board members to take over.

In CP4, the process was more conflictual, *"[...] The cooperative had an extremely closed management model, the president at the time, he was kind of the exclusive owner of the cooperative and then we didn't have access to the information [...] I got the number of signatures [...] for me, I was a member to call a meeting and without needing the directors [...] we dismissed the entire board of directors".*

The two cooperatives, CP2 and CP4, were characterized by a long previous management and the succession took place at a time when there was a search to renew the staff, because according to Bertolin *et al*., (2008) the distrust of the cooperative members in the decision-making processes of the management evidences the need for a change in management.

The link between ownership and management generates costs, such as the difficulty of managers to reconcile the management of the property with that of the cooperative, which may arise problems of poor management, lack of preparation, carelessness with the demands of the position (CP2, CP4, CP7), *"[...]Me being more focused on the cooperative I can't be running my farm but I have my brother so I can rest assured [...]" (CP3).*

Conflicts of interest arise when the cooperative members (CP3) or the counselors are not participative in discussions and decision-making (CP1, CP2, CP5, CP7) and when property rights are not clearly delimited.

The lack of autonomy of the technical team (CP2, CP4) can also lead to conflicts since *"[...]it [*the technical team] *is the one who is on top of everything, it knows who arrives and talks about something, who says if they [*the cooperative members] *are happy or not [...]"* (CP6), adjusting to the new trends in the configuration of production, which, due to technological innovations, require reciprocal and collective relations (Carvalho; Bernardes, 1996; Ianni, 1994).

In this sense, it is crucial that the technical team participates in the discussions to avoid problems of discontinuity of work because *"[...]The board will leave but the technical team will continue, it is the one that knows the pain, it is the technical team that knows the progress, the new board will learn from the technical team [...] so the technical team is the main evaluation [...]"* (CP4).

Actions are important in order to circumvent inefficiencies and conflicts, through the renewal of the council (CP1, CP2) *"[...]The expectation is [...] to do a succession work so that more people can participate and the cooperative goes through more evolved succession processes with more committed and qualified people [...]"*(CP2), this process is essential for the decentralization of power, so it is opportune to have a succession plan

(CP2, CP4) aiming at a smooth transition where trained people can be at the head of the cooperative (CP1, CP2).

A wrong decision regarding succession can result in recruitment costs, adverse selection, moral hazard, corruption and monitoring (Shapiro, 2005), thus, a careful look at this process becomes essential, so that it is a planned process and integrates the practices carried out within agricultural cooperatives, through the optimization of the use of available resources.

Having someone trustworthy on the property can be fundamental for the president of the cooperative to be able to dedicate himself to management (CP3, CP4), another option to mitigate conflicts would be the professionalization of management (CP5; Antonialli, 2000), but this alternative requires capital and high professionalism, in addition to the necessary adaptation to cooperative institutional principles, aiming to minimize uncertainties, avoid conflicts, reduce costs and provide for the growth of the organization (North, 1991), in this sense contracts can also be useful in terms of safeguarding collective objectives (Williamson, 2002) and strengthening trust between the parties (Bachmann; Inkpen, 2011).

The problem of free ridership and control arising from opportunistic behavior and agency conflicts and associated with the difficulty of monitoring self-interested behaviors incur unnecessary costs such as agency and influence costs. The latter is due to the plurality of objectives of the associates and managers of cooperatives that have owners/users, in this sense, managers and counselors need to deal with the demands by evaluating the most urgent needs, as it is not possible to please 100% of the employees and associates (CP2).

The firm's succession planning should include incentives for qualified associates to be involved in management, and the alternate should be prepared to take charge if necessary, requiring governance to coordinate an incentive structure (Williamson, 2002; CP3, CP6), *"[...]I was vice president and for private reasons the president had to be absent and then I was forced to take over, but I didn't have that desire and then I'm going to the third term"* (CP6).

The technical team is a strategic link, as it is in direct contact with management and users, so it can play an important role, minimizing informational asymmetry and bringing the demands of cooperative members closer to counselors and managers. Thus, it is crucial to involve this team in the discussions (CP4, CP5, CP6), including the elections for the presidency of the cooperative (CP4), as all *stakeholders* are affected by the board's decisions (Álvares et al., 2008).

Very long administrations are not advantageous, as they lead to the centralization of power, inhibiting the participation and involvement of the cooperative members, so some presidents evaluated the renewal of management (CP3, CP4, CP5, CP7) as fundamental, eight years is the ideal time (CP4), for the president of *CP7 "[...]there has to be change if it doesn't become a very centralizing business [...]you begin to put your own practices within the cooperative and [...] feel like you own [...] the cooperative [...]"*(CP7).

This will allow a constant renewal of ideas, enabling the demands of the various links to be resolved, avoiding conflicts between groups and providing opportunities for a greater number of individuals to participate in the management process, but with the maintenance of members of the previous management to continue the projects in progress so that all the effort and resources employed are not lost (CP2, CP3, CP5, CP7).

The members who are at the head of the cooperative need to combine availability, capacity (CP2) and above all moral qualification (CP4, CP7) to perform their activities, because a good manager is one who achieves the trust of the cooperative members (CP5, CP6), seeking more committed individuals to assume responsibilities (CP3, CP5, CP6).

FINAL CONSIDERATIONS

The agency conflicts experienced in agricultural cooperatives and their relationship with the succession of the president reflect problems involving capital and individuals. The relations between the president, cooperative members, the board of directors, the technical team and other *stakeholders* showed impasses for a future succession.

This economic and social scenario of cooperatives challenges the efficiency of these organizations with a view to better performance, involving the difficulties of raising funds for long-term investments, complexity in management regarding the asymmetry in communication/information, internal and adverse selection of the board of directors, opportunistic behavior and agency costs.

The peculiarities of cooperative legislation, with requirements involving the need for internal candidates, terms of a maximum of four years, and a link between ownership and management, end up hindering the succession processes of executive positions in these organizations.

With the intensification of the demands for quality, reliability, innovation and value creation to remain competitive in the labor market, agricultural cooperatives struggle to choose their leaders, because the managers are also rural landowners and need to reconcile the activity in the field with that of the cooperative, they usually have experience in managing the property, but are not used to managing a greater amount of economic and

human capital, Thus, discussions arose about the professionalization of the management of these organizations and ways of monitoring them.

All cooperatives, regardless of size (large, medium, small and micro), are faced with agency problems (horizon, portfolio, carpooling, control and cost of influence) when analyzed in the face of the succession phenomenon. The category in relation to the control problem stands out, in which the seven cooperatives surveyed presented evidence of occurrences in their statements.

Thus, the need to plan the succession process emerges, aiming at preparing potential successors to assume the positions of directors within the cooperatives, with the participation of the technical team in decision-making, to continue the processes and activities in progress. In this sense, the management has as a great challenge the development and maintenance of trust between associates and managers.

This trust comes from the work done for the common good, which, when neglected, gives rise to agency conflicts, such as free ridership and adverse selection, experienced by these cooperatives, when the board is more concerned with its own benefits than with the whole.

These conflicts generate costs for the cooperative, which needs to implement control mechanisms avoiding the opportunistic behavior of both parties and safeguarding individual and collective rights. Thus, it is important that the roles of formal institutions, mechanisms and norms and informal ones, which involve the relationship and transparency between the parties, are effective.

When the directors reach a high level of trust, they enable better communication, based on easier and more transparent decisions, triggering efficiency in the choice of directors and participation of members in management.

This research contributes to point to the importance of evaluating the impacts of agency conflicts in agricultural cooperatives and how they can affect the succession process of the president. The limitations are related to the delimitation of the interviews that took place in Mato Grosso do Sul, as a suggestion for future research it is proposed to evaluate the existence of these conflicts in cooperatives in other states.

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A DESCRIPTIVE ANALYSIS OF BRAZIL: THE IMPORTANCE OF TOURIST ENTERTAINMENT

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ABSTRACT

Tourist entertainment plays a crucial role in the economic and social development of Brazil's tourist regions. This study investigated the importance of tourist entertainment in the Brazilian context, describing its various forms, economic benefits, contribution to the diversification of the regional economy, infrastructure strategies and professional training, relationship with environmental preservation, involvement of the local community, use of technology and the challenges faced by the sector. In addition, the study aimed to propose strategies and recommendations to promote the sustainable development of tourist entertainment in Brazil. The results highlight the need for investments in infrastructure, professional training and environmental awareness, as well as the use of technologies to improve the tourist experience. Collaboration between the public and private sector, together with the active participation of the local community, is essential for the success of tourism entertainment and for the achievement of the country's sustainable development goals.

Keywords: Tourist Animation. Economic benefits. Hospitality.

INTRODUCTION

Through a variety of activities offered, such as cultural, sporting and recreational events, tourist entertainment seeks to provide memorable experiences to tourists. In addition, this practice aims to promote interaction between visitors and the local environment, thus stimulating the involvement of tourists with the culture, history and nature of the destination.

One of the main characteristics of tourist entertainment is the diversity of activities available to visitors. This variety allows it to cater to the different preferences and interests of tourists, ensuring that everyone can enjoy an enriching experience during their stay in the destination. Through participatory and engaging activities, visitors are encouraged to actively engage in the experiences offered, becoming an integral part of the animation process.

In addition to the social and cultural benefits, tourist entertainment also brings significant economic advantages to destinations. By offering a wide range of attractive activities, this strategy contributes to increasing the length of stay of visitors in the destination. This results in an increase in tourist spending on lodging, food, transportation, and local shopping. In this way, by promoting thematic events and festivals, tourist entertainment stimulates local consumption and boosts the economic development of the receiving communities.

The relationship between tourist entertainment and the preservation of cultural and natural heritage is a crucial aspect to be considered. Through the promotion of activities that value and highlight tourist resources, this practice contributes to the conservation of these resources. By engaging visitors in authentic and educational experiences, tourist entertainment sparks interest in the history, culture and nature of the destination, thus encouraging its protection and preservation.

The implementation of tourist entertainment faces several challenges. One of the main ones is the need for training of the professionals involved in this activity. It is essential that these professionals have technical knowledge and specific skills to plan, organize and execute animation activities efficiently. There are numerous successful examples of tourist entertainment in national and international destinations. Strategies such as themed festivals, outdoor concerts, guided tours, and cultural workshops have been successfully adopted in different places around the world. These initiatives have achieved positive results, increasing the number of visitors, extending the length of stay in the destination and stimulating local economic development.

This study aimed to describe the importance of tourist entertainment in the Brazilian context, showing its various forms, economic benefits, contribution to the diversification of the regional economy, infrastructure strategies and professional training, relationship with environmental preservation, involvement of the local community, use of technology and the challenges faced by the sector.

On the lookout, the prospects for tourist entertainment are promising. With changing traveler profiles and market trends, this practice is expected to continue to evolve and adapt to new demands. The personalization of experiences, the use of innovative technologies and integration with other forms of tourism, such as sustainable tourism and adventure tourism, are some of the trends that should shape the future of tourist entertainment. In this sense, it is important that destinations are prepared to reinvent themselves and offer unique and memorable experiences to visitors.

THE IMPORTANCE OF TOURIST ENTERTAINMENT FOR THE HOTEL SECTOR

The main characteristics of tourist entertainment include direct interaction with tourists and the offer of leisure and entertainment activities. Direct interaction occurs through the active participation of tourists in the proposed activities, allowing them to experience unique experiences during their stay in the destination. Leisure and entertainment activities, on the other hand, cover a wide range of options, such as concerts, shows, guided tours, and sports activities, which aim to meet the different interests and preferences of visitors (CORDEIRO, PORDEUS, 2022).

This passage describes the essence of tourist animation, which is based on direct interaction with visitors and the provision of a variety of leisure and entertainment activities. Direct interaction occurs when tourists actively participate in the proposed activities, which allows them to experience unique moments during their stay at the site. As for the activities offered, they cover a wide range of options, such as concerts, shows, guided tours and sports activities, in order to meet the different preferences and interests of visitors, providing a more complete and satisfactory tourist experience.

In the context of tourist entertainment, there are different types of activities that can be offered to tourists. The shows and spectacles are examples of cultural animation, which aim to present aspects of local culture through artistic performances. Guided tours, on the other hand, allow tourists to explore the attractions of the destination accompanied by specialized guides. In addition, sports activities are also popular in tourist entertainment, providing visitors with the opportunity to enjoy sports and outdoor activities.

Tourist entertainment brings several benefits to tourists. In addition to providing moments of fun and entertainment during the trip, tourist entertainment also offers visitors the opportunity to learn more about the local culture. Through the proposed activities, tourists can experience traditions, customs and typical gastronomy of the destination, enriching their travel experience and promoting greater understanding and respect for the local culture.

However, professionals working in the field of tourist entertainment face significant challenges. One of the main challenges is the need to create attractive programs adapted to the preferences of tourists. For this, it is essential to know the profile of visitors and be up to date on trends in the tourism market. In addition, it is necessary to ensure that the proposed activities are safe, sustainable, and aligned with the cultural values of the destination.

The current trends in the area of tourist entertainment are related to the use of digital technologies to offer more immersive and personalized experiences to visitors. Through virtual reality, for example, it is possible to create virtual simulations that allow tourists to explore destinations even before traveling. In addition, the use of mobile applications and online platforms facilitates communication between tourism animation professionals and tourists, allowing for greater interaction and personalization of activities (PINHEIRO, 2018).

The training of professionals who work in the area of tourist entertainment is important to ensure a quality and satisfactory service for tourists. It is necessary that these professionals have technical knowledge and specific skills, such as cultural animation, event management and interpersonal communication. In addition, the training should also address topics related to sustainability, professional ethics and safety, aiming to provide positive and responsible experiences to visitors.

Tourist entertainment plays an indispensable role in attracting and retaining customers in the hotel sector. By offering a variety of activities and entertainment to guests, hotels are able to create a differentiated experience, making them more attractive to tourists. In addition, tourist entertainment contributes to the creation of a relaxed and fun atmosphere, which can be an important differential in the choice of hotel by customers (CABECEIRO, ESTEVES, 2019).

During off-season periods, hotel occupancy tends to decrease significantly. However, tourist entertainment can be an effective strategy to increase this occupation. By offering exclusive activities and special programs during these periods, hotels such as the Copacabana Palace, in Rio de Janeiro, and the Tivoli Ecoresort, in Bahia, are able to attract a greater number of guests. For example, these hotels host food festivals, wellness

workshops, and themed cultural events, allowing visitors to enjoy unique experiences while making the most of their facilities and services, even outside of peak season.

The integration of tourist entertainment activities into the services offered by hotels not only strengthens their competitive position, but also contributes to the diversification of the customer experience. Hotels such as the Belmond Hotel das Cataratas, in Foz do Iguaçu, and the Txai Resort, in Itacaré, are examples of establishments that have successfully adopted this strategy. Belmond Hotel das Cataratas offers exclusive guided tours of Iguaçu National Park, allowing guests to explore the falls at different times, away from the crowds. The Txai Resort promotes cultural events such as capoeira performances and local handicraft workshops, providing an authentic and immersive experience that connects visitors to Bahian culture and the local community.

In addition to attracting and retaining customers, tourist entertainment also has the potential to improve the guest experience and make their stay unforgettable. Through recreational activities, live shows, theme parties, and other entertainment options, hotels are able to provide unique moments to their guests, creating positive memories that will be associated with the hotel's brand.

The offer of tourist entertainment services also adds value to hotels, making them more competitive in the market. By providing a wide range of activities for guests to enjoy during their stay, hotels stand out from the competition and position themselves as well-rounded destinations that cater to the different needs and interests of tourists.

It is essential for hotels to offer a variety of tourist entertainment activities to cater to the different preferences and interests of guests. While some may prefer more relaxing activities such as yoga classes or spa sessions, others may be looking for adventure and extreme sports. Therefore, it is important that hotels have a diversified program, with options for all tastes (SILVEIRA, 2022). In addition to benefiting individual hotels, tourist entertainment also plays an important role in promoting the destination as a whole. By offering activities that encourage guests to explore local attractions, hotels contribute to the development of tourism in the region, generating a positive impact on the local economy and strengthening the image of the destination as a whole.

Investing in qualified and trained professionals to carry out tourist entertainment activities is essential to ensure quality service and guest satisfaction. These professionals may include expert tour guides, who have in-depth knowledge of local history and attractions, and are responsible for conducting informative and engaging excursions and tours. In addition, it is important to have entertainers and facilitators of recreational activities, such as yoga instructors, dancers, and local artists, who lead cultural events and

workshops, providing entertainment and unique experiences. These professionals must have specific skills in animation and entertainment, as well as a solid understanding of the destination and its attractions, to deliver memorable guest experiences and increase their satisfaction and loyalty.

METHODOLOGY

The methodology adopted to investigate the importance of tourist entertainment in Brazil involved a qualitative approach based on bibliographic research, focusing on the period from 2016 to 2023. This study sought to analyze and synthesize information available in reliable sources, such as scientific articles and relevant documents on the subject, published between 2016 and 2023.

Initially, a systematic review of the literature was carried out using academic databases such as Scopus, Web of Science and Google Scholar, as well as virtual libraries and websites specialized in tourism. Publications that address various aspects of tourism animation, including its definition, types, benefits, challenges and trends, both on a global scale and with a specific focus on the Brazilian context, were selected and analyzed.

Table 1: Selection criteria

Criteria Selection	Description
Relevance of the Title	Evaluation of the relevance of the title to the theme of tourist entertainment in the Brazil.
Quality of the Summary	Prioritization of abstracts that clearly align with the objectives of the research and with the analysis period (2016 to 2023).
Content Complete	Inclusion of works with complete, accessible content and sources Reliable.
Period of Publication	Inclusion of works published between 2016 and 2023.

The exclusion criteria can also be observed.

Table 2: Inclusion and exclusion criteria

Exclusion Criteria	Description
Duplicity	Deleting duplicate jobs to avoid redundancies in analysis.
Irrelevant Title	Exclusion of works whose title is not directly related to the theme of tourist entertainment.
Inappropriate Summary and Content	Exclusion of papers with abstracts that do not show relevance to the theme or content that is not aligned with the objectives of the research.

For data collection and analysis, critical reading and interpretative synthesis techniques were used. The relevant information was extracted and organized according to

the thematic categories identified during the literature review process. The analysis of the data allowed a comprehensive and in-depth understanding of the importance of tourist entertainment for Brazil, highlighting its economic, social, cultural and environmental implications over the period from 2016 to 2023.

In addition, relevant bibliographic references, published within the period studied, were incorporated to theoretically support the conclusions and arguments presented in this study. The critical analysis of these sources contributed to support the discussions and recommendations proposed throughout the work.

It is important to note that this study focused on providing a comprehensive and up-to-date view of the importance of tourist entertainment in Brazil, based on information available in the specialized literature published between 2016 and 2023. The results obtained aim to contribute to the advancement of academic knowledge and to the improvement of practices in the Brazilian tourism sector.

ROLE OF THE HOTEL PROFESSIONAL IN TOURIST ENTERTAINMENT

The role of the hotel professional in tourist entertainment is extremely important to ensure the fun and entertainment of guests during their stay. One of the main responsibilities of this professional is the planning and organization of activities that meet the interests and expectations of tourists. This involves selecting leisure options, such as tours, cultural and sporting events, as well as creating themed programs that can appeal to different audiences. In addition, the professional must be aware of the logistics of these activities, ensuring that all the necessary resources are available and that the schedules are adequate for the participation of guests (CORDEIRO, PORDEUS, 2022).

Another responsibility of the hospitality professional in tourist entertainment is to create a welcoming and friendly environment for tourists. This includes everything from the warm welcome at check-in to the care with the details of the decoration and ambiance of the hotel's common spaces. For example, the Hotel Fasano, in São Paulo, stands out for its warm welcome and attention to detail in the ambiance of the spaces, with sophisticated décor and personalized service. Similarly, the Pestana Rio Atlântica in Rio de Janeiro provides a welcoming experience with attentive staff and décor that reflects Rio's vibrant culture. By creating a positive atmosphere, these hotels contribute to providing a memorable experience for guests, making them feel welcome and comfortable throughout their stay.

The ability of the hotel professional to deal with different tourist profiles is essential for the success of tourist entertainment. Each group or individual has specific preferences

and needs, and it is up to the professional to adapt the activities according to these characteristics. For example, Hotel Unique, in São Paulo, demonstrates this adaptability by offering differentiated programs to its various clienteles. For families with children, the hotel hosts cooking workshops and recreational activities in the pool area, ensuring that the little ones have a good time while their parents relax. On the other hand, for elderly guests, quieter activities are offered, such as yoga sessions and walks through the hotel's gardens, promoting a relaxing and pleasant environment.

Likewise, Mavsa Resort, also in São Paulo, stands out in customizing its offers to meet the specific interests of the groups. For those looking for adventure, the resort offers activities such as tree climbing and zip lining. For food lovers, it offers exclusive culinary experiences, with workshops led by renowned chefs and tasting events for local dishes. This ability to adapt and customize activities allows the hospitality professional to meet the diverse needs of guests, providing a more enriching and satisfying experience.

Efficient communication on the part of the hotel professional in tourist entertainment is essential to ensure the participation of guests in the available activities. It is necessary to convey clear information about the times, locations and details of the activities, as well as to encourage guests to participate actively. To do this, the professional must use different communication channels, such as bulletin boards, hotel social networks, and personal interactions during the stay (SILVA, 2023).

The ability of the hotel professional to solve problems and deal with unforeseen events during tourist entertainment activities is crucial to ensure the smooth running of the activities and the satisfaction of guests. It is possible that unexpected situations may occur, such as weather changes that prevent an outdoor activity from being carried out or technical problems in equipment used in the activities. In these cases, the professional must act quickly and efficiently, seeking viable alternatives to circumvent the situation and minimize the negative impact on the guest experience (CABECEIRO, ESTEVES, 2019).

The hospitality professional plays a crucial role in assessing guest satisfaction with tourist entertainment activities. This process starts with collecting data through satisfaction surveys and individual feedback, which offer direct insights into the guest experience. Additionally, analyzing indicators such as activity participation rate provides valuable insights into which events are attracting the most interest and which may need adjustments. For example, if a hotel observes that cooking activities have a high participation rate, but that water sports sessions are receiving less engagement, this may indicate a need to review or diversify water sports-related offerings.

Based on this information, the hotel professional can propose adjustments and improvements in tourist entertainment programs. For example, if the feedback reveals that guests would like more options for evening activities, the hotel may consider introducing events such as theme nights or live performances. If the data shows a growing demand for authentic local experiences, the hotel can increase the frequency of workshops and cultural tours. This ongoing process of evaluation and adjustment allows the hospitality professional to better meet customer expectations, providing an experience that is more aligned with their interests and preferences, and ensuring overall guest satisfaction.

Tourist entertainment is a widely used strategy to attract and entertain tourists during their travels. Among the different types of tourist entertainment, cultural entertainment stands out. This form of animation involves activities related to local culture, such as visits to museums, festivals, and cultural events. Through these experiences, tourists have the opportunity to get to know and experience the cultural richness of the destination visited (SOUSA, 2023).

Another type of tourist entertainment is sports entertainment. This modality includes sports and adventure activities, such as hiking, climbing and cycling tours. Through these activities, tourists can explore the natural beauty of the destination while exercising and having fun outdoors.

In addition to these activities, some destinations offer specialized experiences, such as rafting on fast rivers, ziplining in tropical forests, and even diving in coral reefs. For example, at a mountain resort like Palladium Hotel Group, located in Serra da Estrela, guests can participate in climbing and hiking activities, exploring the natural beauty of the region. In coastal destinations such as the Pousada de Estalagem do Mar in Portugal, visitors can enjoy bike rides along the coast and swims in crystal-clear waters.

According to the Vila Galé Cumbuco Hotel, the resort offers several leisure and entertainment options, including exciting buggy rides through the dunes, nautical sports activities, nightly entertainment with shows and dances, recreational programs for children and excursions to the city of Fortaleza.

These sports entertainment experiences allow tourists not only to stay active and healthy, but also to experience and interact with nature in a dynamic and exciting way. Through these activities, tourists have fun outdoors, explore the natural beauty of the destination, and create lasting memories while connecting with the environment around them.

In addition, we have the gastronomic animation, which focuses on local cuisine and offers unique gastronomic experiences to tourists. This modality allows visitors to explore

the richness of regional flavors and engage directly with the local culture through food. For example, Hotel Ponta dos Ganchos, in Santa Catarina, offers a gastronomic immersion with its exclusive beachfront dining experience, where guests can taste dishes prepared with fresh and local ingredients, while enjoying a stunning view.

Another example is the Balthazar Hotel in Rio de Janeiro, which promotes regular events such as Brazilian cuisine theme nights, where renowned chefs prepare traditional dishes and guests can participate in tastings and culinary workshops. In addition, the Hotel Tivoli Ecoresort Praia do Forte, in Bahia, offers local cooking workshops and live cooking experiences, allowing visitors to learn how to prepare typical dishes of Bahian cuisine, such as moqueca and acarajé.

These dining experiences not only allow tourists to sample typical dishes from the region but also provide a deeper understanding of the local culture and its culinary traditions. Through these activities, visitors have the opportunity to experience traditional restaurants, interact with local chefs, and acquire new culinary skills, making the travel experience even richer and more memorable.

Another relevant type is environmental animation, which promotes environmental awareness and offers nature-related activities. This type of entertainment includes trails in preserved areas, bird watching, and walks in nature reserves, providing tourists with a deeper connection with the environment and encouraging the preservation of nature.

An excellent example is the Kaya Forest Resort, located in the Atlantic Forest, which offers guided trails through preserved areas and birdwatching activities. Guests can explore the rich biodiversity of the region, learn about the local flora and fauna, and participate in environmental volunteer programs.

Another example is Pousada do Sandi, in Paraty, which promotes ecological tours in partnership with specialized local guides. Visitors have the opportunity to explore the rich vegetation of the region through walks in nature reserves, in addition to participating in activities aimed at environmental education, such as workshops on sustainable practices and nature conservation.

These eco-hotels not only provide enriching experiences for tourists but also play an active role in protecting and preserving local ecosystems, reinforcing the importance of environmental conservation.

Social entertainment is another important form of entertainment for tourists. It involves social interactions between tourists and locals, such as theme parties and cultural gatherings. These activities provide visitors with the opportunity to meet local people, learn

about their traditions and customs, and experience the culture in a more authentic way (SILVA, 2023).

Educational entertainment is a modality that aims to provide knowledge to tourists through guided tours of historical sites or educational lectures. This form of animation allows visitors to learn about the history and cultural heritage of the destination, enriching their sightseeing experience.

An example is the Hotel das Cataratas, in Foz do Iguaçu, which offers guided tours of the Iguaçu Falls with detailed information about the geological formation and ecological importance of the region. The guides provide an educational experience by sharing knowledge about the local biodiversity and the history of the area.

A similar example can be found at the Hotel Belmond Copacabana Palace in Rio de Janeiro, which offers its guests the opportunity to participate in guided tours of the iconic building and its surroundings. Guests can learn about the hotel's art deco architecture, the history of the Copacabana region, and the building's cultural importance in Rio de Janeiro society. In addition, the hotel organizes lectures and cultural events that provide an in-depth look at the history and traditions of Brazil. These educational activities not only enrich tourists' knowledge of the destination but also allow for a deeper connection with the local culture and heritage, making the tourist experience more meaningful and memorable.

It is important to emphasize the importance of diversifying the types of tourist entertainment to meet the different preferences of tourists and promote a more attractive destination. By offering a variety of entertainment options, destinations can appeal to a wider audience and ensure that each visitor finds activities that are of interest to them. In addition, this diversification contributes to the promotion of local culture, environmental preservation, and economic development in the region (TEIXEIRA, 2022).

PLANNING OF TOURIST ENTERTAINMENT AND THE PREPARATION OF SCHEDULES AND ITINERARIES

The planning of tourist entertainment plays an indispensable role in the success of a tourist destination. Through proper planning, it is possible to identify and explore local resources and potential, providing unique experiences to visitors. In addition, planning allows for the definition of clear objectives and goals, which must be realistic and measurable, in order to guide actions and ensure satisfactory results.

One of the essential stages of planning tourist entertainment is the identification of local resources and potential. This involves a thorough analysis of the destination, taking into account aspects such as natural, cultural and historical attractions. This identification

allows the creation of activities that value these resources, thus promoting an authentic experience for visitors (PINHEIRO, 2018).

Setting objectives and goals is another crucial step in planning tourist entertainment. It is important to set realistic and measurable goals that can be achieved within the established timeframe. This allows you to direct actions efficiently, ensuring that efforts are aligned with the expected results.

In the process of planning tourist entertainment, it is essential to carry out a detailed analysis of the tourist market. This includes identifying the profile of visitors, their specific preferences and demands. This analysis enables the development of activities that meet the expectations of visitors, making the destination more attractive and competitive.

The selection of tourist entertainment activities is also an important step in planning. It is necessary to take into account the interests of visitors, as well as the characteristics of the destination. In this way, it is possible to offer a variety of options that meet the different preferences of tourists, contributing to the diversification of the tourist offer (CORDEIRO, PORDEUS, 2022).

The preparation of a schedule is essential in the planning of tourist entertainment. This schedule aims to organize activities over time, avoiding scheduling conflicts and ensuring the realization of the planned actions. In addition, the schedule allows for better management of available resources, thus optimizing the development of activities (DANTAS, 2016).

In the context of tourism entertainment planning, it is essential to consider integration with other tourism-related initiatives and sectors. Collaboration with government agencies, local companies, communities, and educational institutions can enrich the planning process, bringing different perspectives and expertise to the design and execution of activities. This collaborative approach not only strengthens the ties between the various actors involved in the tourism sector, but also promotes a holistic and integrated approach, which takes into account not only the economic, but also the social, cultural and environmental aspects of the destination.

Evaluation and monitoring are essential steps in the planning of tourist entertainment. Through these processes, it is possible to monitor the results achieved and identify possible adjustments that may be necessary. Evaluation and monitoring allow a critical analysis of the actions carried out, contributing to the continuous improvement of planning and ensuring the success of tourist entertainment.

The planning of tourist entertainment plays an indispensable role in the success of a tourist destination. Through the identification of local resources, definition of realistic

objectives and goals, analysis of the tourism market, selection of appropriate activities, preparation of an efficient schedule and constant evaluation of the results achieved, it is possible to provide memorable experiences to visitors and promote the sustainable development of the destination (PEREIRA, 2018).

It is worth mentioning the importance of sustainability in the planning of tourist entertainment. When developing and implementing animation activities, it is essential to consider the principles of sustainability, aiming to minimize negative impacts on the environment and local communities, and to promote responsible practices that contribute to the preservation of natural and cultural resources. In this way, the planning of tourist entertainment not only aims to meet the demands of visitors and promote economic growth, but also seeks to ensure the preservation and conservation of the destination in the long term, providing lasting benefits for future generations.

The preparation of schedules and itineraries plays an indispensable role in tourist animation, as these tools help in the organization and planning of activities. By establishing a schedule, it is possible to set deadlines and dates for the completion of each stage of the project, ensuring that all tasks are completed within the allotted time. In addition, the elaboration of itineraries allows the creation of a logical sequence of events, providing a more fluid and coherent experience for tourists (PINHEIRO, 2018).

When preparing a schedule or itinerary for tourist entertainment, it is necessary to consider several elements. First, it is essential to define clear and specific objectives for the project, identifying what is intended to be achieved with the proposed activities. In addition, it is important to analyze the target audience of tourist entertainment, taking into account their characteristics and preferences to adapt the activities according to their needs.

The steps involved in the preparation of a schedule or itinerary for tourist entertainment are diverse. Initially, it is necessary to carry out a detailed survey of the relevant information for the project, such as available resources, budget constraints, and established deadlines. Next, it is necessary to define the activities that will be carried out during the tourist entertainment and establish their logical sequence. It is also important to determine the estimated duration of each activity and identify possible dependencies between them.

There are several techniques and tools available to assist in the preparation of schedules and itineraries for tourist entertainment. One option is the use of specialized software, which allows the creation of detailed schedules and graphical visualization of activities. In addition, electronic spreadsheets can also be used to organize information in a structured way and facilitate the monitoring of the progress of activities (PEREIRA, 2018).

The constant review and updating of tourist entertainment schedules and itineraries are essential to ensure its effectiveness. It is important to take into account unforeseen events that may arise during the execution of the project, as well as changes in the market or customer demands. In this way, it is possible to make necessary adjustments and keep the planning in line with reality.

For example, Hotel Ponta dos Ganchos, in Santa Catarina, conducts regular updates to its activity itineraries to meet guest preferences and weather conditions. If an outdoor activity, such as kayaking or scuba diving, needs to be canceled due to weather, the hotel quickly adjusts the schedule to include alternative activities, such as cooking classes with local ingredients or spa sessions (Hotel Ponta dos Ganchos, 2024).

Another example is Hotel Unique, in São Paulo, which adapts its itineraries and events based on continuous guest feedback and market trends. If interest in dining experiences increases, the hotel can rearrange its offerings to include more themed dinners or introduce new chefs and menus inspired by customers' emerging preferences (Hotel Unique, 2024).

These adjustments ensure that the tourist entertainment remains relevant and attractive, providing a positive experience that is tailored to the expectations of tourists, even in the face of unexpected changes or new demands.

A good preparation of schedules and itineraries can bring several benefits to tourist entertainment. First, it contributes to increased operational efficiency, as it allows for a better organization of activities and optimization of available resources. In addition, careful elaboration of these tools results in an improvement in the quality of services provided to tourists, providing a more satisfactory experience. A well-structured schedule increases customer satisfaction by ensuring that all activities are carried out within the established deadline (SOUSA, 2023).

There are several practical examples of success in the preparation of schedules and itineraries for tourist entertainment. A real case is that of the Belmond company, which has implemented a system of schedules and detailed itineraries for its tourist activities in various destinations. With this, the company was able to significantly improve the organization of its teams, avoiding schedule conflicts and ensuring that all activities were carried out as planned. As a result, there has been an increase in operational efficiency, as well as an improvement in the quality of services provided to customers.

A similar example can be found in Brazil with the Uxua Casa hotel, located in Trancoso, Bahia. Like Tulum, Trancoso is a region with a strong tourist appeal, known for its

stunning beaches and rich cultural history. Uxua Casa integrates perfectly with the region's tourist itinerary, offering its guests an immersive experience in local traditions.

Guests at Uxua Casa have the opportunity to explore the nearly pristine beaches and take part in local excursions that highlight the culture and history of the region. Activities such as capoeira classes, visits to the Historic Square of Trancoso, and walks through the local nature are some of the experiences provided by the hotel. This integration with the tourist itinerary of Trancoso not only enriches the guests' stay, but also contributes to the economic and sustainable development of the local community (Uxua Casa Hotel, 2024).

FINAL CONSIDERATIONS

Tourist entertainment is a vital component for the economic and social development of tourist regions in Brazil. By offering a variety of activities and entertainment, this practice attracts visitors and increases revenue generation for local businesses. In addition, tourism entertainment plays an important role in diversifying the regional economy, helping to reduce dependence on specific sectors and drive sustainable growth.

The success of tourist entertainment depends, to a large extent, on the available infrastructure and the continuous training of the professionals involved. Collaboration between the public and private sector is essential to ensure that the activities offered are of high quality and meet the expectations of tourists. Investments in infrastructure and specialized training are necessary to provide memorable and satisfying experiences to visitors.

In addition to the economic impact, tourist entertainment must be planned with a focus on sustainability, to ensure that the activities promote the preservation of the destination's natural and cultural resources. The active participation of the local community is crucial in this process, as it not only strengthens the bonds between residents and visitors, but also enriches the tourist experience, making it more authentic and meaningful.

Emerging technology offers new opportunities to personalize and enhance tourism experiences, making them more engaging and tailored to individual tourist preferences. However, it is important that the human element continues to be valued, as direct interaction with tour guides, local artists, and the community is what truly differentiates and enriches the visitor experience.

Tourism animation is a powerful tool to promote tourism in Brazil, but it requires careful planning and an integration of sustainable practices to maximize its long-term benefits. As traveler demands and market trends evolve, the industry must continue to

adapt and innovate, ensuring that destinations offer unique and enriching experiences that value both tourists and local communities.

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THE OPENEHR ELECTRONIC MEDICAL RECORD IN CONTENT MANAGEMENT SYSTEMS: TOWARDS AN IMPLEMENTATION

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ABSTRACT

This article describes research motivated by the challenges arising from efforts that seek semantic interoperability in Electronic Health Records (EHR) via the OpenEHR standard. The research sought the implementation of OpenEHR information models in Python language, as these models provide the semantics necessary for the construction of OpenEHR archetypes. As a contribution, it implements and opens the perspective of expression of the OpenEHR Archetypes on this platform, suggesting the feasibility of implementing this pattern in the various language frameworks. The research analyzes the requirements involved in the implementation of the OpenEHR standard in RES software coded from scratch, verifying the various advantages of its implementation in CMS's. The result of this theoretical effort clarifies the possibilities of building this type of software in content management systems, in general.

Keywords: Electronic Health Record. Interoperability. OpenEHR archetypes. Content Management System.

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INTRODUCTION

The electronic patient record (EHR) was developed for doctors and nurses to recover clinical facts in a systematic way, allowing everyone access to the same information, speeding up treatment and reducing errors. Filing in individual files leads to problems (Massad, 2003) such as illegibility, ambiguity, misreading, absence and loss of information, among others. Thus, the Electronic Health Record (EHR) has been proposed as a means to organize and streamline the registration and access to clinical information.

However, increasingly, patient records are distributed in databases of different information systems of hospitals and clinics. From this challenge came the worldwide effort to make interoperability between these systems a reality. Health institutions aim to be able to exchange data, making information available between professionals and for the patient himself. OpenEHR[2] aims to enable interoperability between RES systems (Beale; Heard, 2008), representing clinical knowledge via metadata standards called "archetypes". External to the system's codes, medical experts can manage them independently by representing complex concepts, such as "blood pressure" or "family history". A motivating factor for the adoption of archetypes is the prospect of reusing clinical knowledge, well specified and validated by reference organizations (Nardon et al., 2008).

For the construction of reusable archetypes, the standard specifies a reference model, stable and generic core that defines the generic blocks to build archetypes (Beale, 2002). Thus, any implementation effort on a programming platform must first answer the question: is it possible to express clinical information according to the OpenEHR standard on this platform? It is in line with this effort that this research proposed to collaborate, at first, by verifying the possibility of expressing clinical information in the OpenEHR standard, in the Python programming language.

Secondly, once this possibility has been verified, the gains brought to clinical information management by its implementation in content management systems (CMS) are analyzed.

It is in the context specified above that this research presents contributions to the generic problem of health information management.

ARTICLE STRUCTURE

The order of presentation and themes of each section were defined as follows: Section 2 describes the factors that motivated the development of the research; Section 3 deals with the *design science research methodology*; Section 4 exposes the aspects

[2] TIOBE Index, institutional page:< http://www.tiobe.com/index.php/content/paperinfo/tpci/index.html>

related to semantic interoperability in EHR and the use of reference models as a solution to this challenge; Section 5 presents the dual model and ontologies, bases for the OpenEHR standard; Section 6 exposes the OpenEHR standard, details of the formulation of the CIR ontology, which serves as the basis for its reference model and its model of knowledge or archetypes; in Section 7, results of the effort to implement the OpenEHR reference model in python as well as the analysis concerning the implementation of RES in CMS's. Finally, Section 8 presents the conclusions of the research.

MOTIVATION

One of the great motivators for the adoption of archetypes in the construction of applications is the prospect of reusing well-specified clinical knowledge validated by reference organizations. It is, therefore, essential for EHR programs, which seek interoperability, to adapt to standards aimed at this purpose, such as OpenEHR.

According to Kobayashi and Tatsukawa (2012), the current implementations of the OpenEHR standard, considering the adoption statistics of the languages used, provide resources for approximately 25% of *software* developers, so additional implementations are necessary to broaden the user base.

Thus, a positive result regarding the problem of the expression of archetypes in the Python platform enables the development of applications aimed at the management of clinical information in this platform[3]. In turn, this result allows an analysis to be carried out that makes it possible for the proponents of such systems to decide between an implementation whose coding starts from scratch and the use of a CMS.

Therefore, the main objective of this research was to verify whether the models (reference and archetypes) of the OpenEHR standard can be expressed in the Python development platform, as well as the possibility of using a framework such as content management systems or CMS's for the implementation of PEP/RES-type systems, according to the OpenEHR standard.

METHODOLOGY

The need to deal with issues of a practical and theoretical nature, nested and interdependent, led to the adoption of *design science research*[4] as a guiding paradigm for the methodological trajectory of this research. The approach allows, in the specific case of

[3] We chose to use the original term "*design* science *research*", since the translated term has not been adopted, at the time of writing this work, in the academic literature researched.
[4] The Python code resulting from the implementation effort for each information model can be accessed in the online repository: <https://github.com/chrispess/Doutorado_ECI/tree/master/openehr>.

information systems, to work with the creation of new knowledge through the design of algorithms, interfaces, methodologies, among other practical results.

Thus, the possibility of working with knowledge characterized as formal, as well as material or empirical, is pointed out. In fact, this research, in its first part, seeks to enable the expression of archetypes via OpenEHR semantics in Python, that is, an empirical effort. Next, it suggests the analysis of the possibility of implementing OpenEHR RES in CMS's, in a theoretical effort of analysis.

As an essential characteristic, *design research* emphasizes the connection between two types of problems, practice and knowledge, seeking to show that scientific knowledge can be produced through the *design* of useful artifacts (WIERINGA, 2009).

Thus, the context of this research, permeated by problems of different natures, nested and influencing their solutions in a chained way, is consistent with the *design research methodology*.

SEMANTIC INTEROPERABILITY IN RES

The recording of clinical information via local EPs limited its use. The significant variation between the systems used increased the informational complexity and made it impossible to compare data from different hospitals and clinics.

The heterogeneity of information is a direct consequence of the large number of existing data models and forms of representation, structure and syntaxes of different data between information systems. At this level, the semantic aspect is also considered, that is, the various interpretations that these data can receive in different contexts of information systems. These differences make the integration of different information systems used by health institutions a complex process. Integration is the arrangement of an organization's information systems into a single system. Interoperability, on the other hand, is the ability of information systems to work together, internally and externally across organizational boundaries, in order to promote effective service delivery (HIMSS, 2010). Thus, interoperability implies different information systems aggregating their forces in favor of a common goal, without, however, altering their autonomy and their own characteristics (Sheth, 1999). At the semantic level, the meaning of the information that is exchanged must be guaranteed by the sharing of a common vocabulary.

The scenario in which EHR systems are found is characterized by heterogeneity, among other factors, as a result of an informational complexity arising from the various medical specialties, terminologies, cultures and languages. There are also the various medical record systems available on the market, with specific functionalities for different

types of organizations. These factors help to explain the importance given to achieving semantic interoperability for EHR systems. According to Kalra (2007), the international community considers the achievement of semantic interoperability between EHR systems essential when thinking about the future of health services, where the use of terminologies, ontologies and archetypes compose the core of such a challenge.

As Nardon (2002) points out, of the various challenges and cultural changes necessary for the development of these systems, from a technical point of view, the challenge of interoperability and the complexity of information make their development more difficult than the development of other information systems.

INFORMATION MODELS OR REFERENCE MODELS

The use of generic information models or reference models has been an internationally accepted approach to achieve semantic interoperability between EHR systems. In general terms, they define a standard for representing clinical data and its common properties. When the same generic information model is used by EHR systems that need to interoperate. Clinical data must be shared in the correct format, even if the nature of the clinical content has not been previously agreed upon (KALRA, 2007). In addition to the generic information model, there are clinical data structures and clinical terminologies. Clinical data structures allow the classes of the information model to be used to consistently represent the relevant clinical concepts (KALRA, 2007). In turn, terminologies are used in the codification of knowledge in the EHR, aiming at a correct interpretation of the data involved, both for humans and machines (HL7, 2010). The development of standards or reference models came, therefore, as an answer to the type of problem presented when seeking interoperable and cost-effective EHR systems.

KNOWLEDGE REPRESENTATION AND ONTOLOGIES

DUAL MODEL

By trying to implement, through the traditional approach of development at a single level, systems that present the degree of complexity and demand that EHR systems need, a system of difficult maintenance, short useful life and high cost was obtained (Beale, 2007). The two-level approach, arising from the knowledge representation techniques of A.I., proved to be adequate to avoid these consequences, with one level referring to the domain model and terminologies and the other to the information model, seeking to leave the generation of knowledge directly under the responsibility of specialists with little (ideally none) dependence on information technology professionals.

THE DUAL MODEL

The development of systems of this nature requires that knowledge about the domain be specified in an abstract way, obtaining the desired specification, and then codifying it. By following this procedure to generate a system, focusing on specifying knowledge unlinked to a specific code, external to the system, the researchers saw advantages such as **ontological or knowledge engagement** (meaning that the logical sentences that describe the specification have a more direct relationship with the modeled domain), readability, inference capacity, semantic fidelity, reusability, knowledge portability, independent of the implementation code and therefore independent of the machine. These characteristics are attractive for efforts to develop dual **model systems**, separating domain knowledge from the rest of the system.

ONTOLOGY

Once knowledge related to the domain is obtained, detached from the specifics of implementation, the so-called ontological level of the types of primitives used in the description of a knowledge system becomes important. Guarino (1995) proposed, for such systems, the insertion of an Ontological level, where the meaning associated with a language of knowledge representation could be formally restricted.

Ontologies can be seen as a contemporary response to a need for knowledge-based systems. One purpose is to favor the sharing and reuse of knowledge stored in systems created for the most diverse purposes. The latter, before the predominance of the Internet, could not be shared or reused. In general, it was organized in knowledge bases isolated from each other, in different languages, without interfaces capable of integrating them and, therefore, without interoperability.

One of the most important definitions of ontology comes from the Computer Science line of thought. According to Gruber (1995, p.1): "an ontology is an explicit specification of a conceptualization". Therefore, for this author, all formally represented knowledge is based on a conceptualization: objects, concepts and their supposed relationships. This conceptualization is a **simplified and abstract view of the world** one wishes to represent.

Guarino (1995, p.2) presents his definition of ontology as: "a logical theory that explicitly and partially explains a conceptualization". From this definition, it can be seen that an ontology provides an understanding of a shared conceptualization of a given domain, a common vocabulary free of ambiguities. Ideally, any instance that makes use of a domain's data and metadata should adhere to the corresponding ontology.

An ontology requires a specific vocabulary that describes a domain and a set of

logical axioms that will guarantee the meaning that is desired for the vocabulary terms. This implies that two ontologies can be different in their vocabularies referring to the same domain of knowledge.

The organization of concepts and semantic integration for interoperability between systems is done via ontologies, which contextualize the data and give it meaning. If an EHR records that a certain patient has "allergy", this means that this data has the same meaning as the term "allergy" in the ontology, implying a correct and consistent mapping between data from the information models and the terms of the ontology (Cannoy; Yier, 2009).

As for terminologies, the **application of ontologies to the domain of EER** can make them logically more coherent and intuitive to common sense, even if they are aimed at interpretation by *software* (SMITH; CEUSTERS; TEMMERMAN, 2005).

SEMANTIC INTEROPERABILITY IN RES: THE OpenEHR standard

Making electronic health records interoperable is, according to Chen (2009), a prerequisite for supporting more and more distributed health systems. To this end, it is necessary to arrange PEP/EHR systems, capable of sharing clinical data, through the use of a **reference model, clinical data structures and terminologies, preserving the existing semantics in the knowledge domain**, updating and retrieving data consistently, without ambiguity.

Within this context and objectives, the OpenEHR standard is presented, according to Leslie (2007) aiming to "enable the semantic interoperability of health information between, and within, EHR systems – all in a non-proprietary format, avoiding the holding of rights by suppliers" (LESLIE, 2007, p.51).

Noting the need for a robust theoretical basis for clinical information models, and aiming at requirements such as interoperability, computability, scalability, economic feasibility and performance, an ontology was used to develop the formal basis of the OpenEHR model.

THE GENERATION OF INFORMATION IN CLINICAL AND BUSINESS PROCESSES

The ontology of clinical information described by Beale (2007), the basis of OpenEHR, starts from two types of process: the clinical process that describes the interaction between the clinical investigation system and the system that represents the patient; and the business process, which contains the clinical process and is inserted in the administrative context.

Aiming at the serialization and exchange of messages between information systems, Beale (2007) will present the types of information that can be created in the processes previously described.

Figure 1 - Information Created by the Clinical Investigator



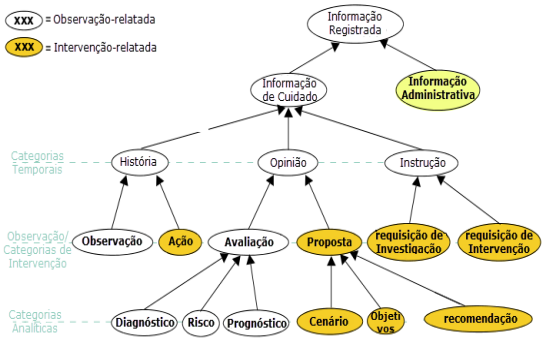
Source: Translated from Beale (2007)

Thus, five distinct types of information can be created during the patient care process: observations, information created by an act of observation; measuring, questioning, or testing a patient or related substance (e.g., urine or tissue); opinions, inferences made by the researcher; instructions, instructions based on observations; actions, registration of intervention actions occurred via instructions or other cause; administrative events, record of events that occurred in the administrative context.

THE CIR ONTOLOGY AND THE REFERENCE MODEL OF THE OPENEHR STANDARD

Based on these categories, Beale (2007) proposes an initial ontology, which aims to situate the types of information presented in relation to the categories of administrative *information* and *care information*, plus necessary categories (Beale, 2007), called **clinical information ontology** or CIR (*Clinical Investigator Record*) ontology), as shown in Figure 2:

Figure 2 - The Ontology of Clinical Information (CIR)



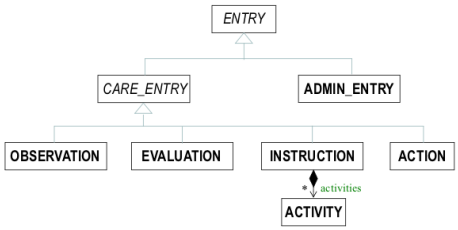
Source: Translated from Beale (2007)

The CIR can be categorized as an information ontology, which deals with any type of information, entities that are committed to some type of medium such as written, audiovisual, etc. In short, something from reality that is being recorded and has characteristics such as the type of registered entity, grades, test results, diagnoses, structure of the records made, relationships between recorded information, etc.

Thus, the CIR ontology, the basis of the ENTRY class (entries) of the OpenEHR standard, is defined to deal with information, more specifically health information. The most important point about the archetypes, built from it, is that they are not descriptions of real things, but records of something that health professionals, by their experience or following a standard procedure, deem necessary to record. Thus, guided by the CIR, health professionals, when recording information via forms, will do so in a more intuitive way, as the categories defined therein correspond to information generated during the workflow of these professionals.

The CIR ontology provides **the basis for the Entry classes of the reference model defined by the OpenEHR standard**, with the main characteristic of being a **generic model**, which represents health care information, but without the semantic specification of particular clinical concepts. Schematically, the conceptual hierarchy defined in the CIR ontology begins with an abstract superclass called *ENTRY*, followed by two subclasses responsible for the entries for **administrative information** (*ADMIN_ENTRY*), as well as **medical care** (*CARE_ENTRY*) followed by four subclasses corresponding to the categories explained above when it was presented, i.e., **observation, evaluation, instruction, and action** (Figure 3).

Figure 3 - The ENTRY Superclass, Based on the CIR Ontology



Source: Beale (2008)

Since the OpenEHR reference model is generic, how will specific clinical concepts such as the patient's blood pressure be represented? In the information models seen, there is no specific class to represent blood pressure, but there is a class that has the clinical concepts to express measurements about the patient: the class (subclass of ENTRY) observation (OBSERVATION). Therefore, blood pressure will be defined as an observation. But then the question arises: how to express the particularities of this observation? The

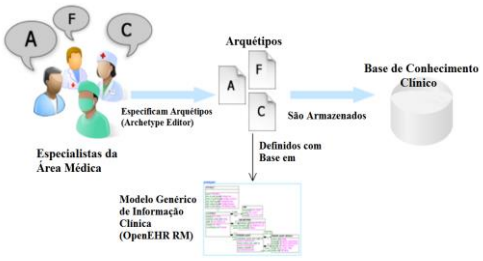
answer to this question will lead to the knowledge model proposed by the OpenEHR standard, or archetype model.

THE KNOWLEDGE MODEL OR ARCHETYPE MODEL OF THE OPENEHR PATTERN

Taking as constituent elements the clinical information models, which allow the representation of general clinical concepts, we arrive at the **knowledge model** of the OpenEHR standard, which aims to represent particular clinical concepts (unlike the reference model, which represents general clinical concepts and resides within the software).

Particular clinical concepts are represented as a set of constraints on the generic information model. The OpenEHR approach, through two-level modeling, enables the medical staff to determine the characteristics of the health record that are most appropriate for their needs, illustrates the separation between the activity of domain specialists (in this case, in particular, the medical field) in the creation of archetypes through the generic information model and that, in turn, they will compose the clinical knowledge bases as shown in Figure 4.

Figure 4 - Construction of Archetypes by Medical Specialists



Source: Translated by Gutiérrez and Carrasco (2013)

Described from the perspective of restriction to the objects of the reference model, the archetypes can be seen according to Martínez-Costa *et al*.:

> The reference model represents the global characteristics of the health record notes, how they are aggregated, and the information context required. This model defines the set of classes that form the generic building blocks of the electronic health record and contains the non-volatile characteristics of the electronic health record. [...] Archetypes apply constraints to objects, which can be considered descriptors of the ontological levels of the domain, defined in a reference model. The archetypes bridge the gap between the generality of the concepts defined in the reference model and the variability of clinical practice, thus becoming a tool to represent these concepts (MARTÍNEZ-COSTA *et al*., 2009, p.151).

The **archetype model**, therefore, can be seen as **a metadata representation** developed to organize and standardize data from knowledge domains. Through archetypes,

clinical concepts are captured structurally **outside** of the *software*.

By developing the EHR as a knowledge-based system, a robust application is obtained, easier to maintain and modify, whose knowledge is added via archetypes, which are the computable expression of a domain-level concept in the form of structured constraint statements, based on some reference information model.

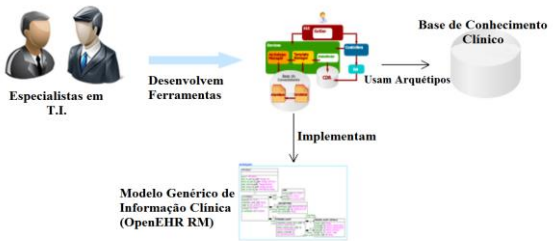
Archetypes can be described as a formal and, at the same time, reusable model of a concept belonging to a given domain that, once represented by an archetype, can be used again in various scenarios that require its application.

From the point of view of **semantic interoperability**, the archetype model can be understood as specifications that seek to ensure the semantics of the information exchanged between the different EHR systems, allowing the incorporation of knowledge into the system directly in the domain model, making semantic interoperability feasible in the exchange of information between EHR systems.

According to Beale (2007), the Reference Model corresponds to the information layer while the Archetype Model formalizes the bridge between the information model and the knowledge model. The most elementary type of distinction in any system model is ontological, that is, at the level of abstraction of the description of the real world, since all models carry some kind of semantic content. **The knowledge model**, therefore, **positions the system at the ontological level**, that is, at the level of abstraction of the description of the real world, since all models carry some kind of semantic content.

The greatest expectation is the possibility of **reusing** the complex structures of information registration, created by domain specialists. Once the archetype repositories have been created, they can be used by information technology specialists to create EHR programs (Figure 5) respecting the division proposed by the dual model.

Figure 5 - Construction of Applications by IT Specialists



Source: Translated by Gutiérrez and Carrasco (2013)

In addition to fostering greater reuse of knowledge, the use of archetypes can be seen as a possible solution to the heterogeneity of health information. Since they promote the separation between processes and data, they make systems more flexible and

interoperable. Thus, EHR systems based on the archetype model can be constantly updated under the most direct supervision of medical teams, even without generating interruptions in the system.

RESULTS

IMPLEMENTATION OF THE OPENEHR REFERENCE MODEL ON THE PYTHON PLATFORM

In the architecture proposed by the OpenEHR standard, the reference model is responsible for the semantics of the information that will be worked on via constraints in the knowledge layer (BEALE, 2002). Thus, through the implementation of the information models defined in the reference model, it is possible to express clinical information according to the OpenEHR semantics in the different software development platforms. In the specific case of this research work, the Python platform was chosen.

The result of this effort was positive, the [5] reference model of the specification was implemented in Python, which constitutes the first level of the dual model, proposed in *the design* of the OpenEHR standard. Thus, it is possible to categorically state the possibility of expressing clinical information according to the OpenEHR semantics on this platform.

Obtaining such a result opens the possibility for information systems developers, as well as for academic projects, to write codes in this language, and to express a clinical model capable of creating and using clinical data in accordance with such semantics.

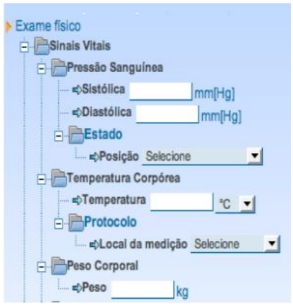
FEASIBILITY AND GAINS OF INFORMATION MANAGEMENT OF AN OPENEHR RES, VIA CMS

Once the certainty regarding the expression of OpenEHR semantics in Python was obtained, the cost-benefit and the challenges that may arise when following a proposal for implementing EMR and EHR software from "scratch" was analyzed, such as the architecture proposal for a five-tier system ("5-tier *System Architecture*") defined by OpenEHR (BEALE; HEARD, 2008).

As seen in section 6, the reference model defines the structure and semantics of clinical information, while archetypes apply constraints to the classes of the reference model to arrive at the concepts or knowledge artifacts defined by clinical experts. Such artifacts, when used by *templates*[6] , allow the entries of electronic medical records to be shaped (Figure 7).

Figure 7 - Representation of Archetypes in the Form of a Tree

[5] *Templates*: These are templates aimed at formatting and facilitating the entry of data into a system.
[6] *Multi level healthcare Information Modelling*. Página Institucional:< http://mlhim.org/>.



Source: Nardon and France (2008)

Requirements Needed for the Implementation of an OpenEHR EHR PEP

To build systems like the one in the illustration above, in addition to the serialization of *compositions* and archetypes, coding of business rules in some programming language, there is a need to use resources, such as component libraries for the visual user interface and orm *frameworks* (in the case of object-oriented languages and relational databases), among others.

The OpenEHR standard also foresees, among several requirements, the need for an *ADL parser*, which transforms archetypes into ADL (*archetype description language*) for the format of objects in memory (OpenEHR, 2013). To perform the reverse path (from objects to ADL), it is necessary to implement an ADL serializer, which starts from the archetypes in the AOM format of memory, for the textual representation in ADL. According to Chen and Klein (2007): "[...] Such a procedure is often used before an archetype is stored and transmitted between systems."

The components described above can be considered as an essential part of a *software* for clinical information management, in the case of implementations that follow the computational architecture proposed by the OpenEHR standard. In view of the functionalities required by such systems, the question can be raised: would there be a need to build such *software* always following the same requirements? Or, there would be the possibility of using a *systemic framework* that, in addition to adding value to *RES/PEP-type software, would avoid the recurrent drop in problems such as* circular import in the implementation of the ARCHETYPE class, described by Kobayashi and Tatsukawa (2012). Such a framework should allow implementation according to the desired characteristics and specific needs, saving the time/effort of coding from scratch.

The need to research solutions for the implementation of the OpenEHR standard, in a line of research, harmonious with the work developed in this research, is highlighted by Gök (2008, p 50): "[...] over time the approach of the OpenEHR standard has matured, however, there is still a gap in knowledge of how to create a system based on OpenEHR (implementation and migration strategies)".

Clinical Knowledge Management via Content Management

There is, in an EHR, the need for an architecture designed to deal with **data** and manipulate **information** at a level of complexity and granularity natural to clinical information. According to Velde and Degoulet (2003, p.108): "The granularity of clinical/health statements varies from text orientation (unstructured), through section orientation (semi-structured), to content-oriented structures (codified)". In this highly complex context, Arancon *et al* highlight content management systems such as:

[...] applications devoted to managing content, documents, and information, structured in such a way as to allow users easy access to knowledge and addition or modification of data. Currently, different solutions are available for such purposes, under categories such as Content Management Systems (CMS), Document Management Systems (DMS), *wikis*, dynamic web portals, search engines, etc. (ARANCON *et al*., 2008, p.245).

A CMS will have features such as ease of content creation and editing by non-technicians, access security, structured workflow in the process for content approval, content versioning and archiving, content*management* to generate consistent outputs, content management, content accessibility, and cost reduction. (Boukar, 2012), (Boiko, 2005) and (Suh, 2003). For a specific situation in the health area, Mooney and Baenziger (2008, p. 70) note that: "a CMS can provide an attractive alternative to the use of expensive laboratory information management systems, by enabling the development of its own web infrastructure".

The detailed analysis of the requirements of the EHR system (Beale *et al*., 2008) and the functionalities of the CMS's brought the realization that characteristics of the OpenEHR reference model, necessary for the archetypes, can be implemented through the use of the structure of a CMS (Boiko, 2005).

An identical situation occurs with the need, in an ideal electronic medical record, to have an intuitive interface that models the natural habits of physicians for entry, information review, and adaptability. As well as providing easy entry of detailed patient information, intuitive interface prototyping , less expensive and advanced *workflow*. CMS's meet these requirements, enabling a reduction in paper use, as well as reducing the documentation load. (LUSK, 2002, p.1227)

From the characterization of the CMS's above, it can be seen that they are inserted in **Information Science**, more specifically as **information management systems**. This finding is corroborated by Han (2005, p.356) when he states that: "[A] ideal CMS is an

information management system that preserves, organizes, disseminates and manages locally developed documents and external documents with associated metadata".

Thus, when seeking to position the EHR systems in the domain of content management systems, they could also be positioned in the information management, that is, in Information Science.

CONCLUSIONS

Initially, the research sought to enable, through the implementation of OpenEHR in the Python platform, mechanisms that enable semantic interoperability in RES/PEP systems built on it. Next, the same is done in the light of the effort in the search for a *systemic framework* that enables the representation of clinical information, in the face of an implementation "from scratch". This analysis takes place from the perspective of the specificities of content management systems or CMS.

Research involving a broad subject such as semantic interoperability in health record systems could include such varied considerations and trajectories that a salutary measure at the beginning of the work was to delimit the scope of the problem to be addressed. The proposal adopted was, after an exhaustive study of the OpenEHR specification, to verify how to make it possible to express knowledge artifacts or archetypes in the Python programming platform.

The perception provided, in this case, by the dual modeling made it clear that, before obtaining the expression of OpenEHR knowledge artifacts, belonging to the **knowledge layer**, it would be necessary to verify that the elements of semantics contained in the information models of the **information layer** could be expressed in this same platform.

Such verification, prior to the implementation of the knowledge layer, is crucial for the claim to express clinical information on any platform, because every knowledge artifact, or archetype, is "constructed" from instances of the classes defined by the information models.

In short, using the classes of information models, an unlimited number of archetypes can be constructed. In fact, these classes represent the global characteristics of the components of the health record. It defines the set of classes that form the generic building blocks for constructing the RES.

After the effort of studying the specification, adapting to the chosen platform and coding (in increasing order of complexity of the classes of its various information models), the objective was achieved in order to categorically affirm the possibility of expressing clinical information (in the OpenEHR standard) on the Python platform.

Such a result not only paves the way for the use of OpenEHR archetypes in the

Python platform, but also for knowledge artifacts of patterns that use, or may use, the OpenEHR reference model. This is the case of the *Multi-Level Healthcare Information Modelling* or MLHIM[7] standard, whose equivalent to the archetype is called "Concept *Constraint Definitions"* or CCD, and which uses the reference model of the OpenEHR standard.

Once the result that allows the expression of the reference model in the Python platform was obtained, a context analysis was carried out that would involve the main requirements of a possible implementation from scratch.

As future works, it is presented as a natural development of the research the implementation, in the Python platform, of the demographic information model[8], which is an essential part of the OpenEHR standard and allows the insertion of demographic content in the created archetypes, as well as their knowledge model, or archetypes. The same can be said for the tools required for *the parsing* of ADL files and for the generation of objects in memory as specified by the *archetype object model* or AOM proposed by OpenEHR (Pessanha, 2014, p. 109-110).

[7] OpenEHR Demographic Information Model Specification: <http://www-test.openehr.org/programs /specification/releases/currentbaseline>
[8] OpenEHR, pagina institucional: <http://www.openehr.org/pt/home.php>

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ENVIRONMENTAL PRACTICES AS AN INSTRUMENT OF INCLUSION FOR PEOPLE WITH DISABILITIES

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ABSTRACT

The study evaluates the contribution of environmental education practices in the lives of people with intellectual disabilities served at APAE - Barcarena through environmental education workshops that are part of the project "Ecoefficient Education: School, Society, Environment and Sustainability", developed through a partnership between the Federal Rural University of the Amazon (UFRA), through the Institute of Agrarian Sciences (ICA) and the Amazon Center for Accessibility, Inclusion and Technology (ACESSAR), and the Company Navegações Unidas Tapajós (Unitapajós). The great challenge of humanity is to reduce the predatory action of man on natural resources and environmental education practices are important tools in the process of awareness and inclusion of people with intellectual disabilities to achieve harmony between man and nature with mutual benefits. In this context, a qualitative research was carried out through a bibliographic survey and application of a questionnaire with questions related to the theme. The results show that the use of environmental education practices to promote socio-educational inclusion proved to be an important tool in the inclusion of people with intellectual disabilities, providing the development of motor coordination, social inclusion and improvements in daily practices and healthy eating.

Keywords: Environmental education. Environmental practices. Intellectual disability.

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INTRODUCTION

When understanding Environmental Education (EE), it is essential to highlight its interdisciplinary character, which extends across different social areas. This makes it an essential tool for sustainable progress and for the preservation of ecological balance (Viana *et al*., 2020). For Bezerra *et al*. (2024), EE not only adds concepts of sustainability, but also reveals its effectiveness in the sensory and cognitive development of individuals with special needs. For Lopes *et al*. (2015), the approach to development and learning in special education signals a transformation in the educational vision that predominated in previous times. In this way, everyone can understand and share environmental education (EE) in their social context.

By emphasizing special education, the legislation ensures the inclusion and accessibility of people with disabilities. Therefore, the educational environment needs to provide support for functional communication, promote the teaching of social skills, and adopt positive and practical approaches that favor behavior during the school phase (Justino *et al*, 2019). In this way, the importance of forming critical and conscious citizens, able to act in environmental preservation and in facing ecological challenges, is highlighted. As established in Federal Law No. 9,795/99, which institutes the National Policy for Environmental Education, Article 10 determines that environmental education must be implemented as an integrated, continuous and permanent educational practice at all levels and modalities of formal education, including special education (Brasil, 1988). The inclusion of people with disabilities in environmental projects reinforces the idea that sustainability is a collective task, emphasizing the unique contribution of each individual (Justino *et al*, 2019). Students acquire essential competencies, such as the ability to solve problems and work as a team, while the community begins to recognize the importance of diversity and cultivate empathy (Almeida, 2021).

Environmental Education aims to raise awareness and prepare people to deal with current ecological challenges, such as waste management, food crisis, pollution, deforestation and climate change (Silva; Leão, 2020). In this context, education and inclusion are areas of study and practice that are significant for society, as they aim at a common goal of fostering awareness and the active participation of all in the construction of a more just, egalitarian, and sustainable society (Lopes and Sartori, 2018). This can be accomplished through tailored activities such as community gardens, recycling, and conservation programs that take into account the specific abilities and needs of these people (Justino *et al*, 2019). This approach also involves the development of accessible teaching materials and the training of educators to meet the particularities of the public with

intellectual disabilities (Alves; Silva, 2024). Analyzing the intersections between Environmental Education and Inclusion is fundamental for the development of policies and pedagogical practices that, in addition to facilitating access to information about the environment, encourage the active participation of all (Silva; Walnut; Pereira, 2015).

In view of this, the purpose of this study was to develop and evaluate inclusive environmental education initiatives. These initiatives covered landscaping and handicrafts using solid waste recycling and the creation of organic gardens. The aim was to identify the opportunities of these practices, in addition to proposing solutions that make education more accessible and effective for the intellectual and social growth of the beneficiaries of the Association of Parents and Friends of the Exceptional (APAE) in Barcarena-PA.

MATERIALS AND METHODS

The study was carried out at the Association of Exceptional Parents and Friends (APAE), located in the municipality of Barcarena, PA. The activities are part of the project "Ecoefficient Education: School, Society, Environment and Sustainability" active since 2014, which is developed by the Federal Rural University of the Amazon (UFRA), through the Institute of Agrarian Sciences (ICA) and the Amazon Center for Accessibility, Inclusion and Technology (ACESSAR), and the Company Navegações Unidas Tapajós (Unitapajós).

The first stage consisted of a bibliographic survey on the object of study, including books, scientific articles, dissertations and published theses. This approach allowed for a broader understanding of what would be possible to search directly. Then, questionnaires and interviews were applied to 8 teachers from APAE - Barcarena, with the aim of capturing explanations and interpretations of the phenomena in a systematic way (PROETI *et al*., 2017), addressing issues related to the theme, to assess the perception of teachers regarding the impacts generated on people with intellectual disabilities.

The pedagogical practices were developed with 12 APAE users with disabilities and a multidisciplinary team, composed of professionals in the area of Agricultural Sciences, including Agronomists, Forest and Environmental Engineers, in addition to APAE specialists, such as Psychologist, Occupational Therapist and Pedagogue.

Among the activities developed, the landscaping workshops stand out (Figure 1) initially, it was explained how the activity would take place, highlighting the importance of landscaping and environmental preservation. Then, the students were introduced to various tools and accessories that would be used during the activity, such as scissors, brushes and paints. Subsequently, the pruning of species in the landscaping and the painting of the external area of APAE was carried out. The purpose was to improve the appearance of the

space, bringing a more pleasant space, while stimulating motor coordination and the interaction of users with the environment, also promoting the development of sensory skills.

Figure 1 – Landscaping activity developed by users of APAE – Barcarena.



Handicrafts were produced using miriti materials and waste was reused, including tires, PET bottles and glass. The activity incorporated the use of tools such as pens, rulers, pencils, sandpaper, scissors and saws, enabling the application of various techniques, such as cutting, sanding, sawing and painting on the materials made. Participants had the opportunity to manipulate these materials, which stimulated creativity and opened up new perspectives for generating income through these skills. In addition, the activity reinforced the importance of education aimed at raising awareness about environmental preservation (Figure 2).

Figure 2 – Handicraft workshop developed by APAE – Barcarena.



In the activities of building vegetable gardens, the planting of vegetable seedlings was carried out by the participants of APAE, where an introduction and guidance on the implementation and maintenance of the garden were offered, highlighting the techniques to be applied in the garden, including the use of essential tools such as hoe, shovel and rake,

emphasizing the importance of producing healthy food both for the health of the participants and for the environment. After the theoretical explanation, the construction of the beds was carried out with the soil of the APAE area, in the dimensions of 1 m wide, 10 m long and 0.2 m high, adopting the spacing of 0.2 m between plants. Subsequently, seedlings of vegetable species were planted and vegetables were harvested, always with the guidance of a multidisciplinary team. Among the species harvested, the following stand out: parsley (*Coriandrum sativum* L.), cabbage (*Brassica oleracea* L.), chicory (*Eryngium foetidum* L.), chives (*Allium schoenoprasum* L.), lettuce (*Lactuca sativa* L.), cowpeas (*Vigna unguiculata* (L.) Walp.) and peppers (*Capsicum annuum* L.).

Figure 3 – Harvest of the vegetable garden produced by users of APAE – Barcarena.

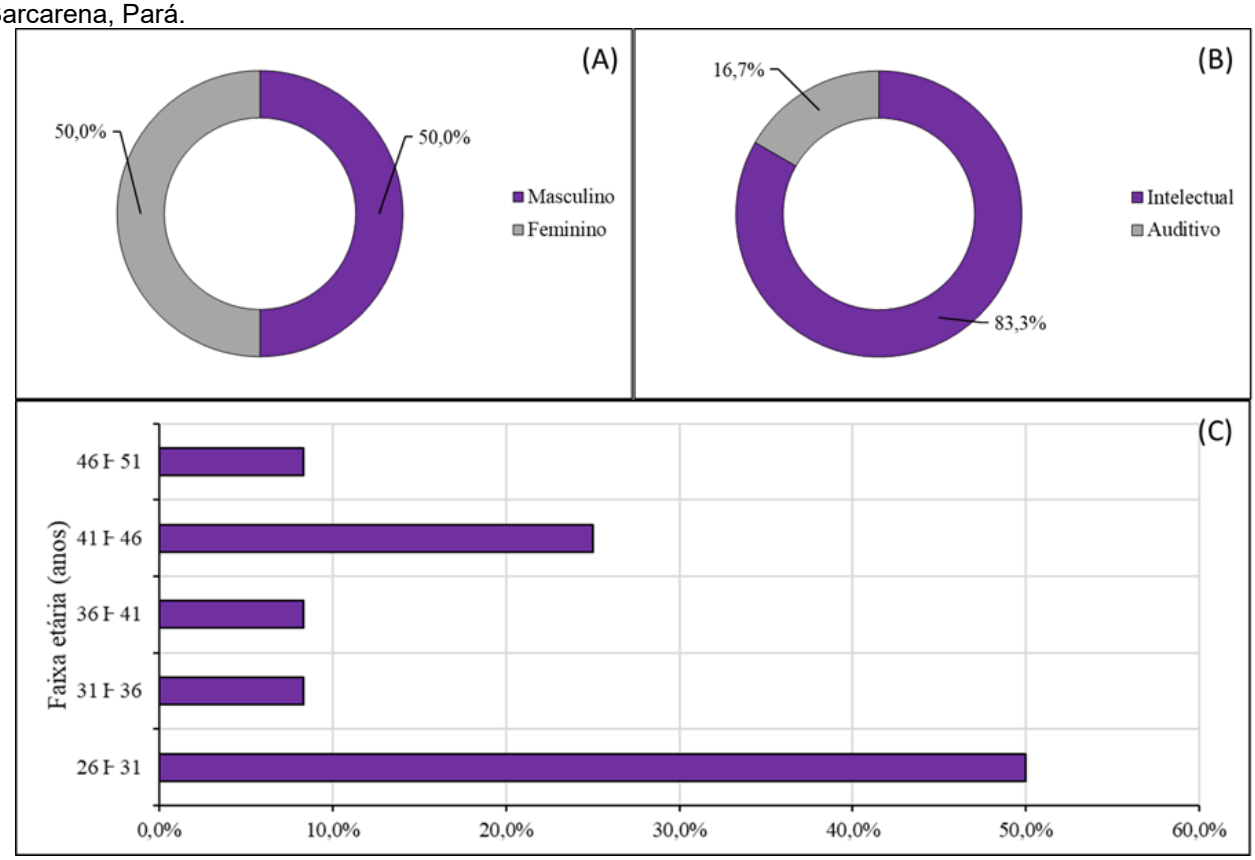


Data collection was carried out through the application of a questionnaire with structured questions. The information obtained was organized and the most relevant were highlighted. Then, the data were entered into an Excel spreadsheet, where the necessary analyses and interpretations were performed.

RESULT AND DISCUSSION

Of the 12 participants assisted by APAE in Barcarena, Pará, who participated in the pedagogical practices, 50.0% self-declared male and 50.0% female (Figure 4, A) and 83.3% had intellectual disabilities and 16.7% had hearing disabilities (Figure 4, B), being people with Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorder (ASD), physical disability (SCD), intellectual disability (ID), visual impairment (VD) and Down syndrome (DS). In addition, 50.0% of the participants were in the 26 to 31 age group, 25.0% in the 41 to 46 age group, and 8.3% in the 46 to 51, 36 to 41 and 31 to 36 age group (Figure 4, C).

Figure 4 - Gender (A), disability (B) and age group (C) of the participants in the pedagogical practices in Barcarena, Pará.



In the interview, when asked about the perception of environmental education as tools for inclusion, whether the workshops improve social interaction with other users of APAE, whether users showed interest in the practices, about the influence of environmental practices on continuous practices, about the influence of environmental practices on healthy eating and whether the practices provide the development of motor coordination of the disabled, 100% of UFRA and APAE-Barcarena professors, pedagogical coordination, director and the president of APAE-Barcarena who participated in the project, answered yes to the questions (Table 1).

Pantaleão (2019) in his research with students with intellectual disabilities, observed an improvement in the social, affective, cognitive and motor development of this public, which improved their behavior in society. Melo *et al.* (2020) in his research with participants of the project "Ecoefficient Education: School, Society, Environment and Sustainability", observed that the practice of building vegetable gardens, in addition to developing learning, stimulated social interaction among the participants.

In this aspect, Santos *et al* (2015) working on the theme of solid waste in a special education school observed the strong interest of students in the development of all stages of activities aimed at environmental education. Medeiros (2018), in his research focused on the practice of the school garden in inclusive teaching through environmental education,

also points out the remarkable interest in the cultivation of vegetables by students with intellectual disabilities who, despite their limitations, do not present difficulties in the development of activities.

Veras (2012), in his research addressing the theme of solid waste, observed that the participants of the research were sensitized to know the environmental problems and the importance of reusing waste that can pollute the environment. The workshops held by APAE make users aware of the importance of practicing environmental education in everyday life with the reuse of waste for the making of handicrafts and composting.

For Moraes *et al* (2016), in their research, they observed that the organic garden as a didactic space gave students from an inclusive education center the opportunity to experience interdisciplinary activities, stimulating in various areas of knowledge to work on awareness of the environmental problem, pesticide use and inappropriate eating habits, encouraging the adoption of positive attitudes as citizens. In their research, Soares *et al* (2013) states that art workshops enabled students to evolve in motor skills, perception and concentration.

Table 1 – Questioning carried out for the participants of the pedagogical practices in Barcarena, Pará.

Questions	Relative Frequency	
	Yes	No
Do you perceive environmental education as a tool for inclusion?	100%	0%
Did participating in the workshops improve social interaction with other APAE users?	100%	0%
Did APAE users show interest in participating in the workshops?	100%	0%
Have you noticed the influence of environmental practices on everyday practices?	100%	0%
Did you notice the influence of environmental practices on participants' healthy eating practices?	100%	0%
Have environmental practices provided the development of motor coordination in the disabled?	100%	0%

When asked about the practices chosen by the users, the most mentioned were the production of jewelry, vegetable gardens and recycling (Figure 5, A). While the practices that users like the most were handicrafts, followed by the production of jewelry (Figure 5, B) and users stated that the cultivation of vegetable gardens, making keychains and production of seedlings are still being carried out in APAE (Figure 5, C).

Environmental understanding for people with intellectual disabilities is permeated by a human sensitivity that must be cultivated, alerting to the insertion of environmental education activities throughout the individual's educational life (Salomão and Klein, 2020). In the study by Souza *et al.* (2020), on the aggregation of value to the planting of cacti with the use of sapucaia urchins (*Lecythis pisonis* Cambess), it was observed that

environmental education can be an excellent tool to promote interaction between people with disabilities. Thus, it is evident that the environmental education practices developed for APAE users generated a sensitivity about the environmental problems arising from anthropic action, in addition to promoting the feeling of belonging agents and promoting environmental conservation.

Figure 5 - Word clouds generated from subjective questions (A) What is the theme most chosen by the participants of the workshops on environmental practices (jewelry, landscaping, vegetable gardens, recycling, composting)?; (B) Activity that you like the most?; and (C) Are any activities being continued?



CONCLUSION

Research shows that it is possible to implement environmental education through practices that enable people with disabilities to experience the environment. The inclusion of people with intellectual disabilities through environmental education actions is a positive way to combat segregation when worked together with the family and all actors in the educational environment.

Environmental education, because it has an interdisciplinary character, allows it to be worked in a transversal way, serving as a tool for the insertion of people with intellectual disabilities in the environmental theme, allowing their cognitive development and the feeling of being part of society regardless of their limitations.

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EPIDEMIOLOGICAL PROFILE OF MALIGNANT SKIN NEOPLASM IN BRAZIL FROM 2018 TO 2023

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ABSTRACT

Introduction: Malignant skin neoplasms refer to abnormal and disordered growth of skin cells due to factors such as solar radiation, genetic predisposition, and other carcinogenic factors. The most common types are basal cell and squamous cell carcinoma, with melanoma skin cancer being the least prevalent. In this context, it is important to understand the profile of the disease in order to develop combat strategies and future studies.
Objective: To define the epidemiological profile of malignant skin neoplasms in Brazil.
Methods: This is a retrospective horizontal epidemiological profile that uses data from

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datasus with the years 2018 to 2023. Results: 44,735 hospitalizations were recorded in the period 2018-2023. As a result, more cases were observed in the age group of 60 years and over, in which 25,548 hospitalizations were reported. Discussion: The year 2020 had 6,387 hospitalizations, which represents a drop in the number of notifications compared to 2019 with 7,532 hospitalizations. When comparing the pandemic period with the post-pandemic period, an increase in the number of notifications was observed. There was possibly underreporting due to the overcrowding of hospitals during the pandemic period. Conclusion: In this sense, it is evident that the overcrowding of hospitals during the pandemic period was a determining factor for the decrease in reported cases as well as hospitalizations for skin cancer. The present study aims to inspire future public policies in the fight against malignant neoplasm of the skin.

Keywords: Treatment. Admissions. Notifications.

INTRODUCTION

Malignant skin neoplasms are an important public health problem in Brazil and worldwide, since it is considered the most common neoplasm in the Brazilian population, representing 30% of all malignant tumors registered in the country. Among skin cancers, it is possible to divide them into two larger groups, melanoma and non-melanoma cancers, within the latter, basal cell carcinoma and squamous cell carcinoma are included. That said, among skin tumors, the non-melanoma type is the one with the highest incidence and lowest mortality. (REZENDE, 2020)

According to the National Cancer Institute (INCA, 2022), the incidence rate of skin cancer is on an upward curve with national rates of 60 cases/100,000 inhabitants. Basal cell carcinoma (BCC) has gained greater prominence because it stands out as the most common type, corresponding to 70-75% of cases. Squamous cell carcinoma (SCC) is the second most frequent type, and the mortality rate of both (BCC and SCC) is low due to the reduced capacity to metastasize, but at the local level they are more recurrent and aggressive. (VERÍSSIMO, 2009)

Melanoma makes up only 4% of malignant neoplasms of the organ. It is considered the most serious type of the disease, due to its high possibility of causing metastasis. (INCA, 2022)

In this context, the risk factors pointed out as contributing to the increase in the number of cases of this type of skin lesion are excessive exposure to the sun, aging of the population, and improvement in the early diagnosis of this neoplasm (NEGREIROS, 2024). Its incidence has been progressively increasing, being more prevalent in individuals over 60 years of age. It usually presents itself as a red mole or a mole on the skin, in brownish or blackish tones, which change color, shape. Thus, the population's access to health systems emerges as a crucial factor for the early diagnosis of skin lesions with potential malignancy, to avoid possible complications, such as metastasis.

Thus, the abnormal and disordered growth of the cells of the dermis and epidermis has as its main etiological agent ultraviolet radiation, which possibly causes direct cell damage and changes in immune function, as well as genetic mutations, oxidative stress and inflammatory responses, all of which contribute significantly to skin photoaging and skin cancer. (NARAYANAN, 2010).

With regard to melanoma, the estimate of new cases in Brazil is 8,450, of which 4,200 are men and 4,250 are women (INCA, 2022). In relation to non-melanoma carcinoma, the estimate of new cases in Brazil is 176,930, of which 83,770 are men and 93,160 are women (INCA, 2022).

Furthermore, primary prevention actions are crucial, through guidance on the risks that excessive solar radiation can predispose to the skin, and, therefore, strongly recommend the frequent use of sunscreen. These actions are effective and low-cost, and should be part of health promotion programs in schools, workplaces, and health centers. Thus, there is a high cost associated with the treatment of skin neoplasms in more advanced stages, compared to treatment in early stages, in which costs are reduced, so primary prevention plays a fundamental role in both the economy and patient survival. (AZEVEDO, 2022)

For all the above, the article aims to explore the particularities involving the epidemiological profile of skin cancer in Brazil in order to inspire future studies as well as new strategies to combat this disease.

METHODOLOGY

The present study is a retrospective, observational, and descriptive epidemiological analysis, evaluating cases of malignant skin neoplasm in the geographic coverage of Brazil, in the period described between 2018 and 2023.

Annual data were searched for the Information System of the Outpatient Information System of the SUS (Sia/Sus), the Department of Information and Informatics of the SUS (DataSus), as well as data from the National Cancer Institute (INCA). In aid of the theoretical foundation, scientific articles in Portuguese were used, extracted from the Scielo, PubMed and Scopus platforms.

To better direct the research, the following clinical and diagnostic variables were considered for analysis: , age group, total cases in the years 2018 to 2022, temporal situation in relation to the Covid-19 pandemic (pre-pandemic period from 2018 to 2019, pandemic from 2020 to 2021, post-pandemic year 2022). Variables were considered in relation to color/race and sex.

RESULTS

Malignant neoplasm of the skin is the most common neoplasm in the Brazilian population, accounting for about 30% of all malignant tumors, with BCC and CEB being the most common types, corresponding to between 70 and 75% of cases (BARREIRO, G, 2016). Thus, particularities related to the quality of health services, application of a control program, low knowledge of the population about its prophylaxis, associated with the low socioeconomic status of the region, contribute significantly to socioeconomic disparities in what discerns the incidence rate in different strata of society, where the level of education

and financial conditions are factors that influence the taking of prophylactic measures to avoid the development of the disease such as the use of sunscreen (RIBEIRO, 2013). In this context, due to social factors and because it is a tropical country, skin cancer in Brazil has an incidence higher than the global average, being the main type of neoplasm in the country (WHO, 2020).

Regarding the most affected regions, (2,332) cases were registered in the Midwest region, (18,068) cases in the Southeast region, (15,778) cases in the South region, (933) cases in the North region, and (7,624) cases in the Northeast region, demonstrating a higher number of cases in the South region.

In addition, regarding malignant skin neoplasms, an average of 3,497 deaths were registered on the DataSus platform in the 2018-2023 period. The highest occurrence of cases was observed in the age group of 60 years and over, which had 4,815 hospitalizations in 2022, representing approximately 55% of total cases. Compared to the other age groups studied, from 0 to 19 years old, 2.2% and 20 to 59 years old, with approximately 42%.

Regarding the most affected color/race, 28,228 hospitalizations were reported out of a total of approximately 44,000, representing about 63% of the affected population, and is therefore the most affected. In relation to the most affected sex, males had a record of 23,063 cases in the period from 2018 to 2023, representing about 51.5% of the cases.

It is important to highlight the variation in relation to the number of cases reported in the periods: pre-pandemic of Covid 19 (2018-2019), during the pandemic (2020-2021) and post-pandemic (2022). In this context, 7,732 total cases were registered in 2018, 7,532 cases in 2019, but there was a significant reduction in the number of cases in 2020 compared to the previous two years, with 6,387 cases, which represents a drop in the number of notifications of 16%. When comparing the pandemic period with the post-pandemic period, a growth in the number of notifications of morbidity of the disease was observed, in 2021 6,468 cases were registered, and in 2022, 8,579 cases, indicating an increase of 32.4%.

DISCUSSION

However, an integrative review by (RIBEIRO, 2013) was able to demonstrate that sociodemographic and economic factors are the most preponderant for the population to have knowledge about skin cancer, with a direct relationship between unfavorable sociodemographic conditions and lack of knowledge about the disease. The data analyzed on the DATASUS data platform showed a higher incidence of cases in the Northeast and

South regions, suggesting the existence of strong demographic, racial, and climatic factors as influencers of the results demonstrated.

In general, difficulties in relation to the prevention, diagnosis and treatment of skin cancer markedly include aspects related to public management and professional practice, which coexist with economic and demographic disparities that condition early screening, in order to have repercussions on screening coverage. This was demonstrated by (SERAFIM et al, 2023), in an investigation that allowed to conclude that the greatest deficits of procedures were found in developing countries such as Brazil as well as the highest incidence rates of the disease in question, the Northeast, South and Southeast regions share the highest incidence and mortality rates for non-melanoma skin cancer, the most prevalent form of the disease in Brazil according to INCA data from 2023. It should be considered that these conditions have greatly hindered the control of malignant neoplasms of the skin in Brazil.

However, it is important to emphasize that there are multiple limiting factors in the practical application of skin cancer care in Brazil in a broad and comprehensive way. In the studies of (REIS, 2016), (PETTIGREW, 2019) obstacles related to the failure to control malignant skin neoplasm in Brazil were listed, among them the aging population being age a risk factor for the disease and the social issues inherent to developing countries thus corroborating the high incidence rates of the disease in question, especially in regions of Brazil with socio-demographic problems, as is the case of the Northeast, or where the population is older, as is the case of the South and Southeast. In addition, factors such as education and level of education in relation to the disease can be determining factors to avoid the evolution of the disease since they instruct the population to use prophylactic measures such as the use of sunscreen, but there is still a lack of numerical data regarding the parallel drawn above. From this, the complexity of the demand for improvements in health care in Brazil is evident, especially malignant skin neoplasms, due to their epidemiological relevance and accentuated morbidity and mortality, demonstrating that appropriate attitudes and practices can mitigate the risks of the appearance of cancerous lesions, contributing to the prevention of skin neoplasms (HUNG, 2022).

In this context, although no scale data were found at the Brazilian level that numerically compare the relationship between schooling and decreased incidence of skin cancer, a study promoted (SANTOS, 2018) showed that the higher the schooling, the greater the access to health services and the better the living conditions during aging, suggesting , Thus, a higher degree of education can influence the application of

prophylaxis such as the use of sunscreen as well as influence a greater frequency in the performance of routine exams useful for the early detection of the disease.

Among the variables considered, it should be noted that the temporality common to a global phenomenon such as the COVID-19 pandemic suggests clear interferences in recent years, resulting in substantial delays in skin cancer screening between 2020 and 2021. The reduction in the number of tests, added to the drop in subsequent records, may express underreporting, and the lack of clarity in these numbers brings the need to reinforce attention to the care of advanced cases. It is noteworthy that health agencies, during the period of the Sars-Cov-2 pandemic, would have advised citizens, in view of the urgency to control the public health scenario triggered by this infectious virus, that consultations, exams, and surgeries that were not urgent should be postponed, adding to the screening of malignant neoplasms such as skin neoplasms being postponed, suggesting underreporting resulting from this phenomenon.

A positive point is that the numbers of notifications according to DATASUS data increased in the post-pandemic period, suggesting an increase in the number of screening exams in the post-pandemic period, possibly even exceeding those of the pre-pandemic period, which may demonstrate a search by the population for screening in awareness of assessing health in a preventive way. Thus, it can be inferred that important regional aspects of the incidence of malignant skin neoplasm in Brazil are projected, which urgently needs an individualized and efficient administration.

CONCLUSION

The records of diagnosed cases of malignant skin neoplasm in Brazil demonstrate a need for greater coverage by the government. There was an increase in the number of hospitalizations for malignant skin neoplasms, reflecting a reality of screening and prophylaxis that is still insufficient in the Brazilian context, as well as a possible underreporting during the pandemic period, which later resulted in a greater aggravation in cases in the post-pandemic period.

In addition, it was not possible to establish a numerical and quantitative relationship between education and the number of screening tests performed, due to the lack of numerical data on the level of education of citizens in Brazil associated with the number of biopsies performed in the period analyzed.

It is concluded that the possible failures in early screening, as well as adequate prophylaxis of malignant skin neoplasia, are linked to local organizational and sociocultural issues. Therefore, it is essential to review public policies to combat skin cancer to address

the obstacles that prevent a more effective fight in the country, in addition to increasing the dissemination of information on the definition, causes, and prevention of skin cancer, as this can significantly impact the number of early diagnoses and the success of treatment.

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FLAVORS OF CHILDHOOD: PROMOTING HEALTHY EATING IN EARLY CHILDHOOD EDUCATION

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ABSTRACT

Healthy eating is one of the most powerful practices in the context of health promotion, being one of the pillars for good child development, with a strong impact on adult life. This report deals with the experience of medical students in a health education activity aimed at children on the theme of healthy eating. The experience took place in the context of a municipal center for early childhood education with children from one to three years old. The students used tools such as games and games to provide guidance on healthy eating in a dynamic and interactive way. The action allowed the involvement between academics, children, health professionals and the school community, providing learning in a playful way and allowing academics to act in a real practice scenario, reinforcing essential principles of primary care and the Unified Health System.

Keywords: Health Promotion. Healthy Eating. Child. Health Education.

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INTRODUCTION

Early childhood education in Brazil, initially welfare in the eighteenth century, began to be recognized as a fundamental right after the 1988 Constitution and the Statute of the Child and Adolescent (ECA) of 1990. The 1996 Law of Guidelines and Bases of Education (LDB) consolidated this change, including early childhood education as part of basic education, focusing on the intellectual, psychological and social development of children up to six years of age (Ranyere; Matias, 2023).

In the basic education network, the Municipal Centers for Early Childhood Education (CMEIs) play a fundamental role in transforming daycare centers into educational spaces, promoting socialization and the cognitive, motor and affective development of children. In this sense, teachers offer conditions for them to explore and interact, meeting their needs and stimulating their integral growth (Leonardo Filho et al., 2023).

Playful activities, which involve games and play, are essential in this process, stimulating creativity, reasoning and socialization in a pleasurable way. Although playing is spontaneous, it also requires social learning and, when well structured, facilitates the teaching-learning process, developing cognitive, physical and emotional skills (Nascimento, 2012).

Recognizing the strong relationship between feeding and children's living conditions and health, with an influence on infant morbidity and mortality, international organizations have stressed the need to adopt public policies to promote healthy eating for infants and children in early childhood, based on breastfeeding and adequate complementary feeding (Einloft; Cotta; Araújo, 2018).

Over time, Brazil has advanced in this perspective, introducing policies and programs that aim to encourage healthy eating as part of a larger process of child care, focused on aspects essential to good child development. The National Food and Nutrition Policy (PNAN) and the Brazilian Breastfeeding and Feeding Strategy (EAAB) are examples of these actions that have repositioned the food and nutrition issue on the agenda of public policies in the health sector (Recine; Vasconcelos, 2011).

In this context, the Family Health Strategy (FHS), implemented in almost the entire national territory, emerged as an important tool to integrate health and education, following the principles of the Unified Health System (SUS). Coordinated by the Ministry of Health, this strategy reorganized and qualified primary health care in Brazil, and aims to bring health care and actions to communities, especially the most vulnerable areas (Brasil, 2017). This is fundamental for the success and guarantee of children's right to a healthy and integral development.

In view of this scenario, the study aimed to describe the experience of medical students in a health education activity on healthy eating with children in early childhood education.

DESCRIPTION OF THE EXPERIENCE

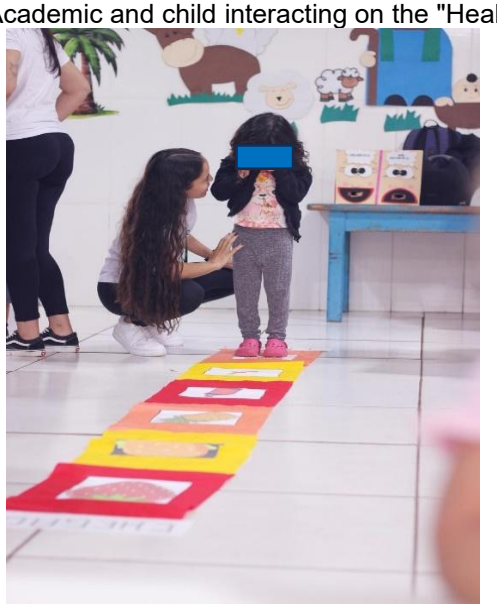
This is an experience report study on an educational activity, developed within the scope of the discipline Integrated Medicine to Community Health (MISCO), with students from the first period of the medical course of a municipal public institution of higher education in the State of Goiás.

The dense development of the activity is part of the students' experience in the context of primary health care, with visits to basic health units, homes of registered users and social equipment in the territory. The visits provide the opportunity to understand the needs of the local population, diversity and how social and economic factors impact the health and well-being of the community.

This practical experience was essential for understanding the strategic role of primary care in health promotion and disease prevention, connecting the knowledge acquired in the classroom with the reality experienced by the community. The educational activity was developed on November 7, 2024, at CMEI Cristiano Emídio Martins, located in the eastern region of the municipality of Goiânia-GO.

107 children aged one to three years participated in the activity. The purpose of the action was to carry out a playful activity entitled "Healthy Trail". To do this, an interactive trail was created consisting of several stages, each representing an image of healthy or unhealthy food. During the course, the children participated in a game with a dice, which, when thrown, indicated the number of houses to be covered on the trail. When falling into a house, the children were asked whether the food represented there was healthy or not, using a simple approach with the terms "good" or "bad" for health, appropriate to the age group of the participants (Figure 1).

Figure 1. Academic and child interacting on the "Healthy Trail".



During the interaction, the children had the opportunity to answer the questions, and with each answer, they proceeded with the explanation of whether that food was healthy or not, encouraging learning in a clear and accessible way. At the end of the trail, as a way of reinforcing learning, the children received an illustrated booklet, made by the students, with images of healthy foods for them to color (Figure 2 and Figure 3). The goal was to help them memorize and recognize these foods, associating them with healthy food choices in a fun way.

Figure 2. Coloring booklet prepared by academics.



The experience was extremely enriching for both the children and the academics. It was possible to observe the diversity of personalities and behaviors among the children. Some were outgoing, speaking and interacting easily, while others were shy, with a little more difficulty expressing themselves. However, all of them, regardless of their particularities, were interested and motivated to participate.

The most gratifying thing was to realize how many children were able to recognize the fruits and healthy foods present in the activity book, also identifying them in the images along the trail. Their interaction with healthy foods showed that the activity had the potential to help understand the concept of healthy eating in a playful and pleasurable way.

In addition, the activity provided an opportunity to strengthen the connection with children and understand their needs and responses to this type of stimulus. The joy and enthusiasm of the children during the activity was evident, reflecting the success of the creative and productive approach adopted.

Figure 3. Dice used in the game of "Healthy Trail".



DISCUSSION

The playful activity carried out at the Municipal Center for Early Childhood Education reinforces the importance of structured play as an effective pedagogical strategy in children's cognitive formation. Studies highlight that play facilitates the acquisition of skills such as memory, attention and language, which are essential for the child's learning and integral development (Rolim et al., 2008). In addition, playing is a powerful tool for building fundamental concepts about the world, such as learning healthy food choices, promoting habits that directly impact long-term quality of life.

The articulation between the Family Health Strategy and early childhood education schools occurs within the sphere of the School Health Program (PSE), an intersectoral

policy instituted in 2007, aimed at promoting the integral health of children, adolescents, young people and adults in Brazilian public education (Brasil, 2007). The proposal reinforces the preventive role of primary care, especially in the formation of healthy habits from the first years of life. Intersectoral actions, such as those carried out between basic health units and educational centers, have a significant impact on the construction of self-care and healthy eating practices, contributing to the reduction of chronic diseases throughout life (Brasil, 2014).

The high consumption of ultra-processed foods is currently frequent in all age groups, and becomes a worrying fact due to the harm associated with this dietary pattern (Sparrenberger et al., 2015). Another relevant point is the increase in the prevalence of childhood obesity, considered a public health problem with considerable health complications (Menezes; Vasconcelos, 2021).

The prevalence of overweight in the Brazilian child population has increased alarmingly. In the period from 1989 to 2009, the number of obese children between 5 and 9 years old grew by more than 300% (Crescente et al., 2021). In this sense, the school is a central point to sensitize children and introduce a healthy eating routine, being one of the most conducive environments for addressing this topic in a pedagogical way (Zompero et al., 2015).

In the first two years of a child's life, food deserves a prominent place. It is at this stage that eating habits begin to be formed and directly impact the behavior of the future adult. The participation of the family in this process is of paramount importance, and it is up to adults to choose healthy foods and encourage consumption by the child, and they should be involved in school activities so that they receive adequate guidance (Brasil, 2019).

Healthy food intake is necessary not only for the nutrients provided, but for the eating pattern that will be formed in the child. Habits and behaviors related to feeding, motor development and coordination when coming into contact with different textures, in addition to affective memory and bonding, are fundamental steps in the transition process between breastfeeding and food introduction (Dewey et al., 2021).

In addition, observing metabolic changes in children is another important aspect, as they can generate negative consequences in adult life, such as the presence of arterial hypertension, type 2 diabetes mellitus and cardiovascular diseases, comorbidities known for their potential for sequelae and death (Ramalho; Lamb; Ribamar, 2024).

The use of games as a pedagogical tool is appropriate in early childhood education, since it facilitates the assimilation of abstract concepts, such as those related to healthy eating. The activity also enables the observation of children's behavior in relation to the

recognition of food and their ability to apply the knowledge acquired. In addition, the direct interaction between medical students and children ensured an exchange of information and a bond, facilitating the transmission of content in a more accessible and enjoyable way.

Games and play are important in the children's learning process, however, it is extremely important that these activities are guided by a qualified professional, such as an early childhood educator. This professional has the necessary knowledge to plan, elaborate and apply activities in a correct, coherent and aligned way with the stages of child development. He is able to adapt activities to meet the diversities and specific needs of each child, ensuring an inclusive and stimulating environment (Santos; Pereira, 2019).

Health education work aimed at children should contemplate current issues and use instruments that enable the dissemination of good practices and the encouragement of self-care, such as playful activities and even the virtual environment through social networks (Nascimento et al., 2020). In addition, the nutrition approach must be associated with other healthy initiatives, such as the practice of sports or other bodily activities, articulating the interdisciplinarity of knowledge to achieve the goal of community well-being (Gonçalves, 2022).

For medical students, participation in this type of activity goes beyond community practice, promoting humanized and interdisciplinary training. The experience provides opportunities for interaction with vulnerable populations and reinforces the importance of teamwork and effective communication, skills that are fundamental in medical practice. In addition, it allows us to experience the principles of the Family Health Strategy and the Unified Health System (SUS), strengthening the understanding of the interfaces between health, education and the community (Dallabona; Mendes, 2004).

CONCLUSION

This report was about the experience of medical students in an educational activity with the theme of healthy eating for children from one to three years old. The interaction and the exchange of learning provided a broader view of the needs and challenges of community work, as well as a practical application of the principles of the Family Health Strategy and the Unified Health System.

It is suggested that educational activities be carried out continuously, involving not only the children, but also their families and the school community. The articulation between teaching-service-community is fundamental for the construction of more integrated, efficient and humanized health systems; allowing students to develop practical competencies in real-world contexts, while health services benefit from innovation and academic knowledge.

In addition, the community gains a voice in the process of training professionals and improving health care, ensuring that interventions are contextualized and socially relevant. This partnership strengthens the commitment to equity, comprehensiveness and social participation, essential pillars for strengthening the SUS.

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MARTIN BUBER'S I-THOU RELATIONSHIP: PHILOSOPHICAL FOUNDATIONS AND APPLICATIONS IN THE HUMANIZATION OF HEALTH CARE

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ABSTRACT

This article analyzes the conception of the I-Thou relationship proposed by Martin Buber and its applicability to health care, particularly in nursing. By contrasting the genuine I-Thou encounter with the objectified I-It relationship, it is argued that the Buberian framework can guide more humanized practices, capable of considering not only physical aspects, but also the emotional, spiritual and existential dimensions of the patient. This perspective expands the autonomy, dignity and active participation of the patient in the therapeutic process, in addition to strengthening the ethical responsibility of the professional. Thus, by replacing mere technical execution with an integral and dialogical approach, care becomes an authentic encounter, marked by reciprocity, respect and appreciation of otherness. The article discusses philosophical foundations, spiritual and existential dimensions, as well as practical implications and challenges to incorporate the I-Thou paradigm in health practice, contributing to the construction of a more ethical, comprehensive and humanized care.

Keywords: Nursing care, Professional-patient relationships, Humanization of care, Philosophy, Spirituality.

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INTRODUCTION

In the field of contemporary health, the incorporation of advanced technologies, the improvement of diagnostic resources and the sophistication of therapeutic protocols have contributed to the increase in life expectancy and quality of life in several areas (WAMBLE; CIARAMETARO; DUBOIS, 2019; MANERO et al., 2022). However, such advances are not always accompanied by comprehensive and humanized care. In many contexts, the patient ends up reduced to a "clinical case" or an "object of intervention", favoring distancing, fragmentation and, sometimes, the dehumanization of care (CARVALHO, TOMAZ, 2020; BITENCOURT NETO; RIZZO, 2022). In the practice of care, it is necessary to balance the ethical scale, in the sense of human dignity as an absolute value and technical care itself. If this balance becomes unbalanced, the results are harmful to both the professional and the patient and, as a consequence, to a weakening of this interaction between professionals and patients. This balance is sometimes difficult to achieve. In view of this reality, it is urgent to reflect on the relational, ethical, and philosophical dimensions that should guide the encounter between professional and patient, rescuing the human essence of this relationship (CARVALHO, TOMAZ, 2020; BITENCOURT NETO; RIZZO, 2022).

In this sense, the dialogical philosophy of Martin Buber (1878-1965) – especially from his work "I and You" (Ich und Du, published in 1923) – emerges as a particularly fruitful theoretical reference (MARGULIES, 2023). Inserted in the context of twentieth-century philosophical thought, marked by phenomenological, existential, and personalist currents, Buber proposes the distinction between two fundamental modes of relationship: I-Thou and I-It (MARGULIES, 2024). By highlighting the importance of the genuine encounter, in which the other is recognized as a full and unique subject (You), Buber questions the modern tendency to objectify the other (I-It), reducing it to a function, object, or means to achieve an end (CARVALHO, TOMAZ, 2020; BITENCOURT NETO; RIZZO, 2022; MARGULIES, 2024).

By transposing this framework to the field of health, especially in the context of nursing, the Buberian approach does not deny the importance of technical and scientific knowledge, but contextualizes it in a broader horizon, in which care becomes an ethical, relational and integral event (SCHAURICH; CROSSETTI, 2008). This perspective dialogues with other currents of humanized thought in health, such as bioethics (which emphasizes the importance of respect for autonomy, beneficence, and justice), the philosophy of care (present in authors such as Leonardo Boff and Joan Tronto), and the humanization policies of the Unified Health System (SUS) in Brazil, which seek to promote person-centered care

and comprehensive care (BRASIL, 2013; DE SOUZA; GRANDSON; NETO, 2019; REIS-DENNIS, 2020; VIEIRA-MACHADO; DE LIMA, 2024)

For Waldow (2015), care is not limited to the performance of procedures; It is defined in the genuine interaction between those who care and those who are cared for. It is necessary to recognize the other as a full subject, endowed with singularity and dignity, and not as an object of intervention (VALE; PAGLIUCA, 2011). This view is reinforced by Bertarello (2011), who points out that the essence of humanity resides in the relationship of alterity, in which the I is only fully constituted in the relationship with the Thou. When this relationship is neglected, there is a distancing from the condition of humanity, which can lead to the dehumanization of care.

This article aims to analyze the conception of the I-Thou relationship proposed by Martin Buber and discuss its applicability in the context of health care, with emphasis on nursing practice. It is based on the assumption that the adoption of the Eu-Thou paradigm offers a promising path for the humanization of care, as opposed to extreme fragmentation and technification (BITENCOURT NETO; RIZZO, 2022). By recognizing the patient's otherness, respecting their beliefs, values and rights, as well as considering the emotional, spiritual and existential dimensions of illness, care becomes an encounter marked by reciprocity, moral sensitivity and mutual responsibility (GILL; FUSCALDO; PAGE, 2019; RODRIGUES; PORTELA; MALIK, 2019). It is about bringing the act of caring closer to its most genuine vocation, understanding it not only as a resolution of biological problems, but as an ethical and existential commitment capable of promoting integral well-being and rescuing human dignity (SCHAURICH; CROSSETTI, 2008).

Thus, the article will deepen the philosophical foundations of the I-Thou relationship and its relevance to rethink health care. In addition, the spiritual and existential dimension of the encounter will be explored, often neglected, but central to the experience of illness, finitude and the search for meaning. Finally, practical implications and challenges to be faced in the incorporation of this paradigm in the daily life of health services will be presented, considering institutional, formative and cultural aspects.

It can be inferred that it contributes to a more humanized, ethical and integral practice, inspiring professionals, managers, educators and researchers in the area to revalue presence, dialogue and otherness as essential elements of care (RODRIGUES; PORTELA; MALIK, 2019). In this way, health care can become not only more effective from a biomedical point of view, but truly transformative, by promoting authentic encounters in which the life, dignity, and integrality of the human being are fully recognized, respected, and cultivated (EKPENYONG et al., 2021).

PHILOSOPHICAL FOUNDATIONS OF MARTIN BUBER'S I-THOU RELATIONSHIP

Martin Buber's philosophy, systematized in his work "I and You" (Ich und Du, 1923), offers an ontological and ethical framework for understanding human relations in depth. Inserted in the philosophical context of the early twentieth century, Buber dialogues with currents such as phenomenology and existentialism, which value the immediate experience and the singular existence of the individual (MARGULIES, 2024). At the same time, his proposal stands out for emphasizing the relational dimension, in contrast to approaches that prioritize only the isolated subject or instrumental rationality (MARGULIES, 2023). From this perspective, Buberian thought anticipates and approaches authors who, in the humanistic field, would seek to understand the human condition not only as a being-in-the-world, but as a being-with-the-other, in permanent dialogue (JONS, 2024).

By proposing the concept of two principle-words – I-Thou and I-It – Buber is not limited to a mere linguistic distinction, but delineates two fundamental ways of relating to the world (MARGULIES, 2024; MARGULIES, 2023). While the I-It mode, characteristic of modern and technicist thought, implies objectifying the other and treating him or her as an instrument, the I-Thou relationship radically shifts the focus: the other is not a means to an end, but an integral, singular being, irreducible to utilitarian categories (BRITO, 2020).

Man can have a double possibility of existence and of relating to the world. This form of relationship between the Self and the world is not static, it can vary between the relationship I-Thou and I-It. There is no full-time I-Thou relationship, it will always be from the I-It relationship. The I-It relationship cannot be evaluated as negative, but part of the process of this man behaving towards the world. The integrality in this I-It relationship is what makes it negative, with man losing values that lead him to meet the other, with the other being seen in an objectified way full-time (SILVA, 2021). For Buber, one of humanity's problems is the exaggerated affirmation of the "I" and the loss of the "You" in the world of relationship. The idea of self-sufficiency of the Self can underpin the origin of today's egocentric and selfish society (SILVA, 2021).

In the I-It plane, the individual measures, classifies and uses what surrounds him, understanding reality from a functional and instrumental perspective. When relating seeing the patient as That, the I/Health Professional does not experience the relationship, the exchange between them is an experience. There is no care, since there is no relationship between the Self and the It. Actions are performed for this patient, but there is no relationship and recognition of the Thou instead of the That there is no care (WALDOW, 2015). In the I-Thou relationship, the I addresses the other, inviting him to an authentic and

mutual dialogue, in which both recognize each other as full subjects, endowed with mystery, dignity and potentiality (MARGULIES, 2024).

This I-Thou relationship is not permanent or stable, but occurs in privileged moments of openness, authenticity, and presence. It is when the Self suspends the will to control, transcending mere functionality and the tendency to instrumentalize the other, that the possibility of genuine encounter arises (CHAI, 2023). At this moment, dialogue is not only the transmission of information, but an event lived in the entirety of the present moment, in which there is no distance between the observer and the observed. Instead, two beings emerge who mutually implicate each other, even if for a fleeting time (VOGEL; KOUTSOMBOGERA; REVERDY, 2023).

The ethics proposed by Buber is not a set of external norms, but an ethics of encounter, which affirms the dignity of the other as an unquestionable value. This view is related to phenomenological and existential concerns with the singularity of human experience, but expands them by underlining the essentially relational character of existence (CARVALHO, TOMAZ, 2020). The "other" is not just a human presence: the I-Thou relationship can occur with nature and, in Buber's perspective, even with the transcendent (BUBER, 2001). However, it is in the encounter between people that this ethic reaches its maximum expression, because it is in human dialogue that mutual recognition, responsibility and reciprocity find fertile ground (BUBER, 2001).

A central element to make the I-Thou encounter possible is the "authentic word". For Buber, the authentic word is not reduced to the transmission of informative content or persuasion, but constitutes a "call" – an invitation that awakens the other to reciprocal presence, free from manipulation (SILVA, 2020). In the context of health communication, this conception of the authentic word can be applied to the dialogue between professional and patient: instead of informing the patient in a mechanical or unidirectional way, the professional opens up to genuine communication, which involves attentive listening, valuing the patient's unique experience and willingness to question each other (SCHAURICH; CROSSETTI, 2008). In this way, the authentic word enriches the therapeutic interaction, making it more welcoming, meaningful, and coherent with the integrality of care (LOPES; RODRIGUES; BARROS, 2012).

Transposing these ideas to the health domain means recovering the human dimension often lost in care systems dominated by routines, economic pressures and quantitative goals. By recognizing the other as You, the health professional sees beyond the disease or the technical procedure, considering the patient as a subject who brings with him history, values, beliefs, fears, and hopes (FERREIRA et al., 2021).

This philosophical view provides an ontological and moral basis for understanding care not only as a technical act, but as a human encounter marked by empathy, mutual responsibility and dialogical presence (BUBER, 2001).

In summary, by proposing the I-Thou relationship, Martin Buber offers an inspiring and humanistic key to rethinking the practice of health care. His philosophy reminds us that the essence of the therapeutic encounter is not found in instrumental efficiency, but in the authenticity of dialogue, in the genuine presence of the professional and in the appreciation of the patient as an integral being, endowed with existential depth and intrinsic dignity (COHN, 2001). This perspective elevates care to a profoundly ethical, relational, and integral phenomenon, compatible with the complexity of the human condition.

Thus, Buberian philosophy offers a conceptual framework that highlights the authentic relationship (I-Thou), the distinction between genuine and objectified encounters (I-Thou versus I-It), the role of the 'authentic word', the importance of the "between" as a relational space, and the ethics of the human encounter (COHN, 2001; WESTERHOF et al., 2014). These elements, presented in a systematic way, can guide reflection on health care, especially in the context of nursing. Chart 1 summarizes the main concepts of Martin Buber's thought, helping to understand how these philosophical foundations can inspire a more humanized practice.

Table 1. Essential concepts of Martin Buber's thought applied to health care – Rio de Janeiro, RJ, Brazil, 2024.

Concepts	Definition of the concept
I-Thou	Authentic and dialogical relationship, in which the other is recognized as a full subject, with uniqueness and dignity. There is no objectification, but mutual presence and reciprocity (BUBER, 2001).
I-It	Objectified relation, in which the other is treated as a means to an end, a functional object. Instrumentalization, distance and the absence of recognition of otherness predominate (BUBER, 2001).
Authentic word	Genuine communication, free from manipulation and persuasion, which invites the other to true dialogue. In health, it implies attentive listening, respect for the patient's experiences and willingness to question each other (BUBER, 2001).
"Between" (Relational Space)	Symbolic space in which dialogue takes place and the relationship is effective. It is not a physical place, but the field in which subjectivities meet, reveal and influence each other (BUBER, 2001).
Ethics of encounter	Moral perspective centered on the dignity of the other, understanding care as a relational phenomenon. The professional recognizes the patient as You, assuming mutual responsibility and unconditional respect (BUBER, 2001).
Spiritual and existential dimension	Recognition that care is not limited to the physical plane. The I-Thou encounter opens space to explore issues of meaning, purpose, beliefs and values of the patient, integrating them into comprehensive care (BUBER, 2001).
Entirety	Totality only happens in the I-Thou relationship, through the dialogical encounter between the Self and the Other, without games or barriers. Thus, this encounter takes place in its totality and originality, the Self is totally available in the relationship with the Thou (BUBER, 2001).

Reciprocity	It is a principle of the relationship between people, which takes place through the dialogical encounter, where the "I" can interfere in the "You" and be interfered by the same "You" (Buber, 2001).
Responsibility	Through the genuine relationship, the encounter in its totality, with the Thou, the Self becomes responsible for it (BUBER, 2001).

Source: Built by the authors

THE I-THOU RELATIONSHIP AND THE HUMANIZATION OF HEALTH CARE

In the field of health, the concept of humanization refers to the recognition of the patient as a full person, endowed with rights, beliefs, values, life history and complex needs (BRASIL, 2010). This approach contrasts with purely biomedical approaches, which tend to privilege diagnosis and therapy to the detriment of the relational and subjective dimension of care (BRASIL, 2010). By valuing the patient's uniqueness, humanization broadens the professional view, shifting the focus from the disease to the person who experiences it, which includes emotional, social and spiritual aspects (BRASIL, 2010).

In this context, Martin Buber's conception of the I-Thou relationship presents itself as a valuable philosophical reference. Unlike the I-It relationship, which objectifies the other and sees him as a means to an end, the I-Thou relationship implies a dialogical and authentic attitude. This posture involves recognizing the patient not as an object to be manipulated, but as a Thou: a unique human being, with their own experiences, meanings, and perspectives. Seeing the patient in this way does not mean denying the importance of technical knowledge or ignoring therapeutic protocols; on the contrary, it is a matter of harmonizing science and sensitivity, technique and empathy (BUBER, 2001; BRAZIL, 2010).

By adopting the Eu-Thou paradigm in health care, the professional not only performs procedures, but participates in an authentic encounter, marked by presence, mutual respect, and attentive listening (FLORES et al., 2019). This change in perspective expands the field of humanization, as the patient becomes an active agent in the therapeutic process, having his preferences, values and autonomy recognized. With this, a therapeutic bond is created capable of promoting greater adherence to treatment, relief of suffering, strengthening trust and cooperation between patient and health team (DIAS et al., 2024).

Chart 2 summarizes some guidelines and examples to implement the Eu-Thou paradigm in daily care.

By incorporating such principles and actions into daily practice, the health professional transcends the role of executor of technical procedures, assuming an ethical and relational posture, in tune with the patient's integral needs. The I-Thou relationship, by valuing the other as a unique subject, transforms care into a living, deep and meaningful encounter (ZUBEN, 2008). This not only benefits the patient, guaranteeing him a more

comprehensive, compassionate and respectful care, but also enriches the trajectory of the professional himself, who finds in the authenticity of the encounter a source of meaning, coherence and fulfillment (LANGARO et al., 2018).

The adoption of the I-Thou paradigm in health care consolidates humanization by rescuing the affective, moral and relational dimension of the act of caring.

Table 2. Guidelines and practical examples for the Eu-Tu paradigm in everyday care – Rio de Janeiro, RJ, Brazil, 2024.

Guideline	Principle	Practical example
Welcoming the patient in his or her entirety	Consider not only the biological aspect of the disease, but also the psycho-emotional, social and spiritual dimensions.	When receiving a patient with chronic pain, the nurse is not limited to measuring vital parameters or recording symptoms. He may start the conversation by asking, "How have you been feeling at home? Is there something that's worrying you besides the pain?" Thus, it shows openness to understand the patient's life context, fears, insecurities and hopes.
Stimulating authentic dialogue	Promote conversations in which the patient can freely express their perceptions, doubts and expectations, being listened to attentively, without judgment.	During the consultation, the nurse takes a few minutes to listen to the patient without interrupting him/her, asking: "What would you like me to know about your experience with the treatment?" This space allows the patient to expose their concerns, frustrations or suggestions, building a relationship based on trust.
Build a relationship of trust and respect	Recognize the patient's autonomy, respecting their beliefs, choices and rhythm in the therapeutic process.	Before starting a venipuncture, the professional explains each step of the procedure, listens to the patient's apprehensions, asks if he prefers one arm to the other and assures him that he can interrupt if he feels discomfort. This care demonstrates that the patient is not a passive object, but an active partner in care.
Sharing responsibilities in care	Humanized care, in the light of I-Thou, encourages shared decision-making, where professional and patient act as partners in the search for solutions.	When planning hospital discharge, the nurse involves the patient in the elaboration of the care plan, asking: "What are the activities that you value most in your daily routine? How can we adapt your treatment so that it fits better into your daily life?" In this way, the patient contributes to decisions about their own care, ensuring that interventions are aligned with their preferences and needs.
Cultivating presence and availability	Being truly present goes beyond mere physical attendance; It implies demonstrating genuine interest in the patient's well-being by dedicating time and attention.	At the end of a hectic shift, the nurse finds a few minutes to sit next to the elderly patient who is anxious. Instead of rushing the conversation, she encourages him to talk about his memories of home, family, or activities that bring him comfort. This short pause, even if brief, can generate a sense of welcome and understanding,

		alleviating feelings of loneliness or fear.

Source: Built by the authors

Recognizing the patient as You, the professional creates conditions for care to be not only a set of techniques, but a transformative experience, capable of positively impacting the experience of illness, the quality of care provided and the caregiver's own identity.

SPIRITUAL AND EXISTENTIAL DIMENSION IN THE I-THOU ENCOUNTER

The spiritual dimension in health has gained increasing prominence, especially in contexts where the patient is faced with challenging experiences such as palliative care or mental health conditions and chronic diseases (DIAS et al., 2024). In this scenario, spirituality is not limited to religiosity, but involves the search for meaning, purpose, and connection with something that transcends immediate materiality (REIS-DENNIS, 2020). It is an intrinsically human dimension, which emerges when the individual confronts anguish, fears, uncertainties, and the possibility of finitude, while seeking to understand the value and meaning of life itself (CARVALHO, TOMAZ, 2020).

The I-Thou relationship, as proposed by Martin Buber, opens up possibilities to approach this spiritual and existential dimension in a more authentic and profound way (BUBER, 2001). Unlike the I-It relationship, marked by objectification, the I-Thou relationship constitutes a genuine encounter, based on presence, listening and reciprocity (COHN, 2001). In this context, the patient is not reduced to a body to be repaired or to a cluster of symptoms, but welcomed in its entirety, including beliefs, anxieties, fears, hopes and ultimate questions about existence (WESTERHOF et al., 2014).

By recognizing the patient as a Thou, the health professional – nurse, doctor, psychologist or any other member of the team – creates a safe and meaningful space for the expression of spiritual and existential concerns (EKPENYONG et al., 2021). Listening becomes compassionate and active, capable of welcoming fears of death, anguish in the face of the loss of capacities, doubts about the meaning of life, religious or philosophical beliefs, and even questions about the transcendent, without judgment or pressure (SCHAURICH; CROSSETTI, 2008). In this dialogue, spirituality is not an appendix of treatment, but a central component of comprehensive care, enabling the patient to reframe their condition and find comfort that transcends physical well-being (FERREIRA et al., 2021).

To make this approach even more effective, one can resort to instruments for evaluating spirituality, integrating them into the I-Thou paradigm. Tools such as FICA (*Faith*,

Importance/Influence, *Community*, *Address in Care*) or SPIRIT (*Spiritual belief system*, *Personal spirituality*, *Integration with a spiritual community*, *Ritualized practices*, *Implications for medical care*, *Terminal events planning*) offer subsidies to identify the patient's spiritual and existential needs (MARGULIES, 2023). By applying such instruments, the professional demonstrates genuine interest in understanding the universe of meanings that the patient attributes to his life and illness, thus establishing a more sensitive, respectful care that is consistent with his values and beliefs (GILL et al., 2019).

This approach requires a true presence from the professional, permeated by empathy, patience and respect for the uniqueness of the other (ZUBEN, 2008). Spirituality, in this context, is not something to be imposed, superficially evaluated or treated as a nuisance, but recognized as a fundamental part of the patient's identity and narrative. The professional acts as a facilitator, helping the individual to get in touch with his deepest roots, strengthening him in the face of the existential challenges that disease and pain impose (LOPES et al., 2012).

In addition to benefiting the patient, the incorporation of the spiritual dimension in the I-Thou paradigm enriches the experience of the health professional himself. By participating in these authentic encounters, the caregiver also confronts their beliefs, values, and limits, recalling the deeper meaning of their practice (LANGARO et al., 2018). This experience can nurture motivation, ethical sensitivity, and resilience, protecting the professional from an exercise of care devoid of meaning and humanity (DIAS et al., 2024).

By assuming the I-Thou perspective, health care goes beyond the sphere of the instrumental and becomes an essentially human phenomenon, in which the spiritual and existential dimension occupies a central place. Through this dialogical and compassionate relationship, the patient finds space to express his or her pains of the soul, seeking meaning, purpose and transcendence (BUBER, 2001). At the same time, the professional has practical tools to identify and welcome these needs, integrating assessment and spiritual care into the therapeutic process (REIS-DENNIS, 2020). The result is a more comprehensive care, capable of recognizing the patient in all his complexity, promoting not only physical relief, but also the reconnection of the individual with himself, with his history, values and, when applicable, with the sacred.

PRACTICAL IMPLICATIONS AND CHALLENGES FOR BUBERIAN HEALTH CARE

The incorporation of the I-Thou framework in health care, particularly in nursing practice, is not limited to a punctual change in attitude; it is a complex process that requires reflection, self-knowledge, ethical commitment and favorable institutional conditions

(BUBER, 2001). While deeply inspiring, the Buberian paradigm faces obstacles at both the individual and organizational levels. Institutional pressures, demands for productivity, work overload, scarce time, and excessive focus on quantitative goals make it difficult to create an environment conducive to a genuine encounter between professional and patient (WESTERHOF et al., 2014).

The recognition of the importance of the other, as emphasized by Bertarello (2011), should be at the center of care practices, allowing care to be conducted by ethical and humanistic values. As Waldow (2015) states, what characterizes care is not what is done, but how it is done, involving responsibility, empathy and valuing the other in their uniqueness.

The continuous and humanistic training of professionals is indispensable. Spaces for reflection, discussion groups, ethics workshops and clinical supervision can sensitize the team to the importance of the I-Thou perspective. These strategies allow professionals to revisit their practices, question objectifying postures, and adopt tools to strengthen therapeutic communication, empathy, and authentic presence (SCHAURICH; CROSSETTI, 2008).

Some experiences reported in the literature demonstrate the benefits of more humanized approaches to health care. Studies show that person-centered communication, valuing the patient's narrative, and including existential and spiritual dimensions can improve patient satisfaction, increase treatment adherence, and contribute to the reduction of stress and burnout among health professionals (REIS-DENNIS, 2020). For example, research in the area of palliative care and oncology indicates that active listening and recognition of the patient's emotional and spiritual needs are associated with better indicators of quality of life and psychosocial well-being (FERREIRA et al., 2021). Similarly, professionals who adopt more empathetic and dialogical communicative practices report greater job satisfaction and less emotional exhaustion (WESTERHOF et al., 2014).

To consolidate Buberian care, it is possible to propose concrete actions that expand its impact on the routine of health services. Institutional policies that value the quality of human encounter, rather than just quantitative metrics, create more favorable structural conditions (BRASIL, 2010). In addition, including disciplines of ethics of care, philosophy of care, humanization, and therapeutic communication in undergraduate and graduate curricula can train professionals who are more sensitive to human uniqueness (SILVA, 2020). Chart 3 highlights some challenges and ways to address them.

Table 3. Challenges and ways to face them in the Eu-Tu paradigm – Rio de Janeiro, RJ, Brazil, 2024.

Challenges	Ways to face them
Overcoming the fragmented view of the human body	The I-Thou relationship requires understanding the patient beyond the physiological systems and isolated symptoms. Interdisciplinary approaches, which integrate biomedical knowledge and human sciences, are fundamental to build a more holistic view of the human condition (CARVALHO, TOMAZ, 2020).
Breaking with the traditional hierarchy in the health team	Caring in a dialogical way requires more horizontal relationships between professionals. The recognition of the various competencies and the promotion of an authentic dialogue in the team favor the I-Thou attitude not only with the patient, but also among the professionals themselves (WESTERHOF et al., 2014).
Create spaces and time for listening and welcoming	The overload of work and the emphasis on efficiency make it difficult to practice attentive listening. Adjusting routines, redefining priorities, and dedicating time to therapeutic dialogue are fundamental steps to establish bonds of trust and mutual respect (DIAS et al., 2024)
Develop communication and empathy skills	Investing in training in empathetic communication, active listening, and person-centered approaches helps to reduce the distance between technical knowledge and human knowledge, making the therapeutic encounter more meaningful and effective (GILL et al., 2019).
Integrating the spiritual and existential dimension into care	By recognizing the person as a Thou, care is not limited to the physical plane. Flexible protocols that include assessments of spiritual needs, access to religious leaders, or practices of comfort and reflection can be incorporated, respecting the patient's preferences (COHN, 2001).

Source: Built by the authors.

By facing these challenges, nurses and other professionals who internalize the I-Thou paradigm strengthen their moral sensitivity, broaden their understanding of the patient's integrality, and cultivate an ethical and compassionate attitude (BUBER, 2001). This more humanized care can positively impact the patient experience, providing greater satisfaction, engagement, and well-being (SCHAURICH; CROSSETTI, 2008). At the same time, professionals tend to find more meaning in their activity, reducing risks of burnout and depersonalization, and promoting a practice that is more consistent with the humanistic values of the profession (REIS-DENNIS, 2020).

Implementing Buberian health care is an ambitious undertaking, but deeply enriching. By overcoming structural and cultural barriers, investing in humanistic training, strengthening therapeutic communication, and recognizing the intrinsic value of the other, health care ceases to be a mechanized relationship between those who treat and those who are treated, becoming an authentic human encounter, in which dignity, autonomy, hope, and mutual recognition are core values (JONS, 2024).

FINAL CONSIDERATIONS

Martin Buber's dialogical philosophy, by proposing the I-Thou paradigm, offers a profoundly inspiring reference for rethinking health care. In an increasingly technological scenario, guided by rigid protocols and quantitative goals, the authentic human encounter tends to be diluted in instrumentalized and distant relationships. By placing the human being at the center of care, the I-Thou relationship recovers the relational essence of care, giving it ethical depth, existential meaning and spiritual relevance (BUBER, 2001).

By adopting the Buberian perspective, the nurse – as well as other health professionals – ceases to be a mere executor of technical tasks to become a moral agent, capable of building meaningful bonds with the patient. However, nursing, in particular, is in a privileged position to establish the I-Thou relationship in the daily care routine. By being present more continuously with the patient, accompanying him throughout his process of illness, hospitalization or outpatient follow-up, the nurse has more time, proximity and opportunity to develop dialogical, empathetic and comprehensive care (SCHAURICH; CROSSETTI, 2008). This prolonged presence makes it possible to get to know the person better, their emotional, spiritual and existential needs, as well as their preferences and values, creating the necessary conditions for the flowering of the I-Thou encounter.

However, the implementation of this humanized and dialogical care faces important challenges. Institutional barriers, work overload, pressures for productivity, and the emphasis on measurable results can reduce the space for attentive listening and authentic dialogue. Overcoming these barriers requires individual and collective efforts, continuous humanistic training, review of institutional policies, and the promotion of work environments that value otherness, cooperation, and co-responsibility (BRASIL, 2013). In addition, nursing, by assuming this vanguard role in humanization, needs institutional support, professional recognition and adequate resources to enable I-Thou care in daily practice (VIEIRA-MACHADO; DE LIMA, 2024).

Although full reciprocity, idealized by Buber, is difficult to achieve due to the asymmetry inherent to the professional-patient relationship, the search to get closer to this ideal is already a significant advance (COHN, 2001). Authentic presence, empathy, willingness to listen, and openness to spiritual and existential dimensions make care more humane, ethical, and transformative (REIS-DENNIS, 2020). Even with the limitations of real life, the I-Thou attitude contributes to the construction of a care environment in which the patient feels respected in his uniqueness, dignified in his condition and recognized as an integral being.

The application of Buberian philosophy in health care not only humanizes the practice, but elevates it to a moral and existential encounter between subjects (DIAS et al., 2024). Nursing, by being closer to the patient, plays an essential role in this process, and can lead the adoption of the I-Thou paradigm as an ethical horizon for the entire team. This perspective can positively influence patient satisfaction, the quality of the therapeutic relationship, the well-being of the professional, and the very structure of the health system, making it more welcoming, compassionate, and capable of honoring the complexity and dignity of human life. Thus, by seeing the patient as You, care ceases to be a mechanical act and becomes a gesture of presence, reciprocity, transcendence and commitment to the humanity that inhabits the relationship between those who care and those who are cared for.

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ACETYLSALICYLIC ACID TREATMENT IN WASTEWATER BY ELECTROCOAGULATION USING ALUMINUM ELECTRODES: ELECTRICAL VOLTAGE EFFECT

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ABSTRACT

Electrocoagulation is a technique that uses electric current to induce oxidation-reduction reactions, forming hydroxides that act as coagulating agents for the removal of emerging contaminants. The general objective of this study is to evaluate the efficiency of the electrocoagulation process applied to the treatment of emerging contaminant acetylsalicylic acid by electrocoagulation. Emerging pollutants are chemicals, both natural and synthetic, and can be organic and inorganic, with high toxic potential and negative impacts on both the environment and human health. A factorial design of 33 times in triplicate was developed, the important variables were reaction time and electrical voltage. The dependent variables or response were concentration and operating cost. At the end of the treatments, the results indicated that the highest percentage of acetylsalicylic acid elimination at 5 volts was 58.67% in the total times of 10, 20 and 30 minutes at the initial concentration of 0.3 mg/mL. In the 11-volt tests, the best removal efficiency was 60.00%, with 30 minutes of removal time. As expected, the greatest wear of the electrodes was obtained through the tests subjected to 11 volts, and in relation to the cost of operation, the test with the highest cost was R$ 3.15/m3. For tests subjected to 5 Volts, the highest cost was R$ 0.73/m3. The results of the study indicated significant elimination of aspirin. Therefore, this study can be a reference for other researchers or manufacturers to evaluate and estimate the process on a larger scale using this system for the treatment of synthetic wastewater.

Keywords: Acetylsalicylic acid (ASA). Electrocoagulation. Emerging Pollutants. Wastewater Treatment.

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INTRODUCTION

The increase in the number of factories and production capacity, coupled with the growing demand for medicines, has led to an increase in wastewater generation. As a result, the massive discharge of pharmaceutical wastewater has become a cause for concern due to the considerable pollution of water bodies and toxicity, both chronic and subchronic, affecting aquatic ecosystems and humans, due to accumulation in the environment and food chain (Chen et al., 2023; Maniakova et al., 2020).

Emerging pollutants are compounds that have emerged due to poor waste management, such as pharmaceuticals, plastics, personal care products, cosmetics, dyes, among others, which end up being deposited in bodies of water, such as rivers, lakes, oceans and groundwater. (Geissen et al., 2015; Camargo et al., 2020; Jari et al., 2022).

Research indicates that small concentrations of these contaminants have been detected in water throughout the country. The U.S. Environmental Protection Agency has been striving to reduce the impact of various emerging contaminants, such as perchlorate, pharmaceuticals, PCP, and EDC (Water Quality Association, 2019).

Currently, the global consumption of medicines has increased, with antidepressants, antiseptics, and treatments for anxiety and overweight being the best-sellers in pharmacies and laboratories (Epi-Phare, 2020). Analgesics and nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen, diclofenac, ketorolac, acetylsalicylic acid and paracetamol, are among the most widely consumed medicines worldwide (WHO, 2007). These drugs generate residues in wastewater, which are classified as emerging contaminants (ECs).

Emerging pollutants are compounds of diverse origins and chemical characteristics, whose presence in the environment and possible impacts have been largely ignored, generating environmental problems and health risks. Most of these are unregulated pollutants, although they could be subject to future regulations depending on studies on their potential health effects and monitoring data related to their frequency of occurrence (Gil et al., 2012; Mugs, 2017).

This poses a significant risk, and requires its regulation, depending on its possible eco-toxicological and toxicological effects, and its levels in the aquatic environment. Therefore, there is an urgent need to strengthen scientific knowledge and adopt appropriate technological and policy approaches to monitor emerging pollutants in water resources and wastewater as well as assess their potential risks to human health and the environment (UNESCO, 2017).

The environmental impact caused by the toxic substances present in emerging pollutants has led the scientific community to develop different methods of water treatment.

These methods include photocatalytic degradation (BALESTRIN et al., 2017), membrane separation (ultrafiltration, nanofiltration) (CRUZ et al., 2020; CARVALHO et al., 2021; FARTO et al., 2021), adsorption (MENDES et al., 2023; SILVEIRA., 2022; KUHL et al., 2021) and electrocoagulation (FONSECA et al, 2024; BEHLING, 2021). Although several of these processes are very effective in the disposal of different types of medicines, their large-scale implementation is limited due to high costs and complexity, especially in Wastewater Treatment Plants (WWTPs) (GOMES et al., 2017). In addition, some of these methods generate secondary contamination, since the byproducts of the transformation can be as toxic or more toxic than the original drugs (; FELIS et al., 2020).

One of the most effective methods for wastewater treatment is electrocoagulation (EC). This process works by electrically dissolving iron or aluminum ions from electrodes of the same material, which act as coagulants in the formation of ions. Metal ions are generated at the anode, while hydrogen gas is released at the cathode. The flocculated particles rise to the surface of the water thanks to hydrogen bubbles formed at the cathode (KHANDEGAR .et al, 2018; TANG et al, 2015).

Electrocoagulation has multiple potential advantages, such as its flexibility, ease of operation, absence of chemical additions, rapid start-up, easy control, and its ability to treat various contaminants, which has increased interest in its application (JAMRAH et al, 2005; TAHREEN et al, 2020; KADIER et al, 2022).

Since effluents with emerging contaminants, such as acetylsalicylic acid, are highly complex and contain elevated levels of chemical contaminants, the aim of this research was to evaluate the efficiency of the electrocoagulation process using aluminum electrodes to remove this emerging contaminant acetylsalicylic acid. Important variables such as reaction time, electric current intensity, concentration, applied voltage, and operating cost were studied.

METHODOLOGY

DESCRIPTION OF THE STUDY SITE

The research experiments were carried out at the Air Pollutants Laboratory, the Water Resources and Environmental Sanitation Laboratory and the Multiuser Laboratory of the Londrina Campus (LabMult-LD), located in the city of Londrina, PR, on the campus of the Federal Technological University of Paraná (UTFPR-LD), block S. In addition, it had the support and collaboration of the laboratories and supplies of the Chemical Engineering career of the State University of Maringá.

EXPERIMENTAL PROCEDURE

The experiments were carried out according to the statistical designs given in Table 1 and Table 2. Two different experimental designs were executed with independent variables of 5 and 11 volts of electrical voltage.

In the first statistical design, electrocoagulation experiments were performed using a 3 3 factorial design, evaluating the effects of independent variables at three levels (-1, 0, 1). The experiments were conducted in triplicate, with a total of 27 trials. The independent variables in this design were acetylsalicylic acid concentration (mg/L) and electrocoagulation time (min) at 5 volts of electrical voltage, as presented in Table 1.

In the second experiment, a 3 3 factorial design was applied. The tests were performed with the independent variables concentration of acetylsalicylic acid (mg/L) and electrocoagulation time (min) at 11 volts of electrical voltage. The arrangements of the experiments are detailed in Table 2.

Table 1 presents the values of the independent variables used in the experimental designs. The independent variables are acetylsalicylic acid concentration (mg/L) and electrocoagulation time (min) at 5 volts of electrical voltage.

Table 1. Values of independent variables (5 volts)

Statistical planning					
Practice	Concentration (mg/mL)	Time (min)	Amperage	Absorbance (ABS)	Acetylsalicylic acid (mg/mL)
1	0.1	10	0.03	2.398	0.08
2	0.1	20	0.03	2.132	0.07
3	0.1	30	0.02	2.035	0.067
4	0.2	10	0.05	3.211	0.109
5	0.2	20	0.02	3.336	0.114
6	0.2	30	0.02	3.336	0.114
7	0.3	10	0.06	3.336	0.114
8	0.3	20	0.04	3.336	0.114
9	0.3	30	0.03	3.336	0.114
10	0.1	10	0.03	2.308	0.077
11	0.1	20	0.02	2.17	0.072
12	0.1	30	0.02	2.282	0.076
13	0.2	10	0.04	3.211	0.109
14	0.2	20	0.03	3.336	0.114
15	0.2	30	0.02	3.336	0.114
16	0.3	10	0.08	3.336	0.114
17	0.3	20	0.04	3.512	0.12
18	0.3	30	0.03	3.336	0.114
19	0.1	10	0.03	2.398	0.08
20	0.1	20	0.03	2.132	0.07
21	0.1	30	0.02	2.035	0.067
22	0.2	10	0.05	3.211	0.109
23	0.2	20	0.02	3.336	0.113
24	0.2	30	0.02	3.335	0.112
25	0.3	10	0.06	3.334	0.114
26	0.3	20	0.04	3.336	0.115
27	0.3	30	0.03	3.336	0.114

Table 2 presents the values of the independent variables used in the experimental designs. The independent variables are acetylsalicylic acid concentration (mg/L) and electrocoagulation time (min) at 11 volts of electrical voltage.

Table 2. Values of independent variables (11 volts)

Statistical planning					
Practice	Concentration (mg/mL)	Time (min)	Amperage	Absorbance (ABS)	Acetylsalicylic acid (mg/mL)
1	0.1	10	0.07	2.385	0.085
2	0.1	20	0.06	2.26	0.081
3	0.1	30	0.06	2.222	0.079
4	0.2	10	0.1	3.301	0.118
5	0.2	20	0.07	3.426	0.123
6	0.2	30	0.06	3.301	0.118
7	0.3	10	0.11	3.426	0.123
8	0.3	20	0.13	3.426	0.123
9	0.3	30	0.08	3.426	0.123
10	0.1	10	0.07	2.385	0.085
11	0.1	20	0.07	2.204	0.079
12	0.1	30	0.06	2.28	0.082
13	0.2	10	0.09	3.426	0.123
14	0.2	20	0.07	3.301	0.118
15	0.2	30	0.06	3.301	0.118
16	0.3	10	0.08	3.426	0.124
17	0.3	20	0.17	3.426	0.124
18	0.3	30	0.15	3.301	0.118
19	0.1	10	0.07	2.385	0.084
20	0.1	20	0.06	2.26	0.08
21	0.1	30	0.06	2.222	0.078
22	0.2	10	0.1	3.301	0.117
23	0.2	20	0.07	3.426	0.122
24	0.2	30	0.06	3.301	0.117
25	0.3	10	0.11	3.426	0.122
26	0.3	20	0.13	3.426	0.122
27	0.3	30	0.08	3.426	0.122

Preparation of Synthetic Water

The water used in the study was prepared with acetylsalicylic acid produced by the pharmaceutical company Adria, following the AOAC method (Association of Official Analytical Chemists, 1995).

The dose of acetylsalicylic acid was determined by the spectrophotometric method, in which a UV spectrophotometer - model DR 5000 was used

Preparation of HCl Solution 0.1 mol/l

Hydrochloric acid (HCl) was considered the "target" of the sample and was used to calibrate the spectrophotometer. HCl solutions were prepared at 0.1 mol/L, taking into account that its molar mass is 36.46 g/mol. Thus, the mass (g) needed to prepare 5 liters of the solution was calculated.

Developing Standard Solutions

Crude acetylsalicylic acid (ASA) standards (0.1 mg/mL, 0.2 mg/mL, and 0.3 mg/mL) were prepared in 2000 mL volumetric flasks. The respective masses of the reagent were weighed and dissolved in a solution of 0.1 mol/L HCl. The volume of the flasks was then filled with the acidic solution. For the preparation of these solutions, the masses (g) of acetylsalicylic acid (ASA) to be weighed were calculated on the basis of a solution of 100 mL at 0.3 mg/mL. The molar mass of acetylsalicylic acid (ASA) was considered to be 180.158 g/mol, as determined by Merck (2001).

Performing the Calibration Curve and Sample Analysis

Table 3 presents the data necessary for the construction of the calibration curve of acetylsalicylic acid (ASA) solutions, taking into account the dilute concentration of each sample (mg/mL) and its respective absorbance. Absorbance was measured at a wavelength of 230 nm using a model DR 5000 spectrophotometer . Thus, it was possible to construct the calibration curve A x C (mg/mL) and calculate the specific absorbance of acetylsalicylic acid (AAS).

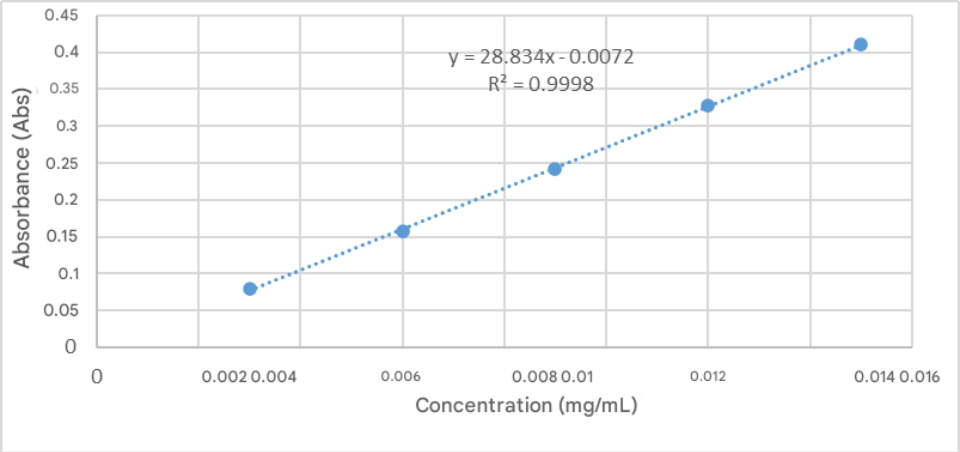
Table 3. Support for calibration curve performance and sample analysis

	Acetylsalicylic Acid (AAS) (mL) Standards	Volumen HCl 0,1 mol/ mL(mL)	Deionized H2O	Concentration Standard (mg/mL)	Absorbance (Abs)
White	-	25	Completed by 100 mL	0	-
1	1	25		0,004	0,080
2	2	25		0,007	0,158
3	3	25		0,010	0,243
4	4	25		0,013	0,329
5	5	25		0,016	0,412

From the data in Table 3, the calibration curve A x C (mg/mL) could be made. Data on the standard concentration of each sample in relation to its absorbance were used. From the curve and equation of the line (y=28.834x-0.0072) obtained, it was possible to determine the value of the concentration of acetylsalicylic acid (ASA) in the x-axis by substituting the absorbance value of the sample in the y-axis.

In Figure 1, it represents the calibration curve, to know the concentration through absorbance.

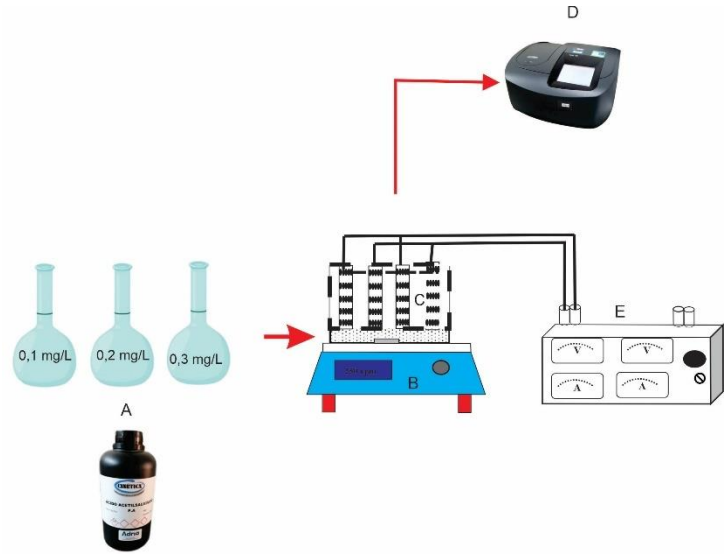
Figure 1. Calibration curve



ELECTROCOAGULATION PROCESS SCHEME ADAPTED FOR ACETYLSALICYLIC ACID

Figure 2 presents a process diagram: A) Preparation of synthetic water in different concentrations (AAS) B) Magnetic stirrer C) Reactor with aluminum electrodes D) UV spectrophotometer - model DR 5000 E) Power source (5 and 11 volts)

Figure 2: Electrocoagulation process diagram



The electrocoagulation process diagram consisted of 1 polypropylene cylindrical reactor with a volume of 200 mL. Four aluminium electrolytic plates were inserted into the reactor, connected in parallel and spaced 2 cm apart. The plates, which refer to the electrodes, are 7.5 cm high, 4 cm wide and 3 mm thick and were fixed with PVC (polyvinyl chloride) screws. In addition, plates of the same polarity were interconnected by a metal screw.

OPERATIONAL COSTS

Electrode Wear Calculation

According to Meneses et al. (2012), electrode wear in the electrochemical formation process of the coagulant agent is related to the consumption of electrons, the generation of which is directly related to Faraday's Laws. Therefore, equation 2 can be used to calculate the amount of electrode consumed.

$$m_{el} = \frac{i \times t \times M}{F \times z} \qquad (2)$$

Where:

mel = maximum amount of electrode consumed (g);

i = applied current (A) - the average of the currents of each test was used;

t = application time of the current(s) - which was constant at 30 minutes;

M = molar mass of the predominant element in the electrode (g/mol) - aluminium (26.98 g/mol)

z = number of electrons involved in the oxidation reaction of the anode element - aluminium (3)

F = Faraday's constant (96,500 C/mol).

Electrode Wear Time

To obtain the actual weight of the electrodes, without the presence of residues from the electrolysis process, they will be cleaned with phosphoric acid. After cleaning, the electrodes will be weighed on a precision balance. According to Wiendl (1998), the estimated electrode wear time can be calculated using equation 3:

$$t = \frac{M_0}{\alpha \times i} \qquad (3)$$

Where:

t = electrode wear time (h);

Mo = initial molar mass of aluminium (g) - 57.35 g

α = electrochemical equivalent of electrode material (g/A.h) - aluminum (0.335 g/A.h)

i = applied current (A) - the average of the currents of each test was used.

Electricity Consumption

According to Kobya et al. (2006), the electricity consumption in an electrocoagulation system can be expressed by the following Equation 4:

$$C_{energy} = \frac{U \times i \times t}{V} \qquad (4)$$

Where:

Cenergy = energy consumption (W.h/m³);

U = electrical voltage applied to the system (V);

i = electric current applied to the system (A) - the average of the currents of each test has been used;

t = current application time (h) - 0.5 hours;

V = volume of treated effluent (m³) - 0.00025 m³

System Operating Cost Calculation

According to Donini et al. (1994) and Kobya et al. (2006), electrode material and electricity costs account for most of the cost of operating an electrocoagulation system, and can be calculated using equation 5:

$$C_{operacion} = a.C_{energy} + b.C_{electrode} \qquad (5)$$

Where:

C operation = Operating cost (R$/m³ of effluent);

a = energy cost (R$/kWh) - R$ 0.63/kWh;

C energy = energy consumption (kWh/m³ of effluent);

b = Mass cost of the plate (R$/kg of electrode) - aluminum (R$ 5.40/kg);

C electrode = electrode consumption (kg/m³ of effluent)

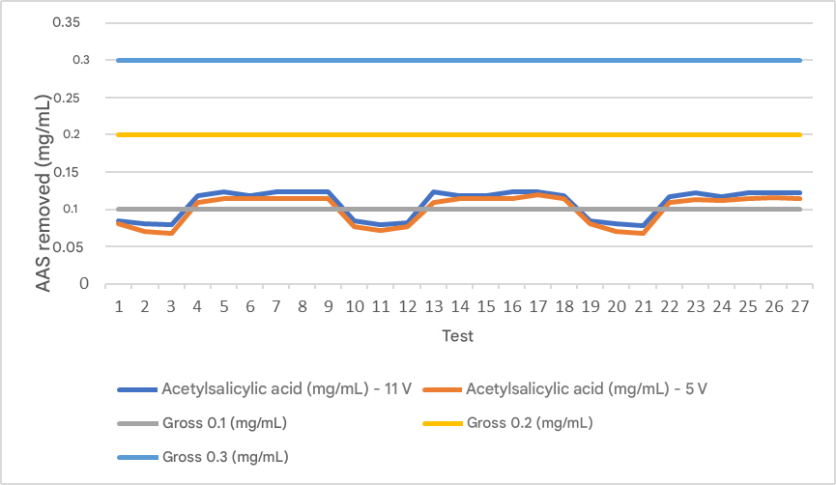
RESULTS AND DEBATE

RESULT OF THE PARAMETERS EVALUATED

After treating the emerging contaminant, the parameters were evaluated using graphs based on the laboratory data. This allowed to analyze the elimination efficiency of the emerging contaminant acetylsalicylic acid, as well as to evaluate the results with the cost of operation, using electrocoagulation.

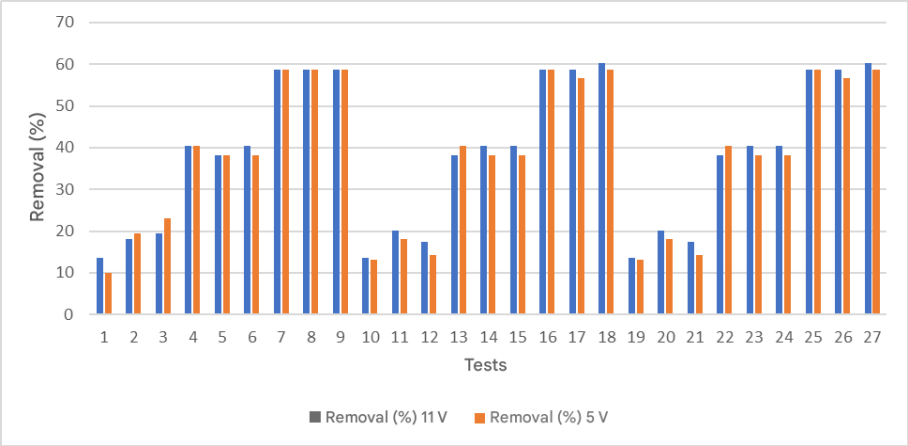
In Fig. 3 . The concentration of acetylsalicylic acid removed in the electrocoagulation process is compared under two different voltage values: 5 volts and 11 volts. The term "ASA (mg/mL)" refers to the concentration of acetylsalicylic acid removed, and horizontal lines indicate the concentrations of contaminated raw water samples. The removal of the substance with both voltages was similar, indicating that there were no significant differences between them.

Figure 3. Concentration of Acetylsalicylic Acid Removed



In Figure 4.- It can be seen that some trials have achieved even greater efficacy in the removal of acetylsalicylic acid, this was the case of trials 7, 8, 9, 16, 17, 18, 25, 26 and 27, which presented the highest concentration of the drug in the crude sample (0.3 mg/mL). The best result was obtained in tests 18 and 27, which were subjected to a voltage of 11 volts and had an electrocoagulation time of 30 minutes, resulting in a removal of acetylsalicylic acid of 60.0%.

Figure 4. Salicylic acid removal efficiency



RESPONSE SURFACE GRAPHS

Figure 5 shows the graph of the response surface of tests subjected to a voltage of 5 volts.

As expected, the surface graph of the electrocoagulation process at 5 volts was similar to the process with a voltage of 11 volts. However, the coefficient of determination presented a slightly better result, with R2 = 0.99134

Figure 5. Surface graph of CE process behavior at 5 volts

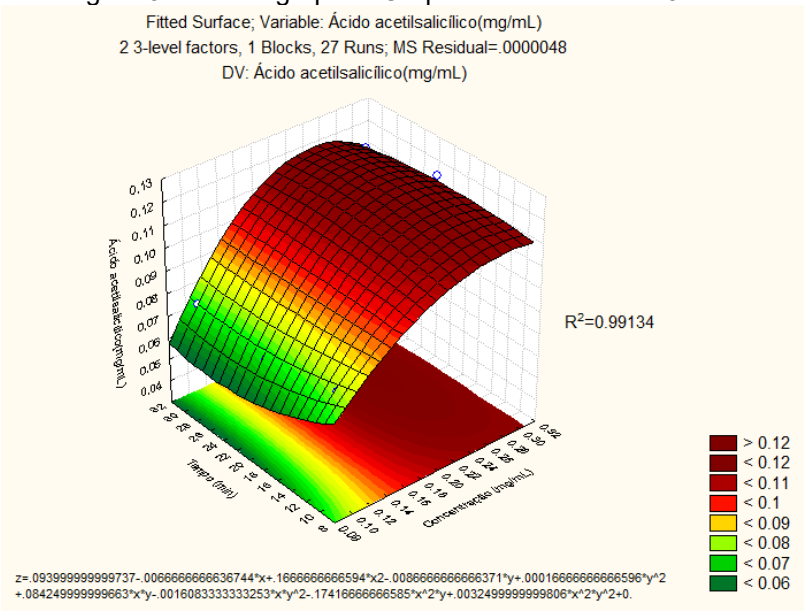
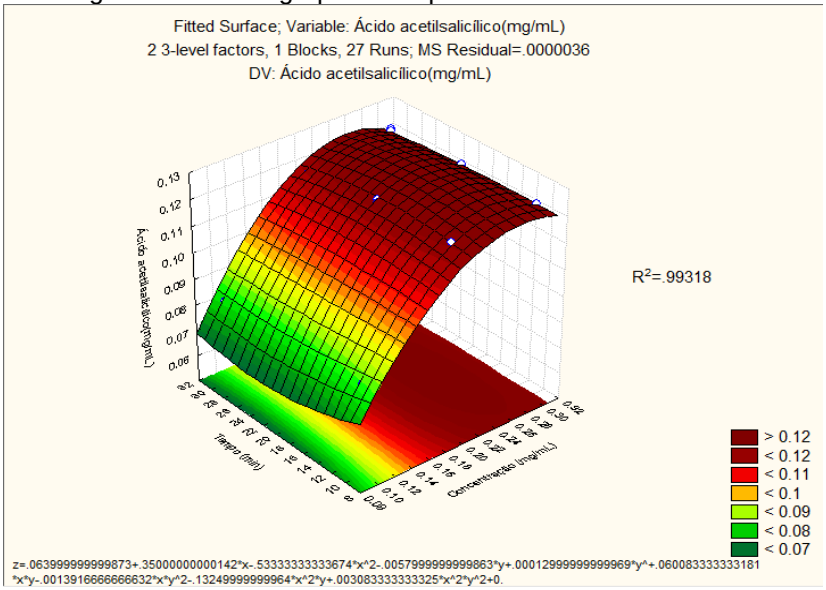


Figure 6 shows the graph of the response surface of tests subjected to a voltage of 11 volts. As expected, the surface graph of the electrocoagulation process at 5 volts was similar to the process with a voltage of 11 volts. However, the coefficient of determination showed a slightly better result, with R^2 = 0.99318. That means that there was a greater removal of the emerging contaminant acetylsalicylic acid at 11 volts.

Figure 6. Surface graph of EC process behavior at 11 volts

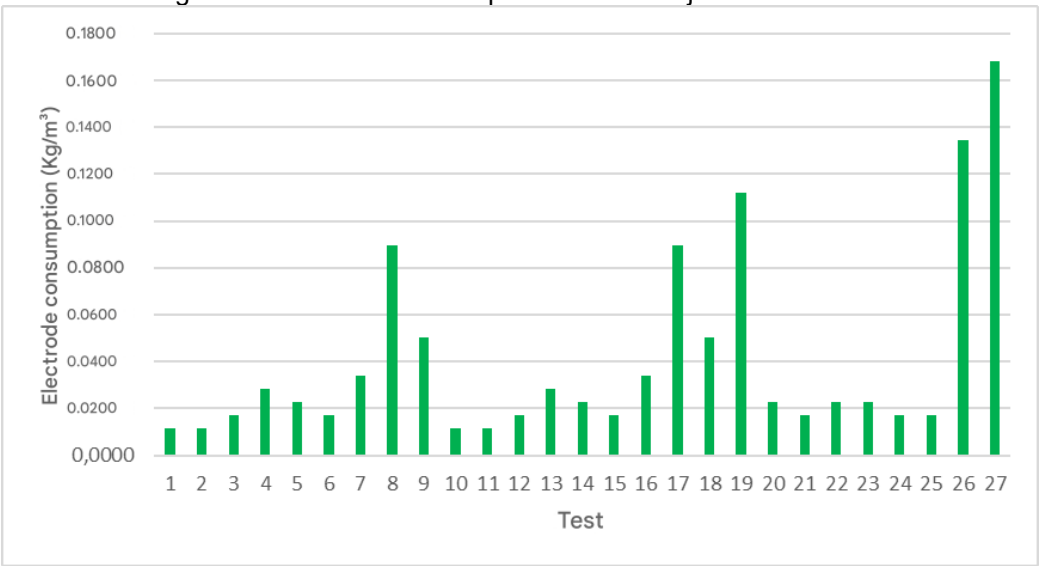


ELECTRODE CONSUMPTION

Figure 7 shows the data obtained for the tests subjected to the elimination of acetylsalicylic acid at a voltage of 11 volts. The highest electrode consumption was reached in test 27, reaching 0.165 kg/m3. According to the experimental plan, this test has an electrocoagulation time of 30 minutes.

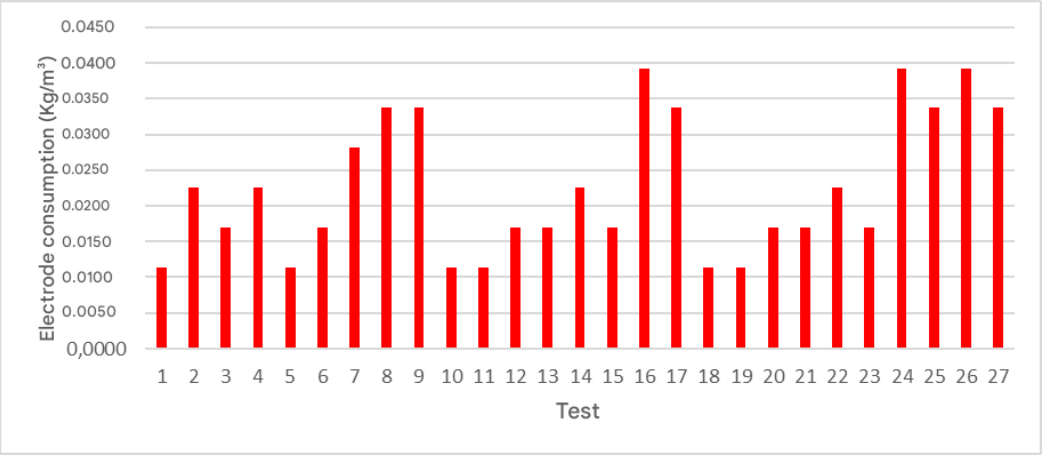
Electrode consumption (kg/m3) was calculated using Equation 2.

Figure 7.- Electrode consumption in tests subjected to 11 volts



In Figure 8, as can be seen, tests 16, 24 and 26 showed the highest electrode wear for those subjected to 5 volts, reaching 0.038 kg/m3 in a 10-minute electrocoagulation process. As expected, the average of the tests subjected to 11 volts achieved a higher average electrode wear due to the application of a higher voltage to the system.

Figure 8.- Electrode consumption in tests subjected to 5 volts



ENERGY CONSUMPTION

In Figure 9, which shows the electrical consumption as a function of the electrode wear at 11 volts, the electricity consumption graph indicates that the test with the highest electrical demand was also test 27, with a value of 5.8 kWh/m3. This correlation makes a lot of sense, since the increased electrode wear was a consequence of a greater amount of energy in the system

Figure 9.- Test power consumption subjected to 11 volts

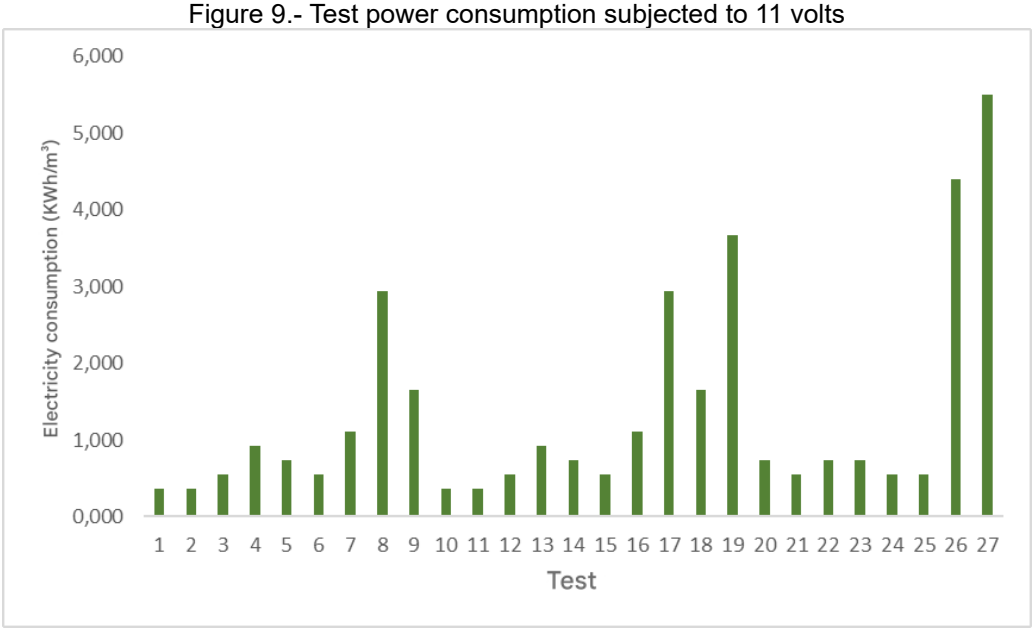
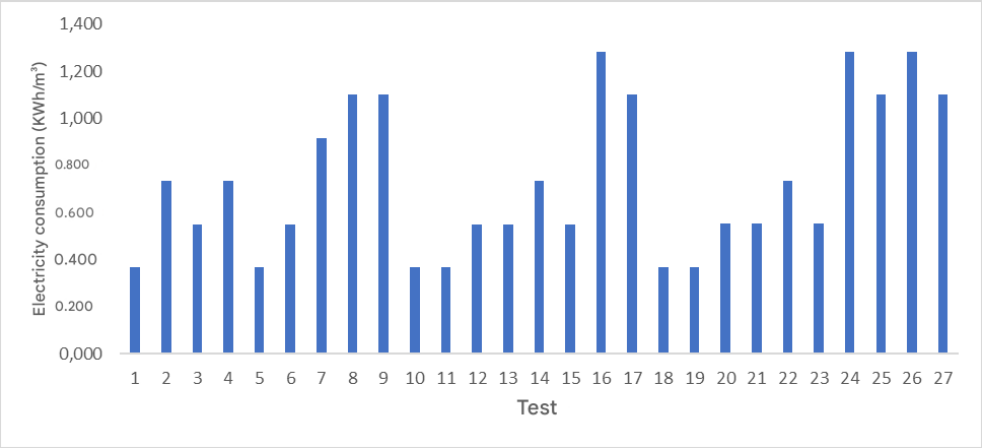


Figure 10 shows the electrical consumption as a function of electrode wear at 5 volts, tests 16, 24 and 26 were the ones with the highest energy consumption, reaching a value of 1.32 kWh/^{m3} and maintaining the correlation with the graph in Figure 9 on electrode wear.

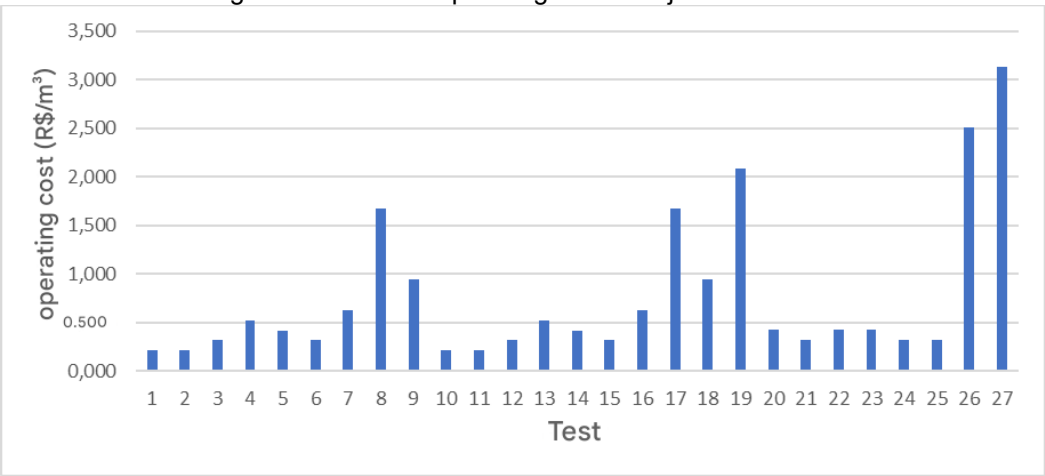
Figure 10.- Test power consumption subjected to 5 volts



COST OF OPERATION

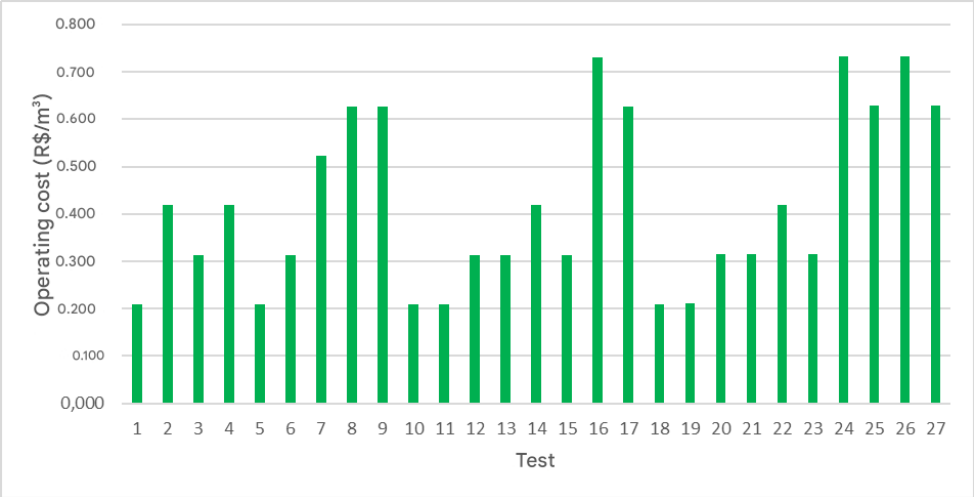
In Figure 11, as can be seen, for the 11 volt voltage, the operating cost was higher for test 27, reaching R$ 3.15/m3

Figure 11. Process operating costs subject to 11 volts



In Figure 12, as can be seen, for the 5 volt voltage, tests 16, 24 and 26 were higher than the others, reaching R$ 0.75/^{m3}. Importantly, test 16 only underwent a 10-minute process, however, it had the highest operating cost of those subjected to 5 volts.

Figure 12. Process operating costs subject to 5 volts



CONCLUSION

After the application of the electrocoagulation method with four aluminum electrodes, it can be concluded that the initial concentration of acetylsalicylic acid in the sample and the process time are important variables that affect the elimination of the emerging contaminant. Thus, the highest overall elimination percentage occurred in trial 27, which reached a removal rate of 60%, which was subjected to an electrocoagulation time of 30 minutes with an initial concentration of 0.3 mg/mL of acetylsalicylic acid. Overall, there were no significant differences between the elimination at the two voltages (5 and 11 volts).

In terms of operating cost, experiments subjected to a voltage of 5 Volts presented the highest cost-benefit of the study, since they had a lower cost to achieve a balanced removal efficiency than those subjected to 11 Volts. Test 27 (11 Volts), in relation to the cost of operation, the test with the highest cost was R$ 3.15/m^3. For tests subjected to 5 Volts, the highest cost was R$ 0.73/m3. It is also important to note that the greatest electrode wear occurred in test 27 (30 minutes at 11 volts), reaching 0.170 kg/m3. In addition to electricity costs, the greater the electrode wear, the higher the aluminum consumption during the process, which is another factor to consider when controlling electrocoagulation costs.

It is recommended for future studies, to add filtration to each test after electrocoagulation, which could increase the efficiency of acetylsalicylic acid removal.

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BEYOND ANTIBIOTICS: NATURAL ALTERNATIVES IN THE FIGHT AGAINST BOVINE MASTITIS

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ABSTRACT

Bovine mastitis is one of the main diseases that affect dairy farming, resulting in economic losses and impacts on animal health and milk quality. Conventional antibiotic treatment faces increasing challenges due to antimicrobial resistance, driving the search for natural and sustainable alternatives, such as the use of herbal medicines and essential oils from medicinal plants. Recent studies highlight the potential of several plant extracts with antimicrobial properties. Research has demonstrated the effectiveness of plants such as Psidium cattleianum, Tagetes minuta and Psidium guajava against Staphylococcus aureus and Corynebacterium bovis. Other studies have indicated that essential oils of species such as Origanum vulgare, Zataria multiflora and Thymus vulgaris are effective in controlling mastitis, reducing bacterial and somatic cell counts, in addition to improving the clinical

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conditions of the animals. Experiments carried out with animal models and dairy cows have shown promising results. Essential oils, applied intramammary or topically, have demonstrated antimicrobial, immunomodulatory and anti-inflammatory effects, without compromising milk quality or causing significant adverse effects. The use of natural alternatives, such as herbal medicines and essential oils, can reduce dependence on antibiotics, minimize risks of chemical residues in milk, and provide a more sustainable approach to mastitis management. The combination of these strategies with hygienic management practices and early diagnosis is essential for effective and integrated disease control, benefiting animal health and milk production.

Keywords: Antimicrobial resistance, Veterinary phytotherapy, Essential oils, Sustainable management, Animal health.

INTRODUCTION

The entire milk production system, from small farms to the dairy industry, is extremely important to ensure the quality of the final product. Several factors influence the quality of milk, such as animal genetics, management, nutrition, herd health and the milking method applied. One of the great challenges of the global dairy sector is the presence of mastitis in the herd, a very common disease in Brazil and in the world and that significantly affects the performance of the entire dairy system until it reaches the consumer's table (SAAB *et al*., 2014; BELOTI, 2015).

Mastitis is the inflammation of the parenchyma of the mammary gland, which can present itself in different forms, such as acute, superacute, subacute or chronic, characterized by a series of physical and chemical changes in the milk, as well as pathological changes in the glandular tissue. Mastitis can also be classified according to the clinical condition that the patient presents, into clinical and subclinical mastitis, and according to the mode of contagion and causative pathogens, into contagious and environmental (RADOSTITS, 2000; SEW; LEE; COSTA, 2012). The disease can be caused by stress, trauma to the mammary gland, infection by microorganisms such as fungi, yeasts, viruses and bacteria, these being the most frequent agents. The most important changes observed in milk are discoloration, the appearance of clots and the presence of a large number of defense cells (leukocytes) (LOPES; L; RONDA, 2013; COELHO *et al*., 2016).

The presence of this disease in the herd ends up compromising the quality of the milk, putting at risk the safety of its handlers and the final consumer, which makes mastitis the most important disease among the pathological conditions that plague the dairy herd around the world, since this disease generates great losses in the economic sphere for both the producer and the industry, in addition to public health problems (MASSOTE *et al*., 2019).

HEALTH AND ECONOMIC IMPACT

Mastitis has a great prominence in the international context due to the high cost of its treatment, and is also considered the disease that most affects the dairy sector (SANTOS *et al*., 2017). According to Peres Neto (2011), approximately 38% of the mortality of the dairy cattle herd is caused by mastitis. Every year, on average, 1 in 3 dairy cows shows signs of apparent inflammation in the udder. Among this number, 7% are discarded and 1% die as a result of the disease. Another important aspect is that more than 25% of the

economic losses resulting from diseases in the dairy herd are influenced by mastitis (PERES NETO, 2011).

In addition to the economic aspect of the activity, the dairy segment plays a very important social role for the country. The dairy sector is responsible for the manufacture of milk and dairy products, intended to meet the needs of thousands of rural families and for the generation of numerous direct and indirect jobs (DEMEU, 2009). According to Maliszewski (2020), Brazil is an important player on the world stage, reaching the fourth position among the countries with the highest milk production. Even with all the country's growth in this area, there is still a great concern about productivity, milk quality, and producers' income (MALISZEWSKI, 2020).

According to Lopes, Manzi and Langoni (2018), in Brazil the economic impact caused by clinical mastitis was estimated at around R$0.1090 to R$0.5985/kg of milk for average annual frequencies of 1 and 15% of mastitis (LOPES; MANZI; LANGONI, 2018). Bovine mastitis causes several losses in all sectors of milk and dairy production. The economic repercussions range from expenses with medicines and specialized services, to the disposal of the positive animal and the already contaminated milk. This is because, in addition to being a risk to public health as a result of the elimination of pathogens that cause zoonoses and toxins produced by milk microorganisms, milk has a drop in quality. Of all the losses mentioned, the disposal of milk, either because an animal is complying with a grace period for the use of antibiotics, or because of the poor quality related to its chemical compounds, is the largest in the production chain, second only to the disposal of animals (MAIOCHI; RODRIGUES; WOSIACKI, 2019).

Another aspect to be considered is the concern with public health, since several microorganisms present in the milk of contaminated animals are capable of causing foodborne infections or toxinfections, as a result of the production of toxins, which are not inactivated by pasteurization or boiling methods (OLIVEIRA *et al*., 2016).

CAUSES AND SYMPTOMS OF MASTITIS

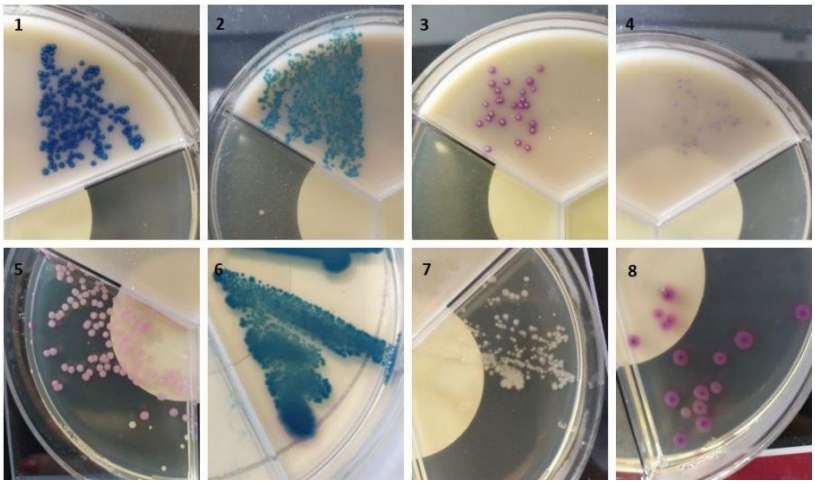
CAUSATIVE AGENTS

Bovine mastitis is a medical condition of great importance in dairy farming, which affects not only the health of the animals, but also the quality and quantity of the milk produced. Characterized by inflammation of the mammary gland, mastitis can be triggered by a variety of pathogens, including bacteria, fungi, viruses, and, in rare cases, algae (TOZZETTI *et al*., 2008; SILVA; MOTA, 2009). These causative agents differ in their modes of transmission, virulence, and impact on milk production, which makes a comprehensive

understanding of each essential for the development of effective prevention and control strategies (ELHADIDY; ZAHRAN, 2014).

Bacteria are by far the most common pathogens associated with bovine mastitis, accounting for the majority of clinical and subclinical cases of the disease. They can be classified into two major groups: contagious agents and environmental agents. Contagious agents are mainly spread during milking and through direct contact between cows. Pathogens such as *Staphylococcus aureus*, *Streptococcus agalactiae* and *Mycoplasma* spp. are significant examples of this group. *Staphylococcus aureus* is particularly problematic due to its ability to adhere to the mammary duct epithelium and form biofilms, which makes it difficult for the animal's immune system and antibiotic treatment to eliminate it (KHAZANDI *et al*., 2018). In addition, *S. aureus* often has resistance to multiple drugs, further complicating treatment (FERREIRA, 2020; RUEGG, 2021). *S. agalactiae* is another common contagious pathogen that is usually limited to the mammary gland, facilitating its spread during milking. This microorganism is one of the main causes of chronic subclinical mastitis, characterized by persistent inflammation that may go unnoticed until significant damage has occurred (ANDREIS; PERRETEN; SCHWENDENER, 2017; KHAZANDI *et al*., 2018). *Mycoplasma* spp., especially *M. bovis*, are less common pathogens but cause severe mastitis that is refractory to treatments. Due to the absence of a cell wall, *Mycoplasma* is resistant to many conventional antibiotics, making eradication of this pathogen a challenge (NICHOLAS; FOX; LYSNYANSKY, 2016).

Figure 1 - Characteristic staining of colonies of mastitis-causing microorganisms inoculated into chromogenic culture media triplate: 1 - Streptococcus uberes; 2- Streptococcus agalactiae/dysgalactiae; 3 - Enterococcus spp. ; 4 - Lactococcus spp.; 5 - Staphylococcus aureus; 6 - Klebsiella spp./Enterobacter spp.; 7 - Prototheca spp./Leaven; 8 - Escherichia coli.



Source: GRANJA (2020).

In addition to contagious pathogens, there are environmental agents that are found in the environment around cows, such as soil, feces, and water. Infection usually occurs

when these microorganisms enter the teat canal, especially during or shortly after milking when the teat sphincter is open. Among the environmental pathogens, *Escherichia coli* and *Klebsiella* spp. are particularly remarkable. *E. coli* is an opportunistic environmental pathogen that causes acute clinical mastitis, often resulting in severe inflammation and severe systemic symptoms. The adaptation of *E. coli* to the bovine mammary gland is a key factor in its pathogenicity (KLAAS; ZADOKS, 2018; MURINDA *et al.*, 2019). *Klebsiella* spp., in turn, are associated with humid and dirty environments and cause severe acute mastitis. These bacteria are often resistant to many commonly used antibiotics, complicating infection management (MURINDA, 2019). Another significant environmental pathogen is *Streptococcus uberis*, which can cause both clinical and subclinical mastitis. This microorganism is prevalent in humid environments rich in organic matter (ALVAREZ-URIA *et al*., 2018; CHENG *et al*., 2020).

Although less common, fungal infections are becoming increasingly relevant, especially in herds where antibiotics are frequently used, which can alter the natural microbial flora of the mammary gland and allow fungi to proliferate. *Candida* spp. and *Aspergillus* spp. are the main fungi involved (DUBIE *et al*., 2015). Yeasts of the genus *Candida* can cause both subclinical and clinical mastitis, often associated with immunosuppression or long-term use of antibiotics (DUBIE *et al*., 2015; MOUSA; ELMONIR; ABDEEN, 2016). Fungi of the genus *Aspergillus* are responsible for rarer infections, which usually occur in cases of contamination of milk or milking equipment (ABD EL-RAZIK *et al*., 2011).

Viruses, although less often associated with bovine mastitis, can play a significant role in certain conditions. *Bovine herpesvirus* (BHV) and Bovine Viral Diarrhea Virus (BVDV) are notable examples. *Bovine herpesvirus* can cause mastitis as part of a systemic infection, although it is best known for its association with respiratory and reproductive diseases (ALTUN; ÖZDEMIR; SAĞLAM, 2019). The Bovine Viral Diarrhea Virus can also affect the mammary gland, leading to inflammation and changes in milk quality, even if its main clinical presentation is systemic (BRODERSEN, 2014).

Algal infections are extremely rare, but they can occur in regions with contaminated water problems. *Prototheca* algae is the main cause, leading to chronic mastitis that is often refractory to treatment. This condition is especially difficult to treat due to algae's resistance to conventional mastitis control methods (JAGIELSKI *et al*., 2019; KANO, 2020).

CLINICAL SIGNS AND DIAGNOSIS

Bovine mastitis can be identified by changes in the udder, such as swelling, warmth, redness, hardness, or pain when it is clinical mastitis. Other indicators include abnormalities in the milk, such as watery appearance, presence of flakes or clots (ACOSTA *et al.*, 2016). In cases of subclinical mastitis, no signs of udder infection or changes in milk are visible.

The most evident symptoms of clinical mastitis include moderate to severe swelling of the udder, which also presents excessive heat to the touch and reddish color (AMORIM; SANTANA, 2021). The udder can also cause discomfort to the cow when handled (FONSECA, 2021). In severe situations, the cow's body temperature may increase and the milk produced may have a watery appearance, as well as flakes, clots, pus or even blood (LANGONI *et al.*, 2017).

Figure 2 - Detection of hardened, swollen and painful parts of the udder during palpation.



Fonte: OLIVEIRA *et al.* (2015).

Other symptoms associated with mastitis may include reduced milk production, lack of appetite, sunken eyes, decreased mobility (due to udder pain or general malaise), and signs of diarrhea and dehydration (AMORIM; SANTANA, 2021). In acute cases of clinical mastitis, the cow may appear extremely debilitated. In contrast, subclinical mastitis may not present with immediately obvious symptoms, other than an elevated somatic cell count in the milk (ACOSTA *et al.*, 2016).

An early diagnosis of clinical mastitis is crucial to prevent losses in milk production and enable effective treatment from the beginning of the disease, in addition to avoiding

dissemination to other animals and alteration of milk properties (BORGES *et al.*, 2020). Common diagnostic methods include visual inspection of the animal's udder and analysis of milk characteristics, such as the presence of lumps during milking (SANTOS *et al.*, 2017).

Figure 3 - Milk with changes in consistency and color.



Fonte: Oliveira *et al.* (2015).

Animals with a history of significant recurrence of infections should be isolated to avoid transmission to other healthy animals. Those who are being treated for the first time must strictly follow the waiting periods of the medications used (ACOSTA *et al.*, 2016). Effective strategies for mastitis control should include a preventive program that identifies the pathogens involved and prevents the development of antimicrobial resistance, a serious threat to human and animal health (SILVA; MOTA, 2019).

Identifying the causative agent of the infection is essential to determine the appropriate treatment of mastitis, as different pathogens require different management approaches. This allows dairy farmers to work together with veterinarians to develop personalized disease control strategies that adapt to the specific needs of their dairy operation (FONSECA, 2021).

Treatment of mastitis usually involves the use of antibiotics, although in resistant cases, other therapeutic approaches may be necessary to combat chronic infections (RODRIGUES *et al.*, 2018). Effective mastitis management is not only one of the biggest

costs for the dairy industry, but also a crucial factor for the well-being of dairy cows (AMORIM; SANTANA, 2021).

CONVENTIONAL TREATMENT WITH ANTIMICROBIALS

COMMON ANTIMICROBIALS

Antimicrobial therapy is widely used to prevent and control mastitis. However, even with the best antimicrobial treatments available, bacterial cure failures are frequent, especially in the case of mastitis caused by *S. aureus* and antimicrobial resistance. In addition, antimicrobial resistance in bacteria constitutes a danger to public health, and the long-term use of antimicrobials is seen as an important contributing factor to this resistance. Several strains isolated from mastitis cases have demonstrated resistance to multiple antimicrobials, such as penicillin-G, gentamicin, streptomycin, ampicillin, ciprofloxacin, and oxytetracycline (CHANDRASEKARAN *et al.*, 2014). To achieve effective antibacterial therapy against mastitis, it is necessary for the active drug to achieve and maintain concentrations above the minimum necessary to inhibit infection at the affected site for the time required to suppress the production and release of toxins by the pathogen responsible. Several elements can interfere with this process, including pathological changes in the glandular tissue of the mammary gland, bacterial factors associated with mastitis, inadequate selection and overuse of antibiotics, and also the way medications are administered (HOSSAIN *et al.*, 2017).

Antibiotic therapy for mastitis should be targeted to achieve therapeutic efficacy and economic advantages, both in terms of increasing productivity and reducing sources of infection. Acute and hyperacute cases of mastitis can be managed with antibiotics and always require additional therapeutic support (including fluid administration, electrolyte replacement, and nonsteroidal anti-inflammatory agents). In the case of cows in the dry period, the most effective treatment for subclinical mastitis involves the intramammary application of long-acting antibiotics, combined with drying of the mammary glands (BENEDETTE *et al.*, 2008). However, due to the type of microorganism involved, location of the infected sites, degree of mammary gland hardening, duration of infection, and other undefined factors, it is difficult to quantify the clinical efficacy of an antimicrobial (TOZETTI *et al.*, 2008).

An analysis of the antimicrobial activity of several antibiotics was conducted against S. *aureus* samples obtained from 63 cows. Drugs tested included: ampicillin, cephalexin, ciprofloxacin, streptomycin, gentamicin, norfloxacin, and tetracycline. The results revealed that more than half of the agents tested demonstrated sensitivity, with efficacy exceeding

50%. Among the antibiotics evaluated, those that stood out for their efficacy were gentamicin, cephalexin, and ciprofloxacin, with a success rate of 100%. Then, norfloxacin showed an efficacy of 94.6%. On the other hand, the least effective antimicrobials were tetracycline and ampicillin, with resistance rates of 10.82% and 13.51%, respectively (SAEKI *et al.*, 2011). Another analysis was conducted using the Disk Diffusion procedure with the commercial strains of *S. aureus*. A total of 16 antimicrobial agents were examined: Florfenicol 30 µg, Enrofloxacin 5 µg, Gentamicin 10 µg, Amikacin 30 µg, Tetracycline 30 µg, Norfloxacin 10 µg, Cephalothin 30 µg, Cephalexin 30 µg, Gentamicin 30 µg, Neomycin 30 µg, Amoxicillin 30 µg, Ampicillin + Sulbactam 10/10 µg, Cefoxitin 30 µg, Bacitracin 10 µg, Ampicillin 10 µg, and Penicillin 10 µg. Total resistance to the drugs Ampicillin and Penicillin was observed. Cefoxitin and Bacitracin showed reduced efficacy, while the others proved to be effective in combating the bacteria responsible for mastitis (SILVA *et al.*, 2022).

With the emergence of evidence of drug-resistant strains, it becomes evident that antibiotics will no longer be effective in combating mastitis. This is a consequence of decades of antimicrobial use and abuse in both human and veterinary medical practice. As a result, there is international attention focused on the search for alternative options for the treatment of bacterial diseases (LI *et al.*, 2023).

CHALLENGES AND LIMITATIONS

The overuse of antibiotics in dairy herds has increased, leading to microbial resistance and making it difficult to treat diseases (ALVES *et al*., 2020). In relation to *S. aureus*, durability varies among herds due to its ability to develop immunity, being one of the pathogens that cause mastitis with a significant economic impact (COSTA *et al*., 2013).

Streptococcus agalactiae is a bacterium commonly found in milk and has become a major obstacle for farms by causing persistent and chronic infections. The presence of antibiotic resistance genes in this bacterium increases concern about the effective treatment of infections (FONSECA, 2021).

Therefore, from a hygienic point of view, milk should be pleasant, clean, fresh and safe (LEITE JÚNIOR *et al*., 2011). Antibiotic residues in milk pose health risks to consumers and cause technological problems in the dairy industry, negatively affecting fermentation processes during the production of derived products (FERREIRA *et al*., 2014). Milk may contain residues of substances such as antibiotics, disinfectants, and pesticides that are administered to animals or used on the farm. Antibiotics can be detected in milk after being administered intramammary, intramuscularly, intrauterinely, orally or subcutaneously (LEITE JÚNIOR *et al*., 2011).

NATURAL ALTERNATIVES

PHYTOTHERAPY AND MEDICINAL PLANTS

The use of herbal medicines can be a more accessible and natural alternative in the fight against bovine mastitis, since the plant source for this treatment is often easy to access and low cost, providing the producer with an alternative for the treatment of this disease (DANTAS *et al*., 2010). Because this disease is commonly caused by bacteria, there is the use of natural products that have antimicrobial activity, making the need for scientific research in this area increasingly greater (SPERANDIO *et al.*, 2019).

A study conducted by Krummenauer, Ponzilacqua, and Zani (2019) investigated the antimicrobial activity of Brazilian medicinal plant extracts against bacterial strains of *S. aureus* and *Corynebacterium bovis* isolated from cases of bovine mastitis. Among the extracts tested, decocts of *Psidium cattleianum*, *Tagetes minuta* and *Psidium guajava* were observed to demonstrate effective activity against both bacterial species. In addition, the extracts of *Polygonum hydropiperoides*, *Casearia sylvestris*, *Achyrocline satureioides,* and *Bidens pilosa* exhibited specific antimicrobial activity against *S. aureus*, but not against *C. bovis*. On the other hand, the extracts of *Allium sativum* and *Matricaria chamomilla* did not show antimicrobial activity against the strains analyzed. The results of this study highlight the potential of medicinal plants from the Brazilian flora in the treatment of bovine mastitis, offering new perspectives for the development of effective and selective active ingredients against specific pathogenic bacteria, especially *S. aureus* (KRUMMENAUER; PONZILACQUA; ZANI, 2019).

The use of natural products in the treatment of mastitis has been an interesting alternative, since most bacteria have a resistance against the drugs already used, making treatment difficult (AUSTREGESILO-FILHO *et al*., 2023). Based on the positive results, and the great potential of several plant species, the field of veterinary phytotherapy can benefit greatly from these studies, offering a viable alternative to the antibiotics that are generally used (BEZERRA *et al.,* 2009).

CASE STUDIES AND RESULTS

PRACTICAL EXAMPLES: *IN VIVO* STUDIES WITH PROMISING RESULTS

The study conducted by Montironi *et al.* (2019) tested the efficacy of *Minthostachys verticillata essential oil* in the treatment of mastitis caused by the pathogenic agent *Enterococcus faecium* through a murine model. The immunomodulatory and protective effects of the EO of *M. verticillata,* at different concentrations, were evaluated against macrophage phagocytosis analysis, reactive oxygen species (ROS) production,

polymorphonuclear neutrophil (PMNs) infiltration, cytokine mRNA expression (IL-1β, TNF-α and IL-10) and bacterial count in the mammary glands of mice that received intramammary injections of *E. faecium* to induce mastitis. It was observed that the intramammary application of EO at a concentration of 3.6mg/ml activated the phagocytosis mechanisms of macrophages, inducing the production of ROS, in addition to reducing the infiltration of PMNs and the expression of proinflammatory cytokines (IL-1β and TNF-α). Increased production of IL-10, an anti-inflammatory cytokine, has also been reported. In addition, a decrease in bacterial load was observed compared to the control groups, which suggests that the immunomodulatory effect of M*. verticillata* EO contributes efficiently against the pathogen that causes mastitis (MONTIRONI *et al*., 2019).

A study conducted in South Korea evaluated the therapeutic effect of oregano essential oil (*Origanum vulgare*) in a group of 18 dairy cows diagnosed with subclinical mastitis caused by *S. aureus* and *E. coli*. The cows were separated into 4 groups – Negative Control Group (CON), which was treated only with saline solution; Positive Control Group (GEN), treated with gentamicin ointment (10g/tube); OEO-1 group, treated with a dose of 0.9ml of oregano OE ointment, twice a day for three days, and finally, the OEO-2 group, treated with twice the dose of OEO-1 group EO for the same period of time. Before and after the stipulated period of time, the physical conditions of the udder, the Somatic Cell Count (SCC) and the leukocyte count (WBC) and the presence of bacteria (*S. aureus* and *E. colli*) were evaluated. As a result, a significant improvement in udder physical conditions was observed in the groups treated with gentamicin and EO. A considerable reduction in SCC and leukocyte count was also reported compared to the control group. The presence of *S. aureus* and *E. colli* was not detected in the milk of the groups treated with OEO. The results of the research indicate that oregano essential oil is effective in the treatment of bovine subclinical mastitis, as it not only reduced somatic cell count and leukocyte count, but also eliminated the pathogens that cause the infection. In addition, treatment with EO improved the physical conditions of the udder without causing significant damage, making it a promising and natural alternative to antibiotics (CHO *et al*., 2015).

Harati *et al.* (2022) evaluated in Iran the efficacy of *Zataria multiflora essential oil* in the treatment of subclinical bovine mastitis caused by *S. aureus*. The study was carried out with 40 dairy cows that were separated into two groups – Control Group, which was treated with gentamicin and OEZM Group, which was treated with an intramammary ointment containing the essential oil of *Z. multiflora* at a concentration of 10% (v/v). Both groups were treated twice daily for the three-day period. Milk and blood samples were collected before treatment (T0) and at regular intervals after the start of treatment (T24, T48 and T72 hours)

for the analyses of Somatic Cell Count CCS, bacterial count, milk composition parameters and hematological and biochemical parameters. The results demonstrated that *Z. multiflora* EO was effective in reducing bacterial count and SCC, without altering milk composition parameters or causing systemic adverse effects, making it a promising alternative for the treatment of subclinical mastitis (HARATI *et al*., 2022).

In the study conducted in Lebanon by Abboud *et al.* (2015), the efficacy of thyme (*Thymus vulgaris*) and lavender (*Lavandula angustifolia*) essential oils against pathogens that cause bovine mastitis (*S. aureus* and *Streptococcus* spp.) was evaluated. The experiment was conducted on four farms, where dairy cows were examined weekly for five months for the presence of clinical mastitis using the California Mastitis Test (CMT). Farm 1 had 5 positive cows for mastitis, while Farm 2, 3 and 4 had 6, 4 and 7 diagnosed cows, respectively. The treatment differed in each farm, with Farm 1 treated with intramammary (IM) injection of 10% thyme EO in methanol, Farm 2 with IM of 10% lavender EO in methanol, Farm 3 IM with the combination of the two essential oils at 10% methanol and Farm 4, in which 4 cows received external application of thyme EO in petroleum jelly and 3 cows received external application of the OE of lavender in petroleum jelly. All treatments were performed for 4 consecutive days and there was clinical evaluation and milk collection to evaluate the parameters of its composition and bacterial count during all days. The results showed that both application methods (intramammary and external) showed a significant reduction in bacterial count and an improvement in the clinical conditions of the affected cows, without significant adverse effects. Farm 1 obtained the best result, demonstrating the highest efficiency of thyme EO compared to lavender in combating bovine mastitis (ABBOUD *et al*., 2015).

FINAL CONSIDERATIONS

Therefore, bovine mastitis represents a major challenge for dairy farming, impacting both the health of the animals and the quality and quantity of milk produced. The diversity of causative agents requires a comprehensive approach to diagnosis, treatment, and prevention. While antibiotics are widely used, growing antimicrobial resistance and the adverse effects associated with their long-term use highlight the need for more sustainable and effective alternatives.

Recent studies suggest that treatments based on plant essential oils may offer a promising solution, with several extracts showing significant antimicrobial efficacy against common mastitis pathogens. In addition, the use of herbal medicines can reduce

dependence on antibiotics and reduce the risks of chemical residues in milk, benefiting both animal and human health.

Thus, the implementation of integrated strategies, combining hygienic management practices, early diagnosis, thoughtful use of antibiotics and adoption of natural treatments, is essential to control bovine mastitis in an effective and sustainable way.

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PERCEPTION OF ACCEPTANCE OF TAX EVASION BY MANAGERS OF MICRO AND SMALL COMPANIES IN VITÓRIA/ES

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ABSTRACT

The purpose of this study was to address the main reasons that lead micro and small companies to opt for tax evasion. Aiming at their own well-being in the face of fiscal and tax obligations, these companies use illicit means and loopholes in the legislation to obtain favorable results on their taxes. Due to the constant search to achieve the reduction of taxes, the Municipal, State and Federal agencies have adopted methods that provide inspection in the fulfillment of obligations. These methods have become possible due to the tools that store data in the database of the responsible agencies, data that refers to the operations carried out by the company, especially information about the value of its revenue. Through the tool used by these inspection agencies, it became possible to control and analyze the data transmitted to these agencies. Thus, the present work aims to identify and evidence, the results of a research published on an online platform, on the main factors that motivate the managers of companies established in the state of Espírito Santo, in the municipality of Vitória, to use fraudulent attitudes to not comply with their fiscal and tax obligations. It identified the profile of companies, managers, and that many managers accept to use illegal methods to obtain even more reduction in their taxes, even knowing that this act may cause future consequences.

Keywords: Company Behavior. Tax avoidance. Tax Fraud.

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INTRODUCTION

The tax is any compulsory livestock provision and its payment is made by currency (money) or any means where the value is equivalent to the currency. In Brazil, tax collection is the main source for financing public services. This collection occurs through the principle of spontaneous compliance. However, due to the complexity of tax legislation, it makes managers carry out studies and strategies that provide the reduction of the weight of the tax burden on their finances. This constant search for tax reduction is one of the factors that motivate entrepreneurs to choose inappropriate means to obtain benefits in their taxes (DUMER et al., 2016, p. 4).

To obtain a reduction in taxes, companies adhere to illegal actions to not comply with their tax obligations, omitting information about their revenue from the tax authorities. These actions are considered criminal, as the result of this feat influences the lower collection of the amounts, which will be used in the investment of health, housing, public security, etc. Evasion of evasion also leads to an increase in the tax burden, as the government seeks ways to cover the embezzlement resulting from fraud in the collection.

However, not all companies adhere to illicit means to benefit from the tax reduction. Some managers carry out procedures in the legislation of their state, seeking legal support before the tax incidence, thus preventing the taxable event from occurring.

Due to the rampant tax evasion of companies, federal, state and municipal agencies have sought inspections for methods that ensure compliance with tax obligations by companies. Each agency is responsible for inspecting a particular tax sector. Companies that choose to obtain insertion or reduction of their taxes by illegal means, are committing serious crimes, and are subject to punitive legal measures employed by the inspection agencies. The body responsible for inspection has the right and duty to adopt punitive legal measures for those who break the law, as long as the fraudster's guilt is formalized through formal processes.

Inspection agencies have adopted tools that help in their inspections. The executive branch, through Decree No. 6022 of January 2007, institutes the Public Digital Bookkeeping System (SPED), this system unifies the activities of reception, validation and storage of tax books and documents. SPED is the way that the Federal Revenue Service found to collect information from various areas of companies. With these declarations, the inspection agencies are able to control the internal and external operations carried out by the companies, being able to identify if there was any illicit means used by the companies to evade taxes.

Therefore, it is necessary to survey the following research problem: **What are the main factors that motivate the managers of organizations in the city of Vitória/ES to not comply with tax obligations?**

The objective of this work is to identify what are the main factors that motivate the managers of organizations in the city of Vitória/ES to not comply with their tax obligations. However, to answer the research problem at hand, it is necessary to analyze the specific objectives below:

- Identify the profile categories of companies;
- Identify the profile of the managers of these companies;
- Identify and analyze the motivation of managers for non-compliance with tax obligations.

Therefore, it is necessary to analyze the data that will be collected in the research made available on an online platform, with the literature addressed in the work, to obtain the conclusion of the research problem highlighted in this work.

The purpose of this article is to highlight in its literature review a critical approach to tax planning, tax evasion and the behavior of private for-profit companies, with the key research being to demonstrate to readers the results of the main factors that motivate tax evasion fraud, exposing the conducts used outside the legal norms to obtain reductions in tax costs.

THEORETICAL FRAMEWORK

The research below refers to a study that highlights the means used by companies to reduce their taxes before the agencies responsible for the inspection and collection of taxes. The purpose of this work is to present theoretical foundations about taxation in Brazil, and the important concepts that support this purpose, such as: tax evasion and its consequences, tax evasion and avoidance, and the main reasons for non-compliance with tax obligations by for-profit institutions.

TAXATION IN BRAZIL

The tax is any compulsory livestock provision and its payment can be made by currency (money) or by another means of payment whose value is equivalent to the currency, or convertible into it, as long as it does not constitute a sanction for an unlawful act, instituted by law and collected through a fully linked administrative activity (LAW No. 5,172, of October 25, 1966, art. 3).

The collection of taxes is the main source of funds for the financing of Brazilian public services. These services include public security, regulation, inspection, development and basic social security services PNEF (2005, p. 11). However, there is a problem regarding the degree of understanding of entrepreneurs when it comes to the spontaneous collection of taxes and their use. Companies seek to defend themselves through legal actions, tax planning or the practice of tax evasion (GRZYBOVSKI; HAHN; 2006, p. 843).

Article 18 of the Federal Constitution of 1988 defines the composition of the national tax system, through the Union, States, Federal District and Municipalities, so that each federative entity is responsible for the inspection and collection of taxes that it is responsible for (SILVA, 2014, p. 19).

In Brazil, the tax system is based on the principle of spontaneous compliance, companies are expected to understand and exercise their tax obligations. However, not all of them exercise this obligation spontaneously. Some companies make false presentations of accessory statements, hiding parts of the activities carried out from the responsible bodies. Others, however, carry out tax evasion involuntarily, for the simple fact of not understanding their due obligations. Regardless of whether voluntary or involuntary, the occurrence of tax evasion is noted (DUMER et al., 2016, p. 4).

TAX EVASION

Tax evasion is a fraudulent action, where companies do not comply with their tax obligations. Companies use illegal means to omit information regarding their revenue in a given calculation period to the tax authorities, thus generating undue reductions in the cost of their taxes to the government. Oliveira et al. (2010, p. 36), defines tax evasion as the use of illegal means to avoid collecting the tax due. Understanding that evasion is any intentional omission tending to prevent or delay the knowledge by the tax authority about the occurrence of the triggering event of the main obligation.

Tax evasion is a serious crime, because companies that use this trick to reduce their taxes are failing to pass on to the public coffers the corresponding amounts that will be used in investment in health, housing, public safety, among others. This act undermines the ability of the public sector to comply with its obligations, thus limiting the resources that will be allocated to the population. (MOREIRA; CARVALHO, 2018, p. 4). According to Law No. 4,729, OF JULY 14, 1965:

> Art.1 The following constitute a crime of tax evasion: (See Decree-Law No. 1,060, of 1969)
> I - To make a false statement or omit, in whole or in part, information that must be produced to agents of legal entities governed by domestic public law, with the

> intention of exempting, in whole or in part, the payment of taxes, fees and any additional taxes due by law;
> II - Inserting inaccurate elements or omitting income or operations of any nature in documents or books required by tax laws, with the intention of exonerating oneself from the payment of taxes due to the Public Treasury;
> III - altering invoices and any documents related to commercial operations with the purpose of defrauding the Public Treasury;
> IV - Providing or issuing gracious documents or altering expenses, increasing them, with the purpose of obtaining a deduction of taxes due to the Public Treasury, without prejudice to the applicable administrative sanctions.
> V - Demanding, paying or receiving, for oneself or for the taxpayer benefiting from the payment, any percentage on the deductible or deductible portion of the income tax as a tax incentive. (Included by Law No. 5,569, of 1969)
> Penalty: Imprisonment, from six months to two years, and a fine of two to five times the amount of the tax.

Another consequence that occurs when there is tax evasion is the increase in the tax burden. This increase is due to the government's attempt to cover the embezzlement resulting from fraud in tax collections. This increase not only penalizes companies that carry out their tax obligations and collect taxes honestly, it also harms final consumers, as this excess amount is passed on to the population through the products and services that will be purchased (MOREIRA; CARVALHO, 2018, p. 4).

In Brazil, tax collection is the main source for financing public services. This collection occurs through the principle of spontaneous compliance. However, due to the complexity of tax legislation, it makes managers carry out studies and strategies that provide the reduction of the weight of the tax burden on their finances. This constant search for tax reduction is one of the factors that motivate entrepreneurs to choose inappropriate means to obtain benefits in their taxes (DUMER et al., 2016, p. 4).

TAX AVOIDANCE, EVASION, EVASION AND FRAUD

Tax avoidance is the procedures carried out in accordance with the legislation. Its practice is considered a lawful act that occurs before the tax incidence, preventing the occurrence of the generating factor, or excluding the company from the comprehensive scope of the tax rule, thus generating tax savings. The legislation has boosted this practice, it offers certain activities a favorable taxable treatment, which may result in the reduction, exemption or even non-taxation of the tax burden (DUMER et al., 2016, p. 3).

> Tax avoidance is the conduct consisting of the practice of an act or execution of a business legally framed in a hypothesis intended by the taxpayer, importing exemption, non-incidence or less onerous incidence of the tax. The avoidance is verified, in most cases, at a time prior to that in which the taxable event would normally occur. It is tax planning, which finds shelter in the legal system, since no one can be forced to practice business in the most onerous way (ALEXANDRE, 2015, p. 446).

On the other hand, evasion is about illicit practices to evade the due payment of taxes, such as: falsehood, fraud and tax evasion. Thus, evasion is the voluntary and conscious action of the company that consists of the total or partial reduction or annulment of the tax burden by illegal means (BELO, 2019, p. 44). According to articles 1 and 2 of Law 8.137 1990:

> Article 1 It is a crime against the tax order to suppress or reduce a tax, or social contribution and any accessory, through the following conducts: I - omitting information, or making a false statement to the tax authorities; II - defrauding the tax inspection, inserting inaccurate elements, or omitting an operation of any nature, in a document or book required by the tax law; III - falsifying or altering an invoice, invoice, trade bill, bill of sale, or any other document related to the taxable transaction; IV - prepare, distribute, provide, issue or use a document that he/she knows or should know to be false or inaccurate; V - To deny or fail to provide, when mandatory, an invoice or equivalent document, related to the sale of goods or provision of services, effectively carried out, or to provide it in disagreement with the legislation. [...] Article 2 - It is a crime of the same nature: I - making a false statement or omitting a statement about income, assets or facts, or employing other fraud, to evade, in whole or in part, the payment of taxes; II - fails to collect, within the legal period, the amount of tax or social contribution, discounted or collected, as a taxable person of obligation and which should be paid to the public coffers; III - demand, pay or receive, for itself or for the beneficiary taxpayer, any percentage on the deductible or deductible portion of tax or contribution as a tax incentive; IV - failing to apply, or applying in disagreement with the statute, tax incentives or tax installments released by a development agency or entity; V - use or disclose a data processing program that allows the taxpayer of the tax obligation to have accounting information different from that which is, by law, provided to the Public Treasury. [...].

Tax fraud occurs when there is a willful omission that partially or totally prevents the occurrence of the generating factor of tax obligations, obtaining advantage to the detriment of third parties (DUMER et al., 2016, p. 4).

Tax avoidance is the execution of abnormal procedures whose purpose is to evade taxation. Unlike tax evasion, which aims to omit information from the tax authorities, in tax avoidance, artificial procedures are used that induce the insertion or non-taxation of taxes paid that would be passed on to the tax authorities. (MOREIRA; CARVALHO, 2018, p. 4).

Both avoidance, evasion, evasion and fraud are situations that aim to reduce tax payments, which can be legal or illegal methods. Companies choose alternative ways in order to avoid taxation, escaping tax rules, reducing or delaying the taxes due (GRZYBOVSKI; HAHN, 2006, p. 860).

SUPERVISORY BODIES

Inspection agencies are responsible for ensuring compliance with tax obligations by companies. Each body is responsible for inspecting a particular tax sector. They are:

- Federal Revenue Service: aims to combat tax evasion, commercial fraud, among other illegal acts committed by entrepreneurs. This body supervises and manages the collection of taxes under the competence of the Union, such as: import of foreign products, export abroad of national or nationalized products, income and proceeds of any nature, industrialized products, credit, exchange and insurance operations, or related to securities or securities, rural territorial property and large fortunes, under the terms of a complementary law (FEDERAL SENATE, 2012, p. 17).
- Treasury Secretariat: collects, controls and inspects taxes under state jurisdiction. The taxes related to SEFAZ (Treasury Secretariat) are: ICMS (tax on the circulation of goods and services); IPVA, Tax on the Property of Motor Vehicles and ITCMD (tax on transmission "causa mortis" and diseases). Its administration is important to ensure the collection of public funds through the collection of taxes (MARQUEZ, 2018).
- Municipal Revenue Secretariat: it is the body responsible for the tax and financial management of the municipality. Its attributions are composed of the coordination and execution of the fiscal, economic and financial administration of the municipality, exercising the collection of active debts and providing a balance between the revenue and expenses of the municipality (PREFEITURA DE VITÓRIA, 2012).

MEANS OF CONTROLS

With technological advancement, inspection agencies have adopted tools that contribute to their inspections. Through Decree No. 6022 of January 2007, the executive branch institutes the Public Digital Bookkeeping System (SPED). This system is managed by the Federal Revenue Service, whose purpose is to unify the activities of receiving, validating and storing tax books and documents. (GIL; BIANCOLINO; BORGES, 2010).

The Public Digital Bookkeeping System is composed of:

- Digital bookkeeping (ECD): This file is the digital version of the daily books, ledgers, trial balances, and balance sheets. Its goal is to replace paper writing with digital file transmission. (BRAZIL, 2007c)
- Digital Tax Bookkeeping (EFD): It is the set of tax information and documents of interest to the tax authorities and the federated units. This file must contain the record of tax assessments. (BRAZIL, 2010d).

SPED is the way that the Federal Revenue Service obtains information from different areas of companies. Through the declarations of these files, the inspection agencies are

able to analyze, control and verify the internal and external operations carried out by the companies. With this information, it is possible to identify the illicit means used by companies to evade taxes.

REASONS FOR NON-COMPLIANCE WITH TAX OBLIGATIONS

There are factors that motivate companies to not comply with their tax obligations. Among them, the most common are:

- The intentional behavior of companies. Managers, with knowledge of tax legislation, use loopholes found in legislation to benefit themselves. Even when there is no broad knowledge about the legislation, they use the "Jeitinho" to lead their tax obligations to a path that is favorable (BELO, 2019, p. 35).
- There are also those who involuntarily do not comply with their obligations. Due to the lack of knowledge on the part of managers in relation to the legislation and important information about taxes, they fail to deliver their real information to the tax authorities, committing tax evasion without the real knowledge of this act (RAMOS, 2014, p. 13).
- The understanding on the part of companies is that the taxes paid will not be used correctly, and will not give the due return of benefits to society (DUMER et al., 2016, p. 5).
- Due to the high tax burden in Brazil, and the low level of return of taxes to society, a culture of non-compliance with tax obligations was created among companies. This custom is based on the lack of knowledge regarding the importance of tax collection and the premise that a large part of the amount collected will be destined for corruption (GRZYBOVSKI; HAHN; 2006, p. 842).
- The psychological factor also influences the non-compliance with tax obligations RAMOS (2014, p. 6). Due to the complexity of the tax understanding and the high value of the tax burden in Brazil, some entrepreneurs are unable to carry out the proper strategic planning for the survival of their company. Making entrepreneurs understand that complying with tax duties will entail a significant cost in their finances. Therefore, many entrepreneurs seek different ways to reduce their costs, through the reduction of taxes, obtaining less costly taxation (DUMER et al., 2016, p. 5).

PENALTIES

The practice of acts contrary to the tax order entails penalties for the offender. The body responsible for the inspection and control of tax taxes has the right and duty to adopt punitive legal measures for those who break the law, provided that the fraudster's guilt is formalized through formal processes.

According to Law No. 8,137, OF December 1990:

> Article 1 It is a crime against the tax order to suppress or reduce a tax, or social contribution and any accessory, through the following conducts: (See Law No. 9,964, of 4.10.2000)
> I - Omitting information, or making a false statement to the tax authorities;
> II - To defraud the tax inspection, inserting inaccurate elements, or omitting an operation of any nature, in a document or book required by the tax law;
> III - falsifying or altering an invoice, invoice, trade bill, bill of sale, or any other document related to the taxable transaction;
> IV - Prepare, distribute, supply, issue or use a document that he/she knows or should know to be false or inaccurate;
> V - Denying or failing to provide, when mandatory, an invoice or equivalent document, related to the sale of goods or provision of services, effectively carried out, or providing it in disagreement with the legislation.
> Penalty - imprisonment from 2 (two) to 5 (five) years, and fine.
> Sole Paragraph. Failure to comply with the authority's requirement, within ten (10) days, which may be converted into hours due to the greater or lesser complexity of the matter or the difficulty in complying with the requirement, characterizes the infraction provided for in item V.

The company that decides to omit information in order to obtain insertion or reduction in the payment of its taxes, is committing a serious crime. This act, considered selfish, not only influences the company that commits the crime, but also negatively influences the economy and development of the country (SILVA, 2014, p. 58).

RESEARCH METHODOLOGY

Research is a systematic and rational method, which aims to search for answers to a proposed problem. The methodologies used in this work were descriptive and bibliographic research. According to Vergara (2000), descriptive research aims to expose the characteristics of a given population or phenomenon, establishing correlations between variables that define its nature. This research method is not committed to explaining the researched phenomena, even if its data provide a basis for such an explanation.

According to Castro (1976, p. 66):

> When it is said that a research is descriptive, it is meant that it is limited to a pure and simple description of each of the variables, in isolation, without their association or interaction with the others being examined.

According to Ferrão (2012), the bibliographic research is based on the consultation of secondary sources, related to the theme chosen to be addressed in the work. The scientific article by the authors Dumer et al. (2016) was essential for the development of the questionnaire used in this work. Through this questionnaire it was possible to gather data on the main theme addressed.

The data collected from 33 managers of micro and small companies made it possible to identify and analyze the main factors that motivate the managers of organizations in the city of Vitória/ES, to non-compliance with tax obligations. For this purpose, a survey was made available in March 2023, where the target audience in question was micro and small companies located in the Greater São Pedro region in Vitória/ES.

Therefore, through the application of the questionnaire, it was possible to acquire compelling information that corroborated the bibliographic research exposed, giving the work veracity and credibility in its study.

RESULTS AND DISCUSSION

COMPANY PROFILE

Table 1 below shows the profile of the companies in the sample. In table *A* we can analyze the size of the companies through the number of employees; in table *B* we can identify the characteristics of the companies; and in table *C* we observe the tax modality of each company that participated in the survey.

Table 1 - PROFILE OF THE COMPANIES

Table A – Company Size (No. of Employees)

PROFILE	FREQUENCY	Percentage %
0-4	14	42,40%
5-9	2	6,10%
1-10	2	6,10%
10-19	10	30,30%
20-24	1	3,0%
50-54	1	3,0%
Over 55	3	9,10%
Total	33	100%

Table B – Business characteristics

PROFILE	FREQUENCY	Percentage %
Sole proprietor	9	27,30%
One of the owners	7	21,20%
Contract Employee	17	51,50%
Total	33	100%

Table C – Tax Modality

PROFILE	FREQUENCY	Percentage %
MAY	5	15,20%
Simples Nacional	15	45,50%

Presumed Profit	1	3%
Real Profit	7	21,20%
They don't know	5	15,20%
Total	33	100%

Source: Prepared by the authors.

When analyzing the results regarding the profile of the companies, we observed that most companies are small, due to the staff having between 0 and 4 employees, a percentage of 42.40%. We can identify in the survey that 17 of the 33 participants are hired employees, representing 51.50% of the sample, while 9 of the 33 are the sole owners. In Table *C*, we analyze that the Simples Nacional regime is the predominant tax modality, represented by 45.50% of the data collected in the sample, where 15 of the 33 companies belong to this tax regime.

PROFILE OF MANAGERS

Table 2 refers to the profile of the managers who participated in the research. It was found that in Table *A*, the predominant gender in the sample was male, where the percentage represented 51.50%, with 17 being the number of frequencies. In Table *B* , the age group with the highest response rate is between 22 and 35 years old, with 54.50% of the answers, 27.30% with ages over 35 years and over 50 years old with 18.20%. In Table C, level of education, we can identify that the highlighted sample with 45.50% was represented by the option of complete graduation, and the second most selected option was complete high school with 33.30%.

Table 2 - PROFILE OF MANAGERS

Table A - Gender

PROFILE	FREQUENCY	Percentage %
Female	16	48,50%
Male	17	51,50%
Other	-	-
Total	33	100%

Table B – Age group

PROFILE	FREQUENCY	Percentage %
From 22 to 35 years old	18	54,50%
From 36 to 50 years old	9	27,30%
From 51 to 65 years old	6	18,20%
Total	33	100%

Table C – Education

PROFILE	FREQUENCY	Percentage %
Complete Fundamental	5	15,20%
High School	11	33,30%
Complete graduation	15	45,50%
Postgraduate studies	2	6,10%

Total	33	100%

Source: Prepared by the authors.

Analyzing the results, we can identify the profile of the managers who were interviewed. The predominant gender was represented by males with 51.50%, the age group between 22 and 35 years, with 54.50%. As for the level of education, we can observe that 45.40%, almost half of the participants have completed higher education, so many managers have in-depth knowledge of their profession, or at least sought to acquire knowledge higher than the last stage of basic training.

RESULTS ON NON-COMPLIANCE WITH FISCAL AND TAX OBLIGATIONS

The tables below show the results obtained through an "online" form, the answer to the research problem: what are the main factors that motivate the managers of organizations in the city of Vitória/ES to not comply with tax obligations?

Failure to comply with tax and tax obligations

Table 3 shows the managers' view in relation to non-compliance with tax obligations. It is noted that the affirmative answer to Table *A* obtained a result above the average with 72.70%. 24 of the managers are aware of the tax obligations of the State of Espírito Santo that guide their companies, and 27.30% do not know about these obligations.

Table 3 – Non-compliance with fiscal and tax obligations

Table A - Am I aware of the tax obligations of the state of ES?

-	FREQUENCY	Percentage %
Yes	24	72,70%
No	9	27,30%
Total	33	100%

Table B – Do I comply with the tax obligations established by the state of ES? Sending of tax files.

-	FREQUENCY	Percentage %
Yes	14	42,40%
No	19	57,60%
Total	33	100%

Table C – Do I comply with the tax obligations (payment of taxes) of the state of ES?

-	FREQUENCY	Percentage %
Yes	12	36,37%
No	21	63,63%
Total	33	100%

Source: Prepared by the authors.

In Table *B*, we can identify that not all managers comply with their tax obligations, even if they are aware of them (Table *A*). 57.60% do not comply with their tax obligations

(sending files), however, only 27.30% are unaware of the tax obligations of the state of Espírito Santo. Analyzing Tables *A* and *B,* we found that 30.30% of managers purposely fail to comply with their obligations. This non-compliance with tax obligations also reaches the payment of taxes (Table *C*). About 63.63% of managers say that they do not collect taxes for their company.

Payment of taxes

Table 4 shows the managers' perception of tax collection. We noticed that in Table *A*, 60.60% of the managers agree that they have to pay less taxes to obtain more profit on their sales. 48.50% of the managers also say that they should pay less taxes, as they are unaware of the functions of government agencies in relation to society (Table *B*). This means that more than half of the managers (51.50%) know the role of the State in society, so this is not a reason for non-compliance with fiscal and tax obligations.

Table 4 – Tax payments

Table A – Should my company pay few taxes, in order to obtain more profits?

-	FREQUENCY	Percentage %
Yes	20	60,60%
No	13	39,40%
Total	33	100%

Table B – Should my company pay few taxes, because I do not know the functions of the government (federal, state or municipal), as a leader of the society?

-	FREQUENCY	Percentage %
Yes	16	48,50%
No	17	51,50%
Total	33	100%

Table C – Should my company pay few taxes because the Government inspection agencies do not have real knowledge of the total sales, purchases, profit, expenses or the total inventory?

-	FREQUENCY	Percentage %
Yes	19	57,60%
No	14	42,40%
Total	33	100%

Table D – Should entrepreneurs in Vitória pay as little taxes as possible, even if they use methods WITHIN the law?

-	FREQUENCY	Percentage %
Yes	30	90,90%
No	3	9,10%
Total	33	100%

Table E – Should entrepreneurs in Vitória pay as little taxes as possible, even if they use methods OUTSIDE the law?

-	FREQUENCY	Percentage %
Yes	5	15,20%
No	28	84,80%
Total	33	100%

Source: Prepared by the authors.

In Table 4, it was evident that the main reason for non-compliance with fiscal and tax obligations is directly linked to the high tax burden and the requirements exposed by the State. Managers have been looking for ways to reduce their taxes through the non-delivery of tax documents, the non-payment of their taxes and the methods provided within or even outside the law. 57.60% of managers say they should pay less taxes, because the government has no way of knowing exactly how much the company sells, buys, has in expenses, inventory and how much it actually profits (Table *c*). For this reason, most managers (90.90%) use methods in the law to benefit from the collection of taxes and 15.20% say that despite using methods in the law, they also use means outside the law, to further reduce their taxes.

FINAL CONSIDERATIONS

This article aimed to identify the main factors that motivate the managers of organizations in the city of Vitória/ES to not comply with their tax obligations. For this, it was necessary to identify the profile of the companies, managers and analyze the motivation for non-compliance with tax obligations. The work in question began from the need to understand the reason why companies in Vitória/ES, take the risk before the government when they evade their taxes. Managers choose to use illicit means in their management, with the motivation of significantly reducing their tax expenses, in order to increase their profits.

The study was developed through a questionnaire made available on an online platform, aimed at managers of micro and small for-profit companies in the city of Vitória/ES. The results obtained allow considerable observations to be made on the samples collected.

With this, we can conclude that the managers participating in this research are employees hired by the companies (51.50%), where their level of education is complete graduation (45.50%). The companies have an average of 0 to 19 employees (0 to 4 42.40% and 10 to 19 30.30%), and 15 out of 33 companies are opting for Simples Nacional (45.50%), while 7 out of 33 are from Lucro Real (21.20%).

About 57.60% of managers say they should pay less taxes, because the government does not have real knowledge about the purchase, sale and expense operations that occur in companies. For this reason, approximately 90.90% of managers seek methods in the law to reduce the amount of taxes, while 15.20% say that despite using methods in the law, they also seek means outside the law that benefit even more in the reduction of their taxes.

Based on this information, we can indicate that the main reason for non-compliance with tax obligations is related to the high tax burden and the low level of tax return for society. For this reason, managers seek, through their knowledge, to develop strategies that result in the reduction of their taxes.

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PHYSICOCHEMICAL AND SENSORY CHARACTERIZATION OF CREAM CRAKER BISCUITS MADE WITH CHICKPEA FLOUR

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ABSTRACT

Chickpeas are a legume of the Fabaceae family, a source of proteins, lipids and carbohydrates, especially long-chain ones such as oligo and polysaccharides. Chickpea flour is considered nutritionally superior compared to refined wheat flour, showing itself to be an abundant source of protein. The use of mixed flours aims to partially replace wheat flour, aiming to improve the nutritional quality of food products and to meet the need of consumers for diversified products. The biscuits were made by mixing chickpea flour with wheat flour, in the proportions of 0%, 10%, 20%, 30% and 40% and other ingredients. Chickpea flour showed high levels of proteins, lipids and fibers, suggesting a high nutritional profile. The sensory analysis revealed that the color, aroma, and flavor attributes of the cookies were well evaluated, remaining within the hedonic preferences of "slightly liked" to "liked very much". Formulations with up to 40% added chickpea flour showed promising results in terms of texture and flavor, indicating a good receptivity on the part of consumers. The production of cream craker with chickpea flour can offer the food industry an opportunity to provide healthy and nutritious products.

Keywords: *Cicer arietinum L.* Mixed flour. Nutritional benefit. Salty biscuit. New products.

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INTRODUCTION

Chickpea (Cicer arietinum L.) is a legume of the Fabaceae family, originally from Asia Minor, from where it spread to several continents in antiquity. The grain ranks third in world grain production among the most important pulses (legumes with edible dry seeds) in the world, along with beans and peas (FAO, 2017). This grain is a source of proteins, lipids, and carbohydrates, especially long-chain ones such as oligo and polysaccharides, which metabolize more slowly in the body, having simple sugars such as glucose and sucrose in smaller proportions (Trindade, 2019).

Chickpeas have a great nutritional potential to be explored in order to minimize protein and mineral deficiencies in the population since in addition to the high protein content it is also a source of minerals such as P, Mg, Fe, K, Co and Mn) (Carneiro et al., 2017). The inclusion of legumes in the daily life of the population has beneficial physiological effects for the control and prevention of metabolic diseases such as diabetes mellitus, heart disease, and colon cancer (Kohajdová; Karovičová; Magala, 2011).

The approximate composition of chickpeas (g/100 g) can vary from 1.12 to 6.80 of lipids, 18.3 to 25.2 of proteins, 1.23 to 1.38 of soluble fiber, 14.1 to 23.2 of insoluble fiber, and 2.54 to 3.90 of total ash (Camargo et al., 2019).

Chickpea flour is considered nutritionally superior compared to refined wheat flour, showing itself to be an abundant source of protein of approximately (24.4% –25.4%) corresponding to twice that found in wheat flour (9.3% –14.3%) (Dandachy; Mawlawi; Obeid, 2019). Fernandes (2019), cited by Marques (2022), evaluating the characteristics of chickpea flour in his research, found that this flour has technological properties that demonstrate affinity with oil, water, and milk, which enables its use in formulations for various food products.

Studies show that the use of chickpea flour alone or associated with flours from other vegetable sources in the composition of bakery products is quite convenient (Arruda; Seville; Almeida, 2016). Mixed flours or flours composed of cereals, legumes and tubers have emerged on the market, in order to replace wheat flour in proportions for the production of baked goods without compromising the technological and sensory characteristics of the product (Cavallini et al., 2020) The intention of product enrichment is to improve the nutritional quality of food and human life, since the Brazilian population suffers from protein and mineral deficiencies.

It is also interesting the use of chickpea flour in the development of gluten-free food products, due to its functional properties of emulsification, foaming, gelling, high water and oil absorption capacity, and viscosity (Azeredo, 2022).

Thus, this work aimed to develop and characterize the physicochemical, nutritional and sensory properties of cream cracker cookies, made from chickpea flour, aiming at nutritional improvement and good sensory acceptance by the consuming public and diversifying eating habits.

THEORETICAL FRAMEWORK

Bakery products are foods that are widely consumed and known globally, and are considered a good source of nutrients and energy for the population (Cavallini et al., 2020). According to Lampignano et al. (2013) cited by Cavallini et al. (2020), the main ingredients used for the manufacture of bakery products are wheat flour, water, salt, and yeast. As essential components, wheat flour and water stand out, and the others can be added, such as: lipids, sugars, yeast, eggs, milk, flavorings and colorings, which will give the characteristics of the various types of product.

According to Oliveira, Pirozi and Borges (2008), the use of mixed flours aims to partially replace wheat flour, aiming to improve the nutritional quality of food products and to meet the need of consumers for diversified products. Until the 60s, the use of mixed flours had the objective of partially replacing wheat flour to reduce imports of this cereal (Arruda; Seville; Almeida, 2016).

Moraes and Teixeira (2021) reported that increased consumer awareness for a healthier dietary change encouraged the emergence of this new product niche, where even consumers who are not sensitive to gluten consider these foods to be of superior quality and healthier than those made of traditional wheat flour.

As stated by Azeredo (2022), the technique of replacing wheat flour constitutes a technological challenge in the production of bakery products, due to its rheological properties, since gluten plays a crucial role in the quality of the processing and the final product. These problems can be solved by using other types of combined flours, in order to adjust the specific characteristics in the desired formulation.

According to research by Cravo et al., (2023) chickpea flour is a potential ingredient for use in the development of a wide variety of gluten-free food products, due to its functional properties of emulsification, foaming, gelling, high water and oil absorption capacity, and viscosity.

Jacomelli (2021) in a research of biscuits with percentages of wheat flour and chickpea flour found satisfactory results for percentages of up to 30% of chickpea flour because they increased the nutritional parameters, without many differences from the standard sample. Cravo and Maradini Filho (2022) in a research with muffins made with

different percentages of wheat flour and chickpea flour found an increase in protein and lipid values and a decrease in carbohydrates among the formulations with a higher percentage of chickpea flour, providing better nutritional quality and, in relation to sensory analysis, the results showed that the use of chickpea flour in the preparation of muffins is viable, for providing satisfactory sensory scores for most of the formulations tested.

According to studies carried out by other researchers, it is noted that the application of chickpea flour is increasingly present in the preparation of food products, presenting satisfactory results in replacing traditional flours, providing a wider range of bakery products for the diet of celiac people and for the vegan market that seeks a healthy diet through products of vegetable origin (Kanai, 2021).

In addition, it is crucial to examine the influence of different concentrations of this flour on the composition of bakery products, aiming to achieve optimal nutritional, sensory, and technological characteristics. Thus, the production of cream cracker cookies with chickpea flour can offer the food industry an opportunity to provide healthy and nutritious products, responding to the growing demand for functional and alternative foods.

MATERIAL AND METHODS

This work was developed at the Laboratories of Food Technology (LPA), Food Chemistry, Unit Operations and Sensory Analysis, of the Department of Food Engineering (CCAE/UFES) and at the Laboratory of Nutrition and Dietetics of the Department of Pharmacy and Nutrition (CCENS/UFES). Chickpeas (Cicer arietinum L.), wheat flour and other ingredients (margarine, sugar, salt, yeast and milk) purchased in the local commerce of the city of Alegre-ES were used.

OBTAINING CHICKPEA FLOUR

The flour was obtained by grinding the grains using a knife mill with a 0.50 mm mesh sieve, to obtain a fine flour, which was properly stored in 500 g plastic bags, vacuum-sealed and stored at room temperature (25 ºC) away from light and humidity until its use.

PHYSICOCHEMICAL CHARACTERIZATION OF CHICKPEA FLOUR

The chemical characterization of chickpea flour was carried out for water, ash, protein, lipid, crude fiber and carbohydrate content. The water content was determined by gravimetry after drying the sample in an oven at 105 °C (IAL, 2005). The ashes were quantified by gravimetry after complete incineration of the sample in muffle furnace at 550 ºC (IAL, 2005). The lipid content was determined in an intermittent Soxhlet extractor, using

petroleum ether as a solvent (IAL, 2005). The total nitrogen content was determined by the modified Kjeldahl method, using a nitrogen digester and distiller system and multiplication factor of 6.25 for protein quantification (IAL, 2005). Crude fiber was quantified according to method 044/IV (IAL, 2005), based on acid digestion of the sample. Carbohydrates were determined by the difference method (Souci; Fachman; Kraut, 2000).

The granulometry of chickpea flour was determined according to methodology No. 66-20 adapted from the American Association of Cereal Chemists, for 100 g of sample (AACC, 1995). A set of sieves with (30, 40, 50 and 60) meshes, equivalent to (0.595, 0.420, 0.297 and 0.250) mm, was subjected to vibrating action for a period of 10 minutes. Then, each fraction was weighed separately and the results expressed as a percentage of material retained in each sieve.

To determine the pH, a solution was prepared with 5 g of flour sample in 50 mL of distilled water, which was stirred for 10 minutes in a magnetic stirrer. Next, the pH of the supernatant liquid was directly read using a digital pH meter (IAL, 2005).

After pH determination, the same solution was used to determine titratable acidity, adding 2 to 4 drops of phenolphthalein solution and titrating with 0.1 M sodium hydroxide solution, until pink color (IAL, 2005).

Flour color was measured by the CIEL*a*b* system, in colorimeter (Konica – Minolta CM-5). The coordinates analyzed were: L* or luminosity (black-0/white-100), a* (green -/red +) and b* (blue -/yellow +) (HUNTERLAB, 2013).

FORMULATION OF CREAM CRAKER COOKIES

The cookies were made from the mixture of wheat flour with chickpea flour in the proportions of 0%, 10%, 20%, 30% and 40%, in addition to margarine, sugar, salt, yeast and milk, after preliminary tests to define the best formulation.

DETERMINATION OF THE CHEMICAL COMPOSITION OF CREAM CRAKER COOKIES

The determinations of water content (method 012/IV), lipids (method 032/IV) and ash (method 018/IV) were carried out in the ready-to-eat biscuits, according to the methodology proposed by the Adolfo Lutz Institute (IAL, 2005).

ANALYSIS OF THE COLOR OF CREAM CRACKER COOKIES

The color of the cream craker cookies was measured by the CIEL*a*b* system, in colorimeter (Konica – Minolta CM-5). The coordinates analyzed were: L* or luminosity (black-0/white-100), a* (green -/red +) and b* (blue -/yellow +) (HUNTERLAB, 2013). The

overall color difference between the cream crakers of each of the formulations was also calculated, compared to the standard cream craker (100% wheat flour) by the parameter ΔE*, according to equation 1:

$$\Delta E* = \sqrt{(\Delta a*^2 + \Delta b*^2 + \Delta L*^2)} \quad (1)$$

ANALYSIS OF THE INSTRUMENTAL TEXTURE OF CREAM CRACKER COOKIES

The instrumental texture properties of the cream crakers were evaluated using the Brookfield® Texture Analyzer (Model CT3), according to the methodology used by Mareti, Grossmann and Benassi (2010). Each sample of cream craker was arranged horizontally on a platform and cut in half with an HDP/BSK knife-type probe, blade set with knife, with pre-test, test and post-test speeds of 5.0 mm/s, trigger force of 0.20 N and 5.0 mm distance, recording the breaking or breaking force (hardness). Three determinations were made for each formulation of cream craker, in randomly selected samples. The samples were analyzed at room temperature (25 ºC) and the texture parameters determined were: hardness, fracturingability, elasticity, adhesiveness and chewiness. Data collection was performed with the aid of the Texture Pro CT V 1.4 Build 17 software.

DETERMINATION OF APPARENT AND SPECIFIC VOLUME OF CREAM CRACKER COOKIES

The apparent volume, in cm3, was determined by the method of displacement of millet seeds after cooling the roasted cream craker (El-Dash; Camargo; Diaz, 1982). The specific volume was calculated by dividing the apparent volume found for the cream craker (cm3) by its mass (g) (El-Dash; Camargo; Diaz, 1982).

PHYSICAL ANALYSIS OF SPREADING THE CREAM CRACKER COOKIES

The spread test was performed according to the AACC 10-50-05 methodology, a modified "Cookie Spread Test", in which six randomly selected cream craker cookies were stacked and aligned to remove the means of thickness (E) and length (C), and then the scattering factor (C/E) WAS CALCULATED (AACC, 1995).

SENSORY EVALUATION OF CREAM CRAKER COOKIES

The sensory analysis of the cream craker was performed through the acceptance test, according to Reis and Minim (2010). Each sample was tested by a group of 100 untrained evaluators, who wrote down on a card the impression that the product, as a

whole, caused them. For this test, a 9-point hedonic scale was used (9 = extremely liked, 5 = indifferent, 1 = extremely disliked). The numerical values obtained were statistically analyzed. Cream craker samples coded with three-digit numbers were served randomly and monodicly in individual booths in the Food Sensory Analysis Laboratory and accompanied by mineral water at room temperature to clean the palate between evaluations.

In the sensory acceptance analysis form applied to the evaluators, the purchase intention test (IAL, 2005 – nº 167/IV) was also presented, in which the evaluators evaluated whether they would "certainly buy the product" (5), "possibly buy the product" (4), "perhaps buy or perhaps not buy" (3), "possibly not buy the product" (2) and "certainly would not buy the product" (1).

This research was approved, according to Opinion No. 6.194.213, by the Ethics Committee of the Alegre-ES Campus, of the Federal University of Espírito Santo, regarding ethical care for consumption by human beings. The evaluators adhered to the sensory analysis by signing the Informed Consent Form.

EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS OF DATA

To determine the physicochemical characteristics of chickpea flour, the results were analyzed by means of descriptive statistics, obtaining the mean and standard deviation for each analysis in triplicate.

To compare the effect of the different levels of chickpea flour in relation to the physical and physicochemical characteristics of the cream craker biscuits, the experiment was conducted in a completely randomized design, with five levels of chickpea flour concentration (0%, 10%, 20%, 30% and 40%) and three replications, totaling 15 experimental units. The means of the results of the analyses were statistically analyzed by means of Analysis of Variance (ANOVA) and comparison of means, adopting a significance level of 5% of probability.

The analyses of sensory acceptance and purchase intention of the cream crakers were carried out using a randomized block design with 100 evaluators, and the data obtained were analyzed through Analysis of Variance and test of means, adopting a significance level of 5% probability (Reis; Minim, 2010). Statistical analyses were performed with the aid of the GENES program (Cruz, 2006).

RESULTS AND DISCUSSION

PHYSICOCHEMICAL ANALYSIS OF CHICKPEA FLOUR

Table 1 shows that chickpea flour had a percentage of 89% of particles with granulometry between 0.600 and 0.300 mm in diameter, which can be considered a coarse flour, but did not compromise the stages of biscuit preparation.

Table 1 - Granulometry of chickpea flour:

	Opening the sieve				
	0.600 mm	0.425 mm	0.300 mm	0.250 mm	< 0.250 mm
%	58,90	16,24	14,23	6,86	0,87

Source: Production by the authors themselves (2024).

According to MAPA's Normative Instruction No. 08 of June 3, 2005, 95% of wheat flour must pass through a 0.250 mm particle size sieve (Brasil, 2005). However, ANVISA's RDC No. 711, of July 1, 2022, does not determine any specific particle size for flours in general (Brasil, 2022).

The results obtained in relation to the physicochemical composition of chickpea flour are presented in Table 2.

Table 2 - Proximate composition and physicochemical characteristics of chickpea flour

Parameters	Mean ± standard deviation*	
	boo**	Bs**
Water content (g/100)	11.62 ± 0.04	--------
Proteins (g/100)	22.89 ± 0.06	25.90 ± 0.07
Lipids (g/100)	10.15 ± 0.71	11.49 ± 0.80
Ashes (g/100)	3.04 ± 0.03	3.44 ± 0.03
Fibers (g/100)	35.16 ± 3.56	39.79 ± 4.02
Carbohydrates (g/100)	17.14 ± 4.37	19.38 ± 3.92
ph***	6.43 ± 0.01	
Acidity (mL NaOH/100g)	8.25 ± 0.67	
L*	87.16 ± 0.17	
the*	2.01 ± 0.13	
b*	20.14 ± 0.37	

*Average of three repetitions; **bu = wet base; bs = dry basis; pH = dimensionless.
Source: Production by the authors themselves (2024).

Based on the legislation in force in Brazil for flours, cereal starch and bran, RDC No. 711/2022 (Brazil, 2022), the maximum moisture content allowed for flours is 15%. The chickpea flour analyzed had an average water content of 11.62%, being within the specific legislation.

The average protein content of chickpea flour was 25.90 g/100 g on a dry basis. Fernandes et al. (2022) analyzed the proximal composition of chickpea flour and obtained a protein content of 15.74 g/100 g (bs), a value lower than that found in this study. In another

study, Kanai (2021), obtained a protein content of 18.99 g/100 g (bs), a value also below this study.

The mean lipid value found was 11.49 g/100 g (bs), which is higher than that found by Kanai (2021), of 5.34 g/100 g (bs) and Fernandes et al. (2022) of 1.90 g/100 g (bs).

The average ash found in chickpea flour was 3.44 g/100 g (bs). The mean ash found by Fernandes et al. (2022) was 2.66 g/100 g (bs), a value lower than that found in this study. On the other hand, Kanai (2021) obtained 3.30 g/100 g (bs), a value closer to the present study.

In this study, a value of 39.79 g/100 g of fiber (bs) was found, which is higher than that found by Fernandes et al. (2022), of 10.18 g/100 g (bs), and Kanai (2021) of 16.85 g/100 g (bs).

The mean pH value of chickpea flour was 6.43. Ladjal and Chibane (2015) obtained a pH value of 6.41 in their study, which is almost identical in both studies. The acidity found was 8.25. Ladjal and Chibane (2015) found an acidity value of 4.17, a value lower than that found in this work.

Regarding color, the flour in this study was subjected to instrumental color measurements, with mean luminosity values (L*) of 87.16, a* of 2.01 and b* 20.14, close to the values observed by Sofi et al. (2023), who obtained L* of 83.3 to 87.0, a* of 1.3 to 2.5 and b* of 13.7 to 18.6, indicating that it is a flour with a light hue and color tending to yellow (b*+) reddish (a*+).

ANALYSIS OF THE CHEMICAL COMPOSITION OF BISCUITS

Table 3 presents the results of the analyses of the chemical composition of the cream cracks of the different treatments.

Table 3 – Results of the moisture, ash and lipid analyses of the biscuits on a dry basis (g.100 g^{-1})

Treatments	Water Content (bu)	Lipids (bs)	Ashes (bs)
F0	9.75 c	9.44 c	3.47 b
F10	10.30 to	9.71 c	3.87 abs
F20	9.61 c	11.16 to	3.94 abs
F30	9.68 c	10.23 BC	4.11 AB
F40	9.95 b	11.08 abs	4.58 to

*Average of three repetitions; bu = wet base; bs = dry basis. F0=100% wheat flour; F10=10% chickpea flour; F20=20% chickpea flour; F30=30% chickpea flour; F40=40% chickpea flour.
Means followed by the same letter in the columns did not differ statistically from each other according to Tukey's test, at a significance level of 5% ($p > 0.05$).
Source: Production by the authors themselves (2024).

It was observed that there was a significant difference ($p \leq 0.05$) for the water content, except between the formulations F0, F20 and F30, ranging from 9.61% (F20) to

10.30% (F10). Compared to the study by Junior, Menezes and Nascimento (2021) with biscuits enriched with cassava starch, the results differed greatly, ranging from 2.11 to 2.35; compared to the work of Cravo and Maradini Filho (2024) they also differed, ranging from 4.72 to 5.87%. However, the values found in the present study still provide microbiological stability to the cookies.

For the lipid content, a significant difference was observed by Tukey's test ($p \leq 0.05$) between the formulations, except for the F0 and F10 treatments, ranging from 9.44% (F0) and 11.16% (F20). It was expected to obtain increasing values of the lipid content of the biscuits with the increase in the amount of chickpea flour in the formulations, since chickpea flour has a higher lipid content than wheat flour.

In relation to the ashes, there was also a significant difference ($p \leq 0.05$) only between the F0 and F40 treatments, ranging from 3.47% (F0) to 4.58% (F40).

ANALYSIS OF THE COLOR, TEXTURE AND SPREADING FACTOR OF THE BISCUITS

The results of the analysis of the parameters of color, texture, specific volume and scattering factor of the biscuits are presented in Table 4. It was observed that there was a significant difference ($p \leq 0.05$) between the mean values of the treatments only for the parameters of fracturtability and scattering factor of the biscuits.

Table 4 – Results of the analysis of the parameters of color, texture, specific volume and spreading factor of the biscuits.

Treatments	L*	the*	b*	ΔE*	Hardness (N)	Fractureb. (N)	Spec Vol. (cm^3/g)	Factor Spread. C/E
F0	66.86a	8.61a	29.36 a	----	68.18a	63.32a	6.66a	8.17 cd
F10	67.18a	7.20A	28.63 a	4.16a	65.99a	44.40ab	6.84a	7.77d
F20	68.87a	7.18a	28.36 a	2.81a	78.08a	49.37ab	6.07a	8.90 b
F30	71.45a	6.81a	29.02 a	5.24a	43.10a	15.92 b	6.00A	8.82 bc
F40	68.50a	7.01a	28.86 a	3.32a	65.97a	60.40a	7.22a	9.88 to

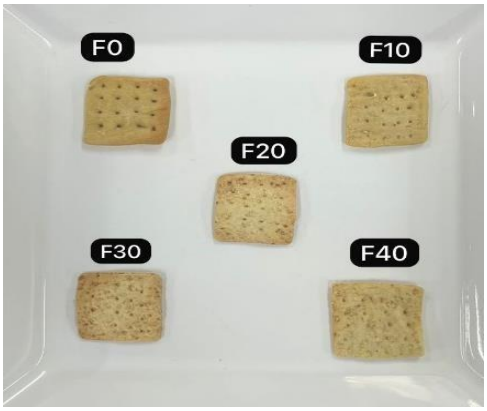
Means followed by the same letter in the columns did not differ statistically from each other according to Tukey's test, at a significance level of 5% ($p > 0.05$).

Source: Production by the authors themselves (2024).

In this study, there was no significant difference ($p \leq 0.05$) between the means of the treatments for the color parameters L* (66.86 to 68.87), a* (6.81 to 8.61) and b* (28.36 to 29.36), indicating that all cookies had a slightly dark color, tending to a reddish yellow, as can be seen in Figure 1. The global color difference (ΔE*) quantifies how much a sample deviates from the standard sample in terms of color perception, that is, how noticeable this

difference is to human eyes (Ramos; Gomide, 2007). According to the classification provided by Konica Minolta, a color difference (ΔE*) ranging from 3 to 6 is considered easily perceptible by consumers (Evangelista et al., 2011), which does not happen in the present study, as shown in Figure 1.

Figure 1 – Image of *cream crackers* made with different percentages of replacement of wheat flour by chickpea flour.



Source: Production by the authors themselves (2024).

It was observed that there was a significant difference ($p \leq 0.05$) between the mean values of the treatments for the fracturability parameter of the biscuits. The formulation with the addition of 30% chickpea flour (F30) differed statistically from the standard formulations (F0) and with the addition of 40% chickpea flour (F40), showing that the biscuits of the F30 formulation were more fragile (crunchy) when compared to the biscuits of the F0 and F40 formulations, but did not differ in relation to the F10 and F20 formulations. However, the formulation (F40) did not differ from the standard formulation (F0) and, therefore, we can infer that the addition of up to 40% chickpea flour did not significantly alter the texture properties of the biscuits. In the work by Cravo and Maradini Filho (2024) with cookie-type cookies, unlike this study, fracturing did not differ statistically, but Jacomelli (2021) observed significant differences only from the addition of 45% chickpea flour to the cookies, so up to 30% there was no statistical difference, thus defining that up to this percentage the cookies were less fragile than with 45% and 60%.

Regarding the spreading factor of the biscuits, it was found that the treatments F0 (control) and F10 presented the lowest values, while the treatment F40 presented the highest value, indicating that from the addition of 20% of chickpea flour, the biscuits presented a higher spreading factor in relation to the biscuit made only with wheat flour, mainly due to the decrease in height in relation to length. This behavior indicates that chickpea flour may have interfered in the rheological behavior of the dough, causing it to suffer greater extensibility and less elasticity during processing, due to the decrease in

gluten content and, consequently, the decrease in the strength of wheat flour (Assis et al., 2009). It can be considered that the addition of chickpea flour reduces the viscoelastic network formed by gluten, due to the absence of this protein in this legume. Spreading is an important factor for the purchase of this product, as it influences its appearance, the main attribute observed by consumers. In addition, spreading control is decisive in industrial processing, as it determines whether the product will fit inside its packaging. Biscuits with too high or too low expansion factor cause problems in the industry, resulting in products with too small size or too high weight (Ferreira et al., 2009). In the study by Kanai (2021) there was no statistical difference between the treatments for the spreading factor, as well as in the work by Jacomelli (2021), but in the study by Cravo and Maradini Filho (2024) there was a statistical difference, as well as in the present study.

SENSORY ANALYSIS OF BISCUIT SAMPLES

Table 5 shows the mean scores of the sensory evaluation of the cookies regarding the attributes color, aroma, flavor, texture and overall impression, as well as purchase intention. It was observed that there was a significant difference ($p \leq 0.05$) between the mean values for the sensory attributes aroma, flavor, texture and overall impression and also for the purchase intention. Only the color attribute did not present a statistical difference between the treatments, being between the hedonic terms "moderately liked" and "liked a lot".

Table 5 – Mean scores of sensory acceptance and purchase intention of the samples of biscuits made with chickpea flour

Treatments	Colour	Aroma	Flavor	Texture	Global Impression	Purchase intent
F0	7.2 to	6.4 bc	6.0 b	5.2 b	5.9 b	2.8 b
F10	7.2 to	6.3 c	5.4 c	4.6 b	5.4 b	2.5 b
F20	7.2 to	6.7 ABC	6.5 AB	6.5 to	6.4 to	3.2 to
F30	7.5 to	6.9 to	6.7 to	6.2 A	6.6 to	3.2 to
F40	7.4 to	6.8 abs	6.5 AB	6.6 to	6.5 to	3.4 to

Means followed by the same letter in the columns did not differ statistically from each other according to Tukey's test, at a significance level of 5% ($p > 0.05$).

Source: Production by the authors themselves (2024).

As we can see for the aroma parameter, only treatments F10 and F30 differed statistically ($p < 0.05$), and treatment F10 received the lowest sensory score. Regarding the flavor attribute, there was a significant difference only between the F0, F10 and F30 treatments, with the formulations F20, F30 and F40 as the most accepted, being located between the hedonic terms "I liked it slightly" and "I liked it moderately". Regarding texture, overall impression and purchase intention, the F0 and F10 treatments differed significantly

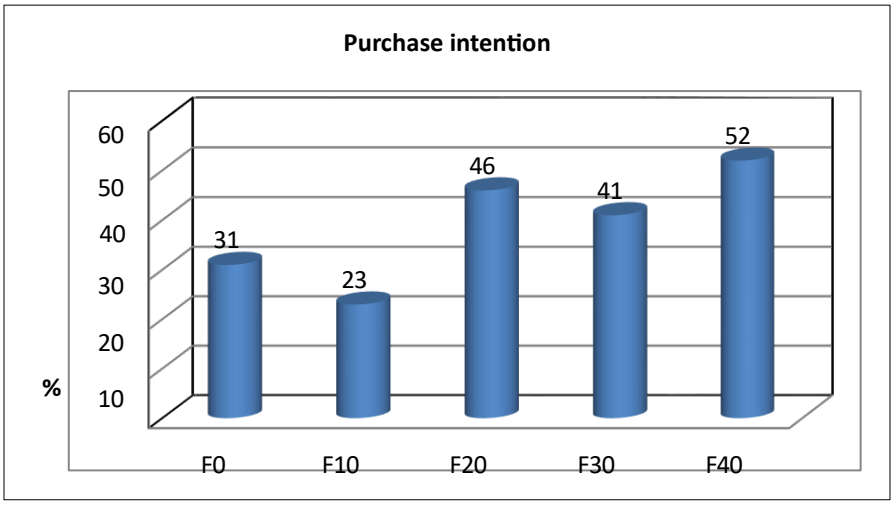
from the F20, F30 and F40 treatments, with higher scores for the treatments with the highest chickpea flour content.

Cravo and Maradini Filho (2024) conducted a research on cookies prepared with different proportions of whole wheat flour and chickpea flour. The sensory analysis indicated that it is feasible to use chickpea flour in the preparation of cookies up to 40% of the addition of chickpea flour because it provides satisfactory sensory scores and good purchase intention for most of the formulations tested. Cravo et al., (2023) worked on the elaboration of muffins with different formulations of wheat flour and chickpea flour, concluding, from the results of the sensory analysis, that it is possible to use chickpea flour in the elaboration of muffins, as no significant differences ($p>0.05$) were found between the treatments F0 (control) to F40 (40% addition of chickpea flour) in the color attributes, aroma, taste and overall impression. The results were between the hedonic categories "I liked it slightly" and "I liked it a lot".

The purchase intention test evaluates the consumer's willingness to purchase a product, using the attributes "would buy" or "would not buy". A structured 5-point scale was used for this evaluation, in which consumers rated their intentions as: "would certainly buy the product" (5), "possibly buy the product" (4), "maybe buy or maybe not buy the product" (3), "possibly would not buy the product" (2) and "certainly would not buy the product" (1).

Regarding purchase intention, it can be observed in Table 5, as well as in Figure 2, that the formulations F20, F30 and F40 obtained the highest scores, being classified as maybe would buy or maybe would not buy the product, while F0 and F10, formulations with the lowest levels of chickpea flour, obtained lower scores classified as possibly would not buy the product.

Figure 2 – Purchase intention chart (class: would certainly buy/possibly buy) for the five formulations of cookies elaborated



Source: Production by the authors themselves (2024).

Therefore, it was observed that the F0 and F10 treatments, standard formulation and with 10% chickpea flour instead of wheat flour, were the least sensorially accepted by the evaluators and showed the lowest percentages of consumers who would certainly/possibly buy the product.

CONCLUSION

The analysis of chickpea flour revealed that this legume has high levels of protein, lipids and fiber, suggesting a good nutritional profile. In addition, color tests indicated that the flour has a light hue, with a tendency toward yellow. Therefore, chickpea flour is an excellent option for the development of food products, meeting the growing demand for functional and healthy foods. This reinforces the importance of research and development of new ingredients that can offer nutritional benefits.

In relation to the biscuits, it was found that the lipid content was higher for the formulations F20, F30 and F40, with a higher amount of chickpea flour as expected, due to the higher amount of lipids present in this flour. The water content of the biscuits was within the established standards for microbiological stability.

The sensory analysis revealed that the color, aroma, and flavor attributes of the cookies were well evaluated, remaining within the hedonic preferences of "slightly liked" to "liked very much". Therefore, chickpea flour can be considered a viable alternative for the development of bakery products with nutritional appeal and differential in the market, evidencing the feasibility of using this flour in the preparation of biscuits, partially replacing wheat flour without compromising the sensory acceptance and technological characteristics of the products. Formulations with up to 40% added chickpea flour showed promising results in terms of texture and flavor, indicating a good receptivity on the part of consumers.

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CONTRIBUTIONS OF CHILDREN'S LITERATURE IN THE LITERACY PROCESS

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ABSTRACT

This article aims to analyze the contributions of Children's Literature to the literacy process, its benefits for the formation of readers and the development of a critical subject. This is a qualitative research, with the foundation of the literature review, bringing references in the areas of literacy and Children's Literature: COELHO, FARIA, FERNANDES, LAJOLO, SILVA, SOARES and ZILBERMAN. The importance of the teacher to stimulate the desire for reading is emphasized, seeking a methodology that favors the process of literacy and literacy, in a precise way, and that triggers the formation of the child's identity. The study about the literacy process and its social aspects, points out as relevant the formation of the teacher as a reading subject and trainer of new readers and the Children's Literature book as a pedagogical resource of this new process that stimulates the contextualization, imagination and creativity of students at the beginning of schooling.

Keywords: Literacy. Development. Reading. Literacy. Children's Literature.

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INTRODUCTION

This research seeks to analyze the contributions of Children's Literature associated with the literacy process, as well as its importance for childhood and in the formation of readers.

The main reason for choosing the theme to be discussed in this project was for personal reasons. Currently, I do not work in the area of school pedagogy, however, when I carried out my face-to-face internship in a school, I enjoyed the opportunity to experience the school routine and the teaching-learning processes.

Literacy and Children's Literature, specifically, enchanted me. I must also mention the classes taught by the professor and advisor of the TCC, Anna Carolina Galhart, in which she provided several options of literature, in this way, she triggered the decisive reasons for the choice.

Together, I must mention my background, which as a child I had no incentive in the field of reading, and today we are faced with how important the transformative role of Children's Literature is, a very powerful tool for understanding the world, which contributes to the information, knowledge and interaction necessary for the act of reading, being able to positively influence social development, child's emotional and cognitive aspects.

And finally, the insertion of the moment of reading delight, within the classroom, awakening the taste for reading, favoring the emergence in the formation of readers, and allows the child to have access to different textual genres, get to know different authors and as the practice is consolidated, it becomes a habit that the reader learns to enjoy and explore for the rest of his life.

In the section that covers the theoretical framework, it is proposed to know the origins of Children's Literature and its historical trajectory.

Next, the importance of working with Children's Literature in the process of literacy and literacy will be presented.

Consequently, the relevance of the teacher's stimulus for the development of reading practice will be discussed.

In the next section, the research methodology will be exposed.

METHODOLOGY

This is a qualitative research. For the elaboration of this study, it was decided to choose the research methodology, the literature review or bibliographic review.

Literature review is the process of searching, analyzing, and describing a body of knowledge, in search of an answer to a specific question. "Literature" covers all relevant

material that is written on a topic: books, periodical articles, newspaper articles, historical records, government reports, theses and dissertations, and other types.

According to Gil (2002), bibliographic research "is developed based on material already prepared, consisting mainly of books and scientific articles" (GIL, 2002, p.44).

The search for studies does not need to exhaust the sources of information. It does not apply sophisticated and exhaustive search strategies. The selection of studies and the interpretation of information may be subject to the subjectivity of the authors. It is suitable for the theoretical foundation of articles, dissertations, theses, course completion works.

In the following section, the theoretical contribution about the contributions of Children's Literature in the literacy process will be presented.

THEORETICAL FRAMEWORK

BRIEF HISTORY OF CHILDREN'S LITERATURE

In this topic, the historical panorama of Children's Literature, in its probable cradle, until its dissemination in Brazil, will be presented in a summarized way.

The history of Children's Literature is linked to the history of the conception of childhood, where the first books for children were produced at the end of the seventeenth century and during the eighteenth century. Children and adults shared the same social events. With the introduction and valorization of a bourgeois family model, the child gains a focus on the reproduction of the class, with a greater interest in his education and in the transmission of bourgeois values.

At this moment, Children's Literature emerged, with the purpose of transmitting the values of this new family model based on a new conception of the child. According to Nelly Novaes Coelho, Children's Literature is:

> Openness to the formation of a new mentality, in addition to being an instrument of emotions, fun or pleasure, played by stories, myths, legends, poems, tales, theater, etc., created by the poetic imagination, at the level of the child's mind, which aims at the integral education of the child, providing him with humanistic education and helping him in the formation of his own style. (COELHO, 1991, p. 5).

Children's Literature is concerned with stories for children, it is the literary form aimed at the child psyche, with vocabulary appropriate to the child's knowledge and understanding, helping in the development of personality, with the intention not only of entertaining and informing, but also of disseminating the experiences of life. Regina Zilberman (1985) points out that through fairy tales, the reuse of myths, fables and folkloric legends or the telling of adventures, the reader recognizes the contour within which he is inserted and with which he shares successes and difficulties.

According to Coelho (1991), Children's Literature actually appears in France in the second half of the eighteenth century, during the absolute monarchy of Louis XIV, the "Sun King", who openly expressed his concern with literature for children and young people. "Tales of Mother Goose" (1691 - 1697) by Charles Perrault, "The Fables" (1668) by La Fontaine, "The Fairy Tales" (8 volumes, 1696 -1699) by Mme D'Aulnoy and "The Adventures of Telemachus" (1699) by Fénelon are the pioneering books of the children's literary world. In this way, it can be said that France, through these great literati, was the cradle of Children's Literature in the world.

Brazilian Children's Literature emerged some time after the beginning of the European one. With the implementation of the Royal Press, in 1808, the first books for children began to be published in Brazil. According to Zilberman and Lajolo (1986):

> [...] the tradition of The Pasmosas Adventures of the Baron of Munchausen and, in 1818, the collection of José Saturnino containing a collection of moral stories relating to the ordinary defects of the tender ages and a dialogue on geography, chronology, the history of Portugal and natural history. (LAJOLO; ZILBERMAM, 1986, p.23).

But these publications, according to the same authors, were sporadic and insufficient to characterize a regular Brazilian literary production for children. It was only after the Proclamation of the Republic that a Brazilian Children's Literature actually began. This phase is represented, in particular, by the translator Carlos Jansen, through the works "Selected Tales of the Thousand and One Nights" (1882), "Robinson Crusoe" (1885), "Gulliver's Travels to Unknown Lands" (1888), and by the adaptor of foreign works Figueiredo Pimentel, where the classic tales of Grimm, Perrault and Andersen were disseminated in "Contos da Carochinha" (1894), "Histórias da Avozinha" (1896) and "Histórias da Baratinha" (1896).

In 1904, Olavo Bilac and Coelho Neto published their "Contos pátrios". In 1907, Júlia Lopes de Almeida launched the "Stories of our land". In 1910, the long narrative appears, "Through Brazil", by Olavo Bilac and Manuel Bonfim. In 1915, the children's library was created in São Paulo by Professor Arnaldo de Oliveira Barreto, which had a collection of about 100 famous books, among them: "Don Quixote", "The Adventures of Gulliver", folk tales and versions by the Brothers Grimm, Perrault de Andersen, and others. In this first moment of Brazilian Children's Literature, there is the appropriation of an ideological educational project, which came from Europe.

At that time, people wrote minimally for children and the few works that existed were separated from children, as ideological literature was valued for them. Patriotism was configured and rooted in the country's political consciousness and Children's Literature

assumed the role of compromising these ideas. The writings of this period made nature and landscape famous, themes inspired by European models.

Zilberman and Lajolo state that "... the extreme appreciation of nature becomes radical in works by authors such as Olavo Bilac, Manuel Bonfim and Coelho Neto" (LAJOLO; ZILBERMAM, 1986, p. 48).

In 1919, Tales de Andrade with the novel "Saudade", transmitting and disseminating the image of a Brazil that finds in agriculture, its cultural, ideological and economic identity, thus ending this first period of our literature aimed at children.

In 1921, Monteiro Lobato published "A menina do Narizinho Arrebitado", a bestseller. When he realizes the need to write stories for children, with a language that interests them, it is with Monteiro Lobato that we will find the new phase of Brazilian Children's Literature, as Nelly Novaes Coelho states, "Monteiro Lobato had the fortune to be, in the area of Children's and Youth Literature, the watershed that separates the Brazil of yesterday and the Brazil of today..." (COELHO, 1991, p. 225).

It is worth noting, with regard to the recognition of important authors in the history of Brazilian Children's Literature, Monteiro Lobato should be mentioned, as well as two essential authors: Ruth Rocha and Marina Colasanti. Ruth Rocha is considered, today, one of the most significant writers in both Children's Literature and Brazilian Youth Literature. Like Rocha, Marina Colasanti is reputed as a fundamental figure in Children's Literature.

Thus, today "Centenary, Brazilian Children's Literature offers the current reader a respectable collection of good works, to be remembered by followers of several generations" (ZILBERMAN, 2005, p. 11).

The historical panorama of Children's Literature was presented in a summarized way. Next, Children's Literature in the process of literacy and literacy and the development of the student will be discussed.

CHILDREN'S LITERATURE IN THE PROCESS OF LITERACY AND LITERACY AND THE DEVELOPMENT OF THE STUDENT

Initially, the concepts of literacy and literacy are discussed, according to Magda Soares (2004), *apud* Fernandes (2019). The word literacy, as well as its concept, is something relatively recent in Brazil. The term was introduced into the language of Education and Linguistic Sciences a little over two decades ago.

Soares (2003) *apud* Fernandes (2019), distinguishes the literacy and literacy process, so that one is not confused with the other, and, mainly, so that the use of the term literacy does not end the specificity of the literacy process:

> Although running the risk of oversimplification, it can be said that insertion in the world of writing occurs through the acquisition of a technology – this is called literacy, and through the development of competencies (skills, knowledge, attitudes) for the effective use of this technology in social practices that involve the written language – this is called literacy (SOARES, 2003, p. 90).

According to Ferreiro; Teberosky, 1999, *apud* Silva, 2021, it is known that school failure does not occur only in the final years of the school day, but even before in the literacy process. Learning to read, understood as questioning the nature, function, and value of this cultural object that is writing, begins much earlier than the school imagines, taking place along unsuspected paths (SILVA, 2021).

Currently, the literacy process encompasses knowing how to read and write and understanding reading and writing practices. It is not enough just to know how to read and write, but to know how to use reading and writing in various social contexts, thus projecting a future of critical and active subjects within a society, offering them the right to go beyond what is seen and what they are shown. Consequently, literacy is to enable literacy contexts by providing critical spaces focused on reading and writing.

In this way, the practices of reading and writing in school need to be reviewed, regarding the training of teachers who work in the formation of future readers and the structure of the school environment for literacy and literacy. Increasing knowledge about Children's Literature in the school environment, its nature, its process and consequence for children's lives, is fundamental to all educators who wish to offer quality education. Within current conceptions, the process of becoming literate is consistent with knowing how to read and write, and understanding reading and writing practices. Literacy is a current concept studied as a social phenomenon in which the new approach to literacy is considered.

Reading is the guiding means of writing, offering subsidies on how to write. It is not a matter of decoding letter by letter, word by word, but of comprehension, in which the meanings begin to be constituted before the actual reading. Forming the competent reader means forming someone who understands what he reads. An efficient reader is one who has a constant practice of reading diversified texts and this work can involve all students, including those who do not know how to read conventionally.

According to Soares, 2011, "There are three main instances of schooling of literature in general, and particularly of children's literature: the school library; the reading and study of literature books, generally determined and guided by teachers [...]" (SOARES, 2011, p. 6).

Reading in school has been a teaching objective. As it is a complex social practice, in order to convert reading into an object of teaching-learning, its nature and complexity must be preserved. The school needs to offer quality materials, proficient reader models, different texts from around the world and effective reading practices. Good readers are not formed by asking for reading in classroom activities or only in the textbook. Without the diversity of reading, one can even teach how to read, competent readers will not be formed.

To learn to read, it is necessary to interact with the diversity of written texts and participate in acts of actual reading. Reading as a social practice is always a means and never an end. Reading is a personal need. A reading action that does not arouse the desire to read is not an efficient pedagogical activity. It is necessary to promote favorable conditions for reading time, such as planning a moment in the library, creating reading corners, making characters from the stories, proposing reading routines, organizing moments of free reading, where the teacher also participates in the reading. It is very important to see your teacher involved at this time, as it will encourage and awaken the desire to do so as well.

With regard to the social issue, social inequality is responsible for interfering in the context of learning. Considering the economic condition, the child from the most favored class is in the process of literacy and literacy even before completing the first year of age, because contact with books and reading is encouraged by parents, who are their first teachers.

At the other extreme, children who come from low-income classes, contact with reading is practically non-existent, considering that in Brazil the culture of obtaining books escapes the family budget, it is also not a very encouraged habit. Thus, the contact with reading and writing in the popular classes ends up starting even only at school and having their teachers as the first reference of reader and writer.

In this topic, the merit of Children's Literature in the process of literacy and development of the student was presented.

In the next section, the results of the search will be presented.

RESULTS

THE RELEVANCE OF THE TEACHER'S STIMULUS FOR THE DEVELOPMENT OF READING PRACTICE

In this section, we will discuss the relevance of the teacher's stimulus for the development of reading practice.

Children's Literature in the process of literacy and literacy has its relevance in the educational and social context, as it involves the formation of the child reader considering the aspects of creation, imagination and production.

Using the Children's Literature book for the literacy and literacy process will not make the pedagogical instrument be used for a moment of leisure, leaving routine pedagogical activities, on the contrary, it will provide a moment of reading knowledge, that is, the interpretation and understanding of the text. The approach to pedagogical work is not only about using the book merely for the production of didactic activities, but providing concrete moments of playfulness in reading and writing, through the reading of a book, much can be explored by the educator and the student.

According to Faria, 2004, the ability of educators to perceive the richness and structure of the Children's Literature book is one of the alternatives to not reduce literature to a merely pedagogical approach. Exploring the children's book, its narrative, its illustrations, its meaning is a resource that must be approached with competence and creativity, the teacher also needs to know how to be a reader.

Teachers must be prepared to form reading subjects, and this means in the daily reading of the literature book, in the collective interpretation, made with students and teacher and in the record, which is the construction of the meaning of the text. The effort to write something that is heard, obviously mediated by the teacher, leads to the understanding of the old and the possibility of creating the new.

The way of working with Children's Literature in the classroom requires an insight of identification under the methodology worked, involving the interpretation of the text, the exploration of the book, the connection of the author and the illustrator with what they intend to convey with the narrated story, stimulating the curiosity of the students and the dialogue about the book read.

For this literary knowledge to be materialized in practice, it is necessary to have a favorable environment that stimulates listeners, the practice of reading and professionals who understand the true meaning of literature, the benefits it will provide, such as stimulation, creativity, improved writing, empathy, ethical attitudes and the development of critical thinking.

According to Galhart, 2013, the driving force for the formation of readers is the *humanizing function* of Literature, proposed by the theorist *Antônio Candido* (1918), in his work *"Literature and the formation of man".* Literature, by its nature, translates man in his essence and influences in a significant way in his formation, performing two essential functions: *the psychological function and the formative function.* The *psychological function*

is linked to a peculiar characteristic of the human being, which refers to the need to transition between the real world and the fictional universe, as something vital to the human being. According to Jung, 2011, *apud* Galhart, 2013, man has a need for escape, and the pages of a work can be an ideal place of refuge.

According to Candido, the reader of a literary work is influenced by the range of information it brings, provoking various reactions that are beyond his control, therefore, this is the reason for the author to expose the *formative function, which* gives literature a formative and educational character.

The point of view of an author, even if implicitly, defended in a work, contributes to new perspectives on reality, and the reader will somehow have a new posture, if not at least questions to be thought about, which had not yet been triggered: literature does not corrupt or edify, it fully humanizes man.

Literature is not learned, it is experienced, it is coexisted, and rehearsing this exchange in a schooled environment is to provide the opportunity for those who do not have access to reading literature, adds Lajolo, 2011, "No one is born knowing how to read, one learns to read as one lives. If reading books is usually learned on the school benches, other readings are learned there, in the so-called school of life [...]" (LAJOLO, 2011, p.07).

In this section, we discussed the relevance of the teacher's stimulus for the development of reading practice. Then, the data presented will be analyzed and discussed.

DATA ANALYSIS AND DISCUSSION

In this section, the data presented in the section that addresses the results will be analyzed.

By briefly knowing the origins of Children's Literature and its historical trajectory, as well as some authors, who are worth mentioning, from the beginning in France, the birthplace, with "the father" of Children's Literature, Charles Perrault, following the Brazilian trajectory that emerged after the European one, highlighting Monteiro Lobato, Ruth Rocha and Marina Colasanti, where everyone was fundamental for the development of the genre, and to analyze facts that were responsible for the changes in society's view of the child at that time, in order to be recognized as a being with characteristics and needs different from the adult, facts that were fundamental for the conception of children today. Children's Literature, by its nature, can act as a device for the processes of literacy and literacy.

According to Soares (2008), literacy is the process by which one acquires mastery of a linguistic code, that is, a set of techniques acquired to exercise the use of reading and writing. Literacy is part of the action of decoding the alphabet and representing the sound

by recognizing its graphic symbol. Therefore, literacy is the result of the action of teaching or learning to read and write. There are several practices, both social and school, that require the use of both, and the permanent use of the skills of reading and writing that the individual will establish with his social environment. Using reading and writing will transform the subject into an asset, conditioning him as a transmitter of various knowledge.

And in the midst of this process, the importance of the teacher is highlighted, who carries the role of mediator, trainer and transformer, through stimuli in the habits and attitudes of the students, empowering them readers, people who can see the world in a different perspective and who are conscious in their actions. The educator needs to be very well prepared to show the way to the world of letters to these beginner beings, the preparation for the discovery of a different world, in the incentive to discover the world with the same curiosity that one has in childhood, at this stage, he needs to find all possible ways to learn to read and write using resources conducive to each profile of the student. To use the children's book as a pedagogical resource is to propose a new sense and meaning within the classroom for the decoding of the linguistic code and to launch oneself from this learning, beyond the limits of the classroom, in favor of literary literacy.

According to Cosson (2009) *apud* Fernandes (2019), literary literacy is the process of appropriation of literature as a language. I use the expression process, because it presupposes the idea of something continuous, in cycles that never close. Thus, Literary Literacy begins in childhood, with the first stories heard and with lullabies and extends throughout life, expanding with each novel book. The term appropriation refers to the act of making something your own, so that it becomes part of your life and thoughts.

For a text to be literary, it depends on literalness, that is, it is part of a special elaboration of language, using elements of fiction and the author's imagination (SOUZA, 1986). This arrangement of Children's Literature enables the little reader to go through the dreamlike universe that Children's Literature is capable of providing.

In this section, the trajectory of Children's Literature, since the classics, the communion between Children's Literature and literacy from the perspective of literacy and literary literacy, respecting literality,

FINAL CONSIDERATIONS

In this research we sought to analyze the contributions of Children's Literature associated with the literacy process, as well as its importance for childhood and in the formation of readers.

The literature review was chosen as a research methodology, based on GIL, as a theoretical contribution.

It was concluded, from COELHO, FARIA, FERNANDES, LAJOLO, SILVA, SOARES and ZILBERMAN, that the history of Children's Literature is linked to the history of the conception of childhood. As for the process of literacy and literacy in the early grades, it is thought to learn to read and write, that is, to decode the linguistic code.

Children are the public that should grow the most for the taste of reading, reading more literature books, because the teacher must be a great encourager, because when Children's Literature is well worked, it helps, not only in the formation of character, but also in the general formation of the child as a critical and well-informed person.

The child who reads acquires more parameters to make comparisons and select the works that seem best to him, both in school situations and in situations of his daily life. Therefore, reading should be seen as an inexhaustible source of research.

The study about the literacy process and its social aspects, points out as relevant the formation of the teacher as a reading subject and trainer of new readers and the Children's Literature book as a pedagogical resource of this new process that stimulates the contextualization, imagination and creativity of students at the beginning of schooling.

In this way, I end the article, leaving this reflection for continuity in studies.

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VETERINARY CARE BASED ON THE USE OF MEDICAL CANNABIS SPP.

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ABSTRACT

Phytotherapy has been present in the daily life of humanity since the dawn of humanity, with several species of medicinal plants that are used for various purposes. However, phytotherapy aimed at veterinary medicine is still little explored, whose basis for treatments is often the transfer of knowledge applied to humans to animals. Plants of the Cannabis genus are known for the richness of cannabinoid compounds, which for some years have been explored for their therapeutic and medicinal properties. The use of Cannabis in

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treatment for animals is an extremely recent subject, in view of the controversial public opinion about plants of this genus. However, studies have revealed specific receptors for cannabinoid compounds in various animal groups, from small invertebrates to large mammals, suggesting that the therapeutic use of Cannabis can be applied to veterinary treatments. The most striking compounds cited in studies focused on cannabis treatments are Cannabidiol (CBD) and Tetrahydrocannabinol (THC), however more than 100 cannabinoid compounds are present that interact with brain receptors and can be explored in research, such as Cannabinol and Cannabigerol. Such receptors are found mainly in the central nervous system in vertebrates and are related to the regulation and maintenance of homeostasis. This chapter discusses the chemical composition, as well as the extraction and purification processes, interaction of cannabinoid compounds with endogenous CNS receptors and cannabis-based pharmaceutical formulations, seeking to contribute with a collection of current information on the use of this controversial plant in herbal treatments for veterinary use.

Keywords: Veterinary medicine. Veterinary treatment. Phytotherapy. Cannabinoids. CNS.

INTRODUCTION

The term phytotherapy is given to the therapy that uses active constituents derived from plants, or the plant itself, which originated in popular knowledge. Phytotherapy in human medicine is currently very widespread, with reports and descriptions of the use of medicinal plants since 200 BC (RODRIGUES; AMARAL, 2012). However, phytotherapy in veterinary treatments is still poorly described and, in general, the substances that are already commonly used in humans are directed to use in animals, without major research specifically focused on veterinary pharmacology (VIDAL; ANGELI, VICTÓRIO, 2023).

The plants commonly known as marijuana of the Cannabis genus, in 2017, were included as a medicinal plant in the list of Brazilian Common Denominations (DCB) through the collegiate board resolution - RDC No. 156, of May 5, 2017. This measure did not change the laws aimed at prohibiting the plant in the country, although it recognizes its medicinal value (LIMA; ALEXANDER; SANTOS, 2021). The active compounds of *Cannabis* are called endocannabinoids and bind to a specific endogenous cell signaling network that is present in various animal groups, from mammals to some invertebrate animals, such as the seahorse and mussel (ELIAM, 2022). Such compounds are membrane phospholipids that bind to the cannabinoid receptors CB1 and CB2, and are related to the regulation and maintenance of homeostasis (SANTOS, 2020; ELIAM, 2022).

Of the endocannabinoid receptors, CB1 is the most abundant, it is found mainly in the central nervous system (CNS), basal ganglia, cerebral cortex, hippocampus, cerebellum, and hypothalamus. CB2 is most commonly found in cells of the immune system (ASCENÇÃO; LESTER; SILVA, 2016). Much of the use of endocannabinoids is used to control pain in diseases such as multiple sclerosis and oncological and neuropathic pain (LIMA; ALEXANDER; SANTOS, 2021). This chapter discusses, through the bibliographic review of the medicinal use of *Cannabis*, the possibilities of using this controversial plant in veterinary treatments.

Figure 1 - Specimen of *Cannabis sativa* showing female flowering.



Cast Iron: WAITE (2022).

CHEMICAL COMPOSITION OF CANNABIS

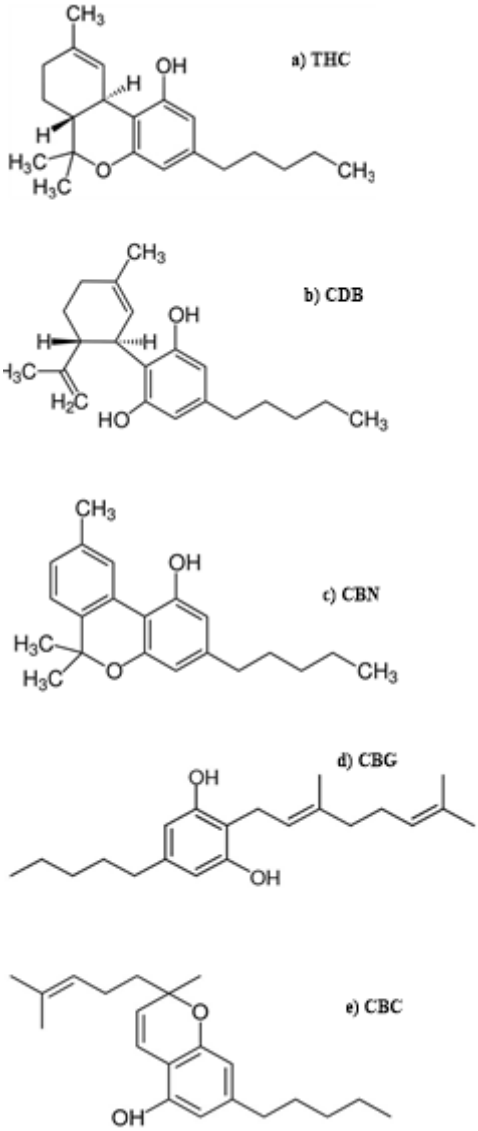
The chemical composition of cannabis is marked by the presence of more than 500 identified compounds, of which more than 100 are cannabinoids (SALAMI *et al*., 2020). The main cannabinoids include Tetrahydrocannabinol (THC), responsible for the psychoactive effects of the plant, such as euphoria and perceptual changes, and Cannabidiol (CBD), known for its therapeutic properties, such as anti-inflammatory, analgesic, anxiolytic, and neuroprotective action (HARTSEL *et al*., 2019). In addition to these, Cannabinol (CBN), Cannabigerol (CBG) and Cannabichromene (CBC) have also been the subject of study due to their therapeutic potential, which range from sedative properties to anti-inflammatory and neuroprotective effects (DELLA ROCCA; DI SALVO, 2020; RIOS *et al*., 2020; SILVA *et al*., 2024; LYONS *et al*., 2024).

In addition to these main compounds, cannabis produces a myriad of other phytocannabinoids, such as Cannabigerol (CBG), Cannabichromene (CBC), and Cannabinol (CBN), each with its own therapeutic potential, ranging from anti-inflammatory properties to sedative and analgesic effects (SCHOFS; SPARO; SÁNCHEZ BRUNI, 2021). The biosynthesis of these phytocannabinoids occurs in the glandular trichomes of the plant, where metabolic precursors such as olivetolic acid are converted by specific enzymes into acidic forms, such as THCA and CBDA, which are later decarboxylated to form the active cannabinoids THC, CBD, and CBC (HARTSEL *et al*., 2019; VASTOLO, *et al*., 2021; ALVES; FETTBACK, 2024). The interaction of cannabinoids with the cannabinoid receptors CB1 and CB2 in the human body plays a crucial role in mediating their therapeutic and psychoactive effects (SALAMI *et al*., 2020; MIRANDA-CORTÉS *et al*., 2023). While CB1 receptors are predominantly located in the central nervous system, modulating functions such as neurotransmission, pain, and memory, CB2 receptors are found primarily in the immune system, influencing inflammatory and immune responses (BRUTLAG; HOMMERDING, 2018; SCHOFS; SPARO; SÁNCHEZ BRUNI, 2021; FLORIO *et al*., 2023).

Cannabinoid biosynthesis occurs in the plant's resin glands, where metabolic precursors such as olivetolic acid and geranyl pyrophosphate are converted into acidic cannabinoids, such as THCA and CBD (GROF, 2018; ANDERSON *et al*., 2022). These compounds are subsequently activated by heat (decarboxylation) to form active cannabinoids, such as THC and CBD, which interact with the receptors of the animals' endocannabinoid system (BOOTH; PAGE; BOHLMANN, 2017; ERŽEN *et al*., 2021). Terpenes, if aromatic compounds found in cannabis, play a role not only by imparting to the plant its characteristic aroma but also by contributing to its therapeutic effects (SOMMANO *et al*., 2020). Terpenes such as myrcene, limonene, pinene, linalool, and caryophyllene

have sedative, analgesic, anxiolytic, anti-inflammatory, and even antibacterial properties, complementing the effects of cannabinoids through the so-called "*entourage effect*", where the interaction between different compounds enhances their therapeutic benefits (HANUŠ; HOD, 2020; DUGGAN, 2021; ISIDORE; KARIM; IOANNOU, 2021).

Figure 2 - Structural Formulas of the main cannabinoids of Cannabis spp. a) Tetrahydrocannabinol, b) Cannabidiol, c) Cannabinol, d) Cannabigerol and e) Cannabichromene.



Source: The Authors (2024).

CANNABINOID EXTRACTION AND PURIFICATION

EXTRACTION METHODS

The pharmaceutical industry maintains a specific niche in the market by valuing the production of isolated active ingredients, including in products based on *Cannabis* spp. This involves not only advanced extraction methods, but also refined techniques for separating and purifying compounds. This type of approach seeks to optimize yield without

compromising the quality of the final products, ensuring consistency in formulations and meeting therapeutic requirements with precision and efficacy (MAJOR; FERRISI, 2024).

Extraction technology using supercritical CO2 emerges as a promising alternative to mitigate the use of organic solvents in the selective extraction of cannabinoids and essential oils. This method makes it possible to obtain CBD-enriched products, characterized by a purity ranging from medium to high, while presenting itself as an ecologically sustainable and scalable strategy (VIEIRA, 2023). Extraction by solubilization of oil in the solvent is also widely used, it can occur in two ways: through dissolution, where the oil is released from the damaged plant cells during pressing or grinding; and by diffusion, where the oil gradually crosses the semipermeable membranes of intact plant cells to the liquid solvent medium continuously (RAMALHO; SUAREZ, 2012).

In steam drag extraction, a boiler is used to generate steam, an extractor or distiller where the raw material is placed, a condenser and a Florentine vessel to collect the condensate. The separation of phases is carried out based on polarity differences, considering that essential oils are typically nonpolar or nonpolar (STEFFANI, 2003).

PURIFICATION AND ISOLATION

The growing interest in *Cannabis* for beneficial purposes has stimulated the demand for efficient and productive methods of separating cannabinoids. These methods are categorized into chromatographic and non-chromatographic. Chromatographs include solid-liquid techniques such as batch HPLC, multi-column countercurrent chromatography (MCCC), and medium-pressure chromatography (*flash*), and liquid-liquid techniques such as countercurrent chromatography (CCC) and centrifugal partition chromatography (CPC). Non-chromatographic methods often involve extraction and recrystallization using solvents of various polarities (CITTI et al., 2020). Due to the complexity of botanical cannabis matrices, combinations of methods including decarboxylation, extraction, and purification are often employed, with additional precipitation, dissolution, and crystallization steps to treat and purify cannabinoids (FELETTI; COMPAGNIN, 2023).

Preparative single-column liquid chromatography is widely used for the purification of cannabinoids, using solid phase chromatography (SPE) or solid phase extraction techniques with stationary phases such as silica, alumina (normal phase) and C18 (reverse phase) (SIRANGELO; LUDLOW; SPADAFORA, 2022). While column chromatography improves purity and throughput, the use of large particles in SPE and flash chromatography impairs separation. Smaller particles, used in HPLC, are more effective, offering better resolution and purity. Preparative methods using C18 columns and water-alcohol mixtures

as the mobile phase can produce small amounts of pure cannabinoids with low selectivity, but still, preparative HPLC can isolate multiple cannabinoids effectively (FERRAZANO *et al*., 2022).

Gallo-Molina *et al*. (2019), in the context of THC isolation and purification, used the solid phase extraction (SPE) technique, employing a column filled with octadecyl-modified silica gel. The extract was dissolved in 0.05% trifluoroacetic acid in water and injected into the SPE column. The compounds were eluted using a linear gradient of 0.05% trifluoroacetic acid in acetonitrile, from 0% to 100%, at a constant flow rate of 1 mL/min. The fractions obtained were analyzed by thin layer chromatography (TLC) and reversed-phase high-performance liquid chromatography (RP-HPLC) to determine the presence of THC and select the THC-enriched fractions. The final fraction, after solvent removal and freeze-drying, was analyzed by RP-HPLC and nuclear magnetic resonance (NMR) to evaluate the purity of THC.

ANIMAL ENDOCANNABINOID SYSTEM

FUNCTIONING OF THE ENDOCANNABINOID SYSTEM

The endocannabinoid system is a neuromodulatory system, which has become of great importance in the last 25 years. It is composed of endogenous cannabinoids (endocannabinoids), cannabinoid receptors, and enzymes that are responsible for the synthesis and degradation of endocannabinoids (LU; MACKIE, 2016).

Cannabinoid receptors are the binding sites of an active substance, which have been classified as specific CB1 and CB2 receptors (SILVA *et al.,* 2009). CB1 receptors, the most abundant in the central nervous system, and CB2 receptors are located mainly in peripheral organs and tissues, both are responsible for modulating the psychotropic effects of cannabinoids in the brain (FONSECA *et al.,* 2013). Endocannabinoids are able to decrease neuronal excitability through several molecular mechanisms, including inhibition of Ca2+ currents and activation of K+ currents. The activation of CB1 receptors, as they are predominantly in presynaptic terminals, leads to inhibition of the release of several neurotransmitters (MATIAS; DI MARZO, 2006).

What is known about the synthesis of endocannabinoids is that their production is done on demand, and they are released through the activation of enzymes, which are triggered by a specific signal from within the cell (BELLOCCHIO *et al*., 2008), so they are transported across the cell membrane so that they can be degraded, occurring the arachidonic hydrolysis of glycerol (2-AG) or ethanolamine (AEA) (LU; MACKIE, 2021).

Among the functions of the endocannabinoid system, we can mention the maintenance of homeostatic balance, neuroprotection, modulation of nociception and control of certain phases of memory processing (PAGOTTO *et al*., 2006). With the discovery of these functions, the doors were opened for scientific research with this system, especially in the area of neurology.

THERAPEUTIC EFFECTS

Cannabis can relieve pain in several ways, including modulating the release of neurotransmitters involved in nociception. CB2 receptors can promote analgesia by releasing endorphins from keratinocytes, which act on opioid receptors to reduce the sensation of pain (KENDALL; ALEXANDER, 2009). In cases of seizures, such as epilepsy, CBD regulates the release of glutamate and increases serotonin absorption. The CB1 receptor is capable of modulating neuronal activity, contributing to the initiation and propagation of seizures (SILVA JÚNIOR *et al*., 2021).

In the text: Rocha (2010), cannabinoids have the ability to inhibit cell growth and induce apoptosis, playing a crucial role in the treatment of tumors. In addition, they can decrease the expression of matrix metalloproteinases, reducing the wear and tear of the extracellular matrix and basement membrane (ROCHA, 2010). In canine cognitive dysfunction, cannabinoids are observed to neutralize the beta-amyloid substance deposited in neurons by stimulating CB2 receptors that induce the removal of the substance by macrophages in microglia (RAMALHO, 2023).

Treatment with cannabis seeks the *entourage* effect, which combines phytocannabinoids, terpenes and flavonoids, known as *full spectrum* oil (BECHARA; ESPOSITO, 2023). The use of *full spectrum* oil reduces the side effects of isolated compounds, such as the psychoactivity of THC, which is neutralized by CBD and other phytocannabinoids due to the *entourage* effect. CBD's ability to modulate the response to THC allows for higher doses of THC, increasing clinical efficacy and improving the safety profile, especially for patients who rely on THC for significant therapeutic benefits (CHRISTENSEN *et al.*, 2023).

CANNABIS-BASED PHARMACEUTICAL FORMULATIONS

LIQUID FORMULATIONS

The liquid formulations most used for the pharmaceutical preparation of Cannabis spp.-based products are oils and hydroalcoholic solutions (tinctures). These forms, in turn, differ in terms of physicochemical characteristics (lipophilicity and stability to intrinsic and

extrinsic factors) and in terms of their pharmacokinetics (time of evolution of their absorption, bioavailability, distribution, biotransformation and excretion) (THOMAS; POLLARD, 2016).

Due to bureaucratic hurdles in some countries, there are still insufficient detailed studies on the pharmacokinetic distinction between liquid cannabis-based pharmaceutical forms in animals. However, there are some studies that point to these characteristics, such as the one carried out by Łebkowska-Wieruszewska *et al.* (2019), which evaluated the pharmacokinetics of Bedrocan®, a cannabis oil extract, in dogs. The methodology was based on the administration of Bedrocan® (containing 20% THC and 0.5% CBD) to fasting and fed dogs. The quantification of the compounds was performed using the LC/MS technique (Liquid Chromatography Coupled to Mass Spectrometry) in the blood samples of the dogs tested. THC levels in the blood were quantified from 30 minutes to 10 hours after administration, resulting in the result that fed dogs had a lower plasma concentration of THC compared to non-fed dogs (there were no significant changes in relation to CBD), concluding that the feeding state (fasted or fed) interferes with the absorption of cannabis oil and, consequently, the availability of THC in the bloodstream (ŁEBKOWSKA-WIERUSZEWSKA *et al.*, 2019).

The research conducted by Bartner *et al.* (2018) aimed to investigate how different administration methods and dosages of cannabidiol (CBD) affect its pharmacokinetics in healthy dogs. In that study, researchers utilized three methods of administering CBD – orally administered CBD oil microspheres, orally administered CBD-infused oil, and CBD-infused transdermal cream. The dogs were divided into groups to receive one of three formulations in two different dosages: 75 mg and 150 mg of CBD, administered every 12 hours for a period of 6 weeks. The study concluded that exposure to CBD is proportional to the dose administered. Oral CBD-infused oil has been identified as the most effective method of administration, providing the most favorable pharmacokinetic profile. This suggests that to maximize the therapeutic efficacy of CBD in dogs, oil infused with oral administration is the best option (BARTNER, *et al.*, 2018).

SOLID FORMULATIONS

A capsule is made by enclosing an active pharmaceutical ingredient (API) in a shell that is odorless, tasteless, easy to swallow, and easy to fill. There are two main types of gelatin capsules today: hard gelatin capsules and soft gelatin capsules, also known as *softshells*. The hard gelatin capsule can be used for dry fillers such as powder, liquids, and semi-solids, whereas the *softshell* capsule can only be used for liquids and semi-solids

(HOAG, 2017). The capsules are mainly used in dogs and cats; However, some vitamin and mineral supplement capsules are made for cattle. Tablets are another commonly used pharmaceutical form. They are less popular for animals because administration can be time-consuming, dangerous, and uncertain, as it is not possible to guarantee whether the tablet has been swallowed, spat out, or dropped from the mouth after the steward has moved away or passed it on to another animal (RAMTEKE, 2014).

The cannabinoid formulation impacts their efficacy due to variation in bioavailability and distribution. Oil-based formulations provide higher bioavailability and longer elimination time compared to other formulations. For example, liposome-encapsulated CBD oil has a superior pharmacokinetic profile to "pure" oil. When 137 veterinarians and 329 veterinary medicine students in Portugal were asked about their familiarity with the use of medical cannabis, 89.9% of veterinarians and 76.7% of students answered affirmatively. In clinical practice, veterinarians were more accustomed to tablets, capsules or microcapsules, and prescribed products available in the Portuguese market, such as Evexia® (capsules) and WeConfort® (tablets) (GASPAR, 2021).

According to an investigation on the perception of dog owners about the use of medicinal products derived from cannabis, in relation to capsules/tablets (n=68), 12 (17.6%) reported using those marketed to animals, while 3 (4.4%) reported using capsules/tablets marketed to humans (KOGAN, 2019). Polidoro *et al.* (2022) sought to analyze the pharmacokinetics of various pharmaceutical forms of cannabis in dogs. For oral administration, one tablet containing 100 mg of CBD was administered along with a small amount of highly digestible commercial canned food. CBD has low water solubility, so orally administered CBD was not detected in 50% of dogs in which it was administered as a powder inside a gelatin capsule. Therefore, if administered orally, it is best absorbed in the presence of polar fats, oils, or solvents. Oral CBD was administered inside a tablet with a small amount of wet food containing 15% fat this may explain why we observed a lower detection of CBD compared to studies using oil-based CBD, but it was still possible to observe good absorption. Thus, it is understood that the administration of solid pharmaceutical products derived from cannabis is an appropriate method of administration, and more studies should be conducted in the area seeking the formulation of new solid drugs that can be used in veterinary care (POLIDORO *et al.*, 2022)element.

CANNABIS-BASED PRODUCTS FOR ANIMALS

ADMINISTRATION AND DOSAGE

Products intended for animals often contain CBD, a non-psychoactive compound in cannabis, while THC (tetrahydrocannabinol), which is psychoactive, is avoided due to the potential for toxicity in animals. Both act on the endocannabinoid system in a similar way to endocannabinoid neurotransmitters. However, the psychoactive effect of THC, which results from its action on the central nervous system, limits clinical studies due to possible cognitive, motor, and memory alterations and the risk of long-term dependence (CARVALHO *et al.*, 2017).

For the use of cannabis-derived products, specific regulations have been established. Formulations with a THC concentration of up to 0.2% require prescription through type B prescriptions, with numbering provided by the local Health Surveillance and renewal of the prescription within 60 days. THC concentrations above 0.2% can only be prescribed to terminal patients or those who have exhausted treatment alternatives, requiring a type A prescription, valid for 30 days, provided by the local Health Surveillance (ANVISA, 2019).

There are several ways to use cannabis for medicinal purposes in veterinary and livestock production, including ointments, eye drops, extracts for oral administration, and the incorporation of seeds into the animals' diets (LANDA; SULCOVA; GBELEC, 2016).

For dogs, the recommended dosage of CBD ranges between 2 to 12 mg per kilogram of body weight, while that of THC recommended is 1.5 mg per kilogram of body weight. Before starting any cannabis treatment, it is essential to consult a veterinarian to assess the animal's health and obtain specific guidance. It is advisable to start with minimal doses and carefully monitor clinical signs to avoid any adverse effects (VAUGHN; KUPLA; PAULIONS, 2020).

SIDE EFFECTS AND SAFETY

To ensure the safety of cannabis use in dogs with spinal injuries, it is essential to determine the correct dose, utilize quality products, and have use supervised by a veterinarian to monitor the animal's response and adjust dosage as needed (LOPES; BONORINO, 2023).

According to Coelho (2021), cannabis toxicity in dogs usually appears about 60 minutes after ingestion or inhalation, with neurological, gastrointestinal, and cardiovascular symptoms varying according to dose (COELHO, 2021). Safe doses include 60 mg/kg CBD,

19 mg/kg THC, or 8 mg/kg CBD + 6 mg/kg THC (VAUGHN; KUPLA; PAULIONS, 2020). Administration of 20 mg/kg/day of CBD for six weeks is also safe (McGrath *et al.*, 2018).

Adverse effects reported in studies include diarrhea, vomiting, sedation, dermatologic and ophthalmic changes, and reduced appetite (McGrath *et al.*, 2019; VAUGHN *et al.*, 2020). Clinical signs of cannabis poisoning in dogs include ataxia, mydriasis, hyperesthesia, muscle spasms, and urinary incontinence (JANECZEK *et al.*, 2018; MEOLA *et al.*, 2012; PETERSON; TALCOTT, 2013).

An analysis of 125 cases in Colorado showed that the most common symptoms of poisoning in dogs were ataxia (88%), disorientation (53%), and urinary incontinence (47%). Two deaths were associated with the ingestion of THC-containing biscuits, indicating the sensitivity of dogs to the compound (MEOLA *et al.*, 2012).

STUDIES AND PERSPECTIVES IN VETERINARY MEDICINE

SCIENTIFIC EVIDENCE

An American study investigated the effectiveness of CBD for osteoarthritis (OA) in pet dogs. Sixteen dogs were given 2 mg/kg of CBD every 12 hours for four weeks. The results indicated a significant reduction in pain and an increase in activity in the dogs. However, 9 of the 16 dogs showed a significant increase in alkaline phosphatase (ALP), possibly due to chronic CBD dosage. The conclusion was that CBD was shown to be effective in reducing pain and increasing activity, but with elevation of liver enzymes in some cases (BRUTLAG; HOMMERDING, 2018).

Mejia *et al.* (2021) investigated the safety and efficacy of CBD in twenty-three dogs, treating them with 2.5 mg/kg of CBD every 12 hours for 6 weeks. No significant differences were found in clinical signs between the groups, although elevations of liver enzymes and vomiting were observed (MEJIA, 2021). Verrico *et al*. (2020) evaluated the effect of CBD on twenty dogs with arthritis, administering doses of 0.5 mg/kg and 1.2 mg/kg of pure CBD, in addition to 0.5 mg/kg of liposomal CBD. They concluded that both pure and liposomal CBD significantly reduced pain and improved mobility, with liposomal CBD proving effective at lower doses compared to pure CBD (VERRICO, 2020).

Mechoulam (2005) reported the use of cannabinoid acids, precursors to neutral cannabinoids such as THC and cannabidiol, for veterinary purposes in Czechoslovakia in the 1950s due to their antibiotic properties (MECHOULAM, 2005). In previous studies, Pate *et al.* (1998) administered AEA, its analogue R-alpha-isopropyl, and the non-classical cannabinoid CP-55,940 in the eyes of normotensive rabbits, demonstrating that CP-55,940 had significant ocular hypotensive effects, while the analogue R-alpha-isopropyl had minor

effects, and AEA caused an initial hypertension followed by a decrease in intraocular pressure (PATE, 1998). Fischer, Ward, and Hendrix (2013) tested the effects of topical administration of an ophthalmic solution containing THC (2%) in clinically normal dogs, resulting in a moderate reduction in intraocular pressure (FISHER; WARD; HENDRIX, 2013). Chien *et al.* (2003) used cannabinoids in normotensive and glaucomatous monkeys (*Macaca cynomolgus*), observing a significant decrease in intraocular pressure (CHIEN *et al.*, 2003). In dermatological applications, Scarampella, Abramo and Noli (2001) administered PLR 120 (analogue of PEA) to 15 cats with eosinophilic granulomas or eosinophilic plaques, observing clinical improvements in 10 of the 15 cats (SCARAMPELLA; ABRAMO; NOLI, 2001). In addition, Cerrato *et al.* (2010) isolated mast cells from skin biopsies of dogs and found that PEA significantly inhibited the release of histamine, prostaglandin D2, and canine anti-IgE-induced tumor necrosis factor-alpha (CERRATO, 2010).

CHALLENGES AND OPPORTUNITIES

Due to the frustration, disorientation and great challenge of caring for an animal diagnosed with neurological problems, many researchers in the area are looking for unconventional therapeutic options, such as treatment with the use of cannabis. Idiopathic epilepsy affects up to 5.7% of the canine population and, consequently, is considered the most common neurological condition among dogs. The first treatment should be done with phenobarbital, potassium bromide or a combination of the two, although the effectiveness of these drugs is questionable, as this treatment fails in 20% to 30% of dogs, which is one more reason for owners to opt for alternative treatments. Cannabis aids in the control of epilepsy as it has the potential to reduce, i.e., minimize sporadic or frequent seizures and also increase the total number of seizure-free days (McGrath *et al.*, 2019).

A study developed by McGrath in 2019 investigated the impacts of CBD on animals with recurrent episodes of seizures. The results of this research indicated a significant decrease in the incidence of seizures in dogs with intractable idiopathic epilepsy. In addition, CBD has antioxidant and anti-inflammatory characteristics, which can contribute to the preservation of the nervous system. Groups of animals undergoing CBD treatment have shown up to a 33% drop in seizures and the high concentration of CBD in plasma is associated with a decrease in seizure incidence (MCGRATH, 2019).

The use of phytocannabinoids in the fight against cancer can improve the patient's quality of life and can treat or delay the development of the disease. In 1975, a study was conducted that reported the antiproliferative and anticancer properties of orally

administered THC. The study describes the inhibition of the development of a lung adenocarcinoma in a rodent and an increase in the lifespan of a rat submitted to treatment compared to control rats (CITAL *et al.*, 2021).

Several beneficial effects are observed in the treatment of canine cognitive dysfunction with cannabis, due to the ability of the endocannabinoid system to regulate neuronal function by modulating calcium influx, neurotransmission, neuroprotection, and inflammatory response, and can also help suppress symptoms such as aggression and pain, thus increasing your quality of life. CBD has already been proven to aid in the regeneration of neurons in the hippocampus (B.G. WILLIAMSON *et al.*, 2021; COILE, 2016).

FINAL CONSIDERATIONS

The scenario on the use of *Cannabis* spp and its extracts is promising in the veterinary environment. However, more research is needed on its therapeutic effects and possible adverse effects for its adoption in the treatment of animals, in order to ensure its safety, efficacy, and therapeutic efficiency. Also, changes in the legislation of some countries are necessary in order to facilitate not only access to cannabis-based products that are already present in the pharmaceutical market, but also to other formulations that may be developed.

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APPLICATION AND IMPACT OF ARTIFICIAL INTELLIGENCE IN MEDICAL CARE: A SYSTEMATIC REVIEW OF THE LITERATURE

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ABSTRACT

Until recently, the application of artificial intelligence (AI) in healthcare was a source of much speculation but little action. Defining AI as "a set of technologies that allow machines and computers to simulate human intelligence," clinical researchers often compare AI to human performance as a means of validation. The present study aims to analyze the application and impact of artificial intelligence in medical care. This systematic review was used to evaluate the applications and impacts of artificial intelligence in medical care. The

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guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA) were followed. In addition, the PubMed, ACM Digital Library, IEEE Xplore, Web of Sciene, and ScienceDirect databases were used for literature review. The literature review revealed 7,415 articles in total. Of these, 11 articles were selected, 5 (45.46%) investigated the impact of AI in medicine, and 6 publications (54.54%) evaluated AI education in medicine. The current application of AI in medical education is focused on clinical specialized training and continuing education, with the main areas of application being radiology, diagnostics, surgery, cardiology, and dentistry. The primary role is to help doctors improve their efficiency and accuracy. The potential benefits of AI for diagnosis, treatment, and drug discovery generate optimism and hope for new knowledge and improved patient outcomes.

Keywords: Artificial Intelligence. Medical education. Teaching. Machine learning.

INTRODUCTION

Until recently, the application of artificial intelligence (AI) in healthcare was a source of much speculation but little action. Defining AI as "a set of technologies that allow machines and computers to simulate human intelligence," clinical researchers often compare AI to human performance as a means of validation. AI is improving rapidly, and its application in the field of medicine is increasing. It is becoming increasingly popular in many medical fields; including ophthalmology, dermatology, and pathology (Al Saad *et al.*, 2022; Ru *et al.*, 2023).

Machine learning (ML) is a division of AI that is involved in teaching machines to classify different medical diseases based on images, sounds, or any data source. AM can also help with diagnosis, finding treatment options, smart health records, and many other applications. AI and ML would play an essential role in improving medicine in the future and support the future needs of medicine by analyzing the enormous amounts and diverse forms of data that patients and healthcare institutions record at any given time (Egert *et al.*, 2020; Ostherr, 2022).

So AI could change more than the way medicine is practiced; it could change the way medicine is taught. Specifically, AI chatbots, such as OpenAI's ChatGPT, have the potential to improve medical education. Equipped with fast efficiency and memory, remarkable accuracy, and a personal interactive style, ChatGPT can perform complex tasks. ChatGPT has already entered the field of medical education, having passed selected and publicly available versions of the questions in Step 1, Step 2 of Clinical Knowledge, and Step 3 of the United States Medical Licensing Examination (USMLE) at the beginning of the year 2023. Its applications in medical education are just beginning to be discovered with emerging research and increased use by medical students; in addition to having the potential to improve patient care and streamline healthcare processes (Sherr *et al.*, 2023).

However, without proper oversight and regulation, the integration of large language models into the healthcare system could introduce a range of risks and unintended consequences. It is essential to explore these potential risks and address them effectively to ensure that AI serves as a beneficial aid in the medical field. One of the main concerns regarding AGI in healthcare is the risk of providing inaccurate medical advice. Since AI-generated content is based on large amounts of data from the internet, there is a possibility that the information provided may be misleading or outright incorrect. For example, ChatGPT may offer treatment suggestions that are outdated or inappropriate for a patient's specific condition. Such inaccuracies can cause patients to receive inadequate treatment or even aggravate their health problems (Liu *et al.*, 2023).

The objective of this research is to analyze the application and impact of artificial intelligence in medical care.

METHODOLOGY

STUDY DESIGN

Systematic review (SR) based on the flowchart of the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA), comprising experimental or quasi-experimental primary quantitative articles. Interventions in randomized controlled trials were evaluated according to efficacy.

INCLUSION AND EXCLUSION CRITERIA

Research articles, peer-reviewed, review articles, case reports, with open access or full text, written in English, between 2019 and 2024. A total of 7,415 articles were searched from June 2024 to July 2024, through the National Center for Biotechnology Information (NCBI/PUBMED), ACM Digital Library, IEEE Xplore, Web of Sciene, and ScienceDirect databases, as shown in Table 1. The articles include information of great importance about the applications and impacts of artificial intelligence in medical care.

Table 1. Bibliographic sources and keywords.

RESEARCH QUERY AND LITERATURE SOURCES ("Medical Education" OR "Medical Training") AND ("Artificial Intelligence" OR "Teaching" OR "Deep Learning")	SEARCH ON	SEARCH RESULT
PUBMED	Full text, English, between 2019 and 2024, research article, essays, review articles, case report	1.194
ACM Digital Library	English, between 2019 and 2024, essays	34
IEEE Xplore	Open access, English, between 2019 and 2024,	30
Web of Science	Open access, English, from 2019 to 2024, research article, review articles, case report	3.266
ScienceDirect	Full text, English, between 2019 and 2024, research article, review articles, case report	2.891

TOTAL		7.415

Source: Prepared by the authors

Articles that did not answer the guiding question of this research were excluded, as well as studies with incomplete abstracts or that do not have well-defined methods and conclusions, which did not present a well-defined guiding question of the research, as well as duplicate articles, not available in full, dissertations or theses, book chapters, news and expanded abstracts published before 2019 in languages other than English.

STUDY PROTOCOL

The PICO strategy (P – population; I – intervention; C – comparison; The – outcomes) guided the elaboration of the SR guiding question and served as a basis for the development of search strategies using the descriptors of Medical Subject Headings (MeSH) and with the Boolean operators AND and OR, as shown in Chart 1. Thus, the research question was: What are the applications and impacts of artificial intelligence in medical care? For this study, the PICO strategy was used, formulated as follows:

Table 1. Stratification of the research problem following PICO strategy for research formulation.

Component	Definition	Descriptors	Keywords
P: Population of Interest	Medical professionals	Medical Education OR Medical Training	Medical Education, Medical Training
I: intervention	How Artificial Intelligence Affects Care	Artificial Intelligence OR Teaching OR Deep Learning	Artificial Intelligence, Teaching, Deep Learning
C: Comparison	Conventional clinical care	-	-
O: result/outcome	identify the impact of AI on healthcare	-	-

Source: Prepared by the authors.

In it, the first element of the strategy (P) Medical professionals; the second element (I) How artificial intelligence affects care C) Conventional clinical care (O) Identify the impact of AI on medical care. The searches were performed using the following search strategy: ("Medical Education" OR "Medical Training") AND ("Artificial Intelligence" OR "Teaching" OR "Deep Learning").

SELECTION OF ARTICLES

The "StArt" Systematic Review Manager was used for the purpose of deleting duplicate articles in an automated manner. Soon after, the analysis of the titles was carried out, followed by the reading of the abstracts to identify which would be evaluated completely, independently (blinded) by two evaluators, in case of disagreements a third evaluator was necessary for final consensus. The final necessary data were extracted using an instrument with identification data (authors and year).

ASSESSMENT OF METHODOLOGICAL QUALITY AND RISK OF BIAS OF STUDIES

To assess the methodological quality of the studies, the Critical Appraisal Skills Programme (CASP) instrument was used.This tool makes it possible to judge the methodological quality, through the classification of the information present in each study through scores. Each item in the table represents one point, and the final sum ranges from 0 to 10 points. The scores were defined as follows: sum of 6 - 10 points good methodological quality and reduced bias and 0 - 5 points satisfactory methodological quality AND increased potential bias. Two researchers independently evaluated each article according to quality criteria, conflicts of interest surrounding the evaluation were resolved through discussions. Below are the quality criteria used.

Table 2. Quality criteria used.

Critical Appraisal Skills Programme (CASP)
1) Is the objective clear and justified?
2) Is there adequacy of the methodological design?
3) Are the theoretical-methodological procedures presented and discussed?
4) Was the study sample appropriately selected?
5) Is the data collection detailed?
6) Was the relationship between researcher and researched considered?
7) Were the ethical aspects of a research respected?
8) Is the data analysis rigorous and reasoned? Do you specify the statistical tests?
9) Are results presented and discussed properly?
10) What is the value of the research?

Fonte: CASP UK, 2024.

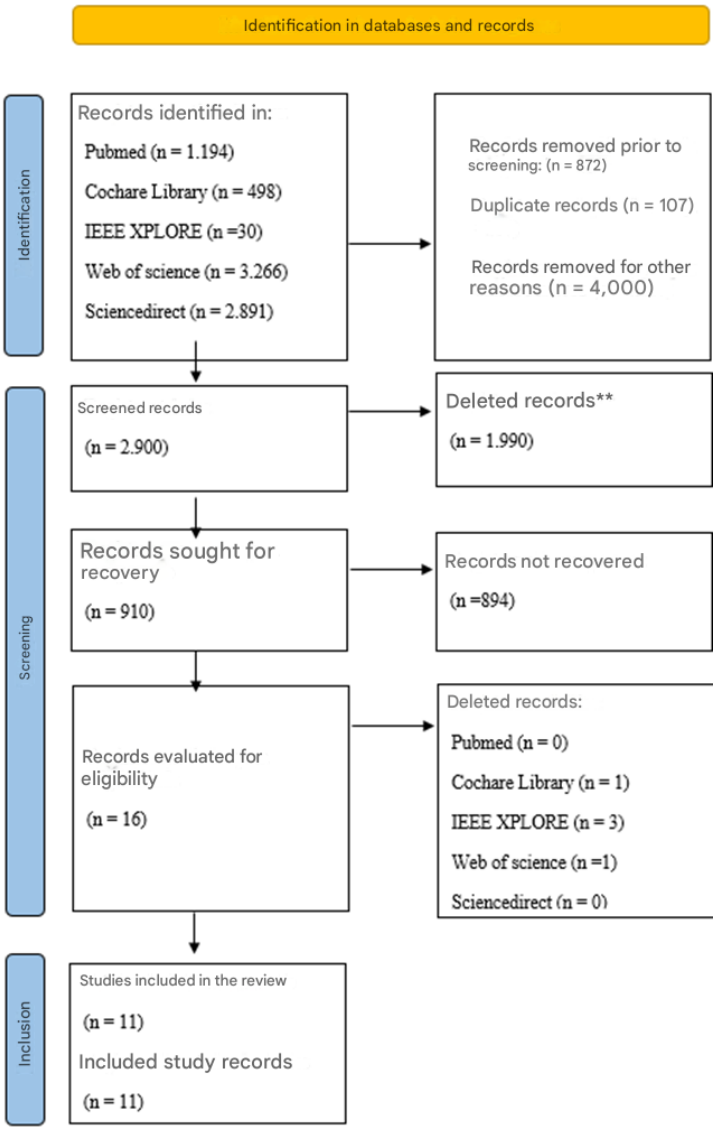
ANALYSIS OF THE RESULTS

The extraction of data from the chosen studies occurred independently by two researchers. The researchers performed a complete reading of the selected articles to extract relevant information that would help them synthesize and characterize the studies. The data from the studies included in this SR were analyzed and presented descriptively in a table (Chart 3) containing the identification of the study (authors and year), type of study, population, objectives, results, and quality evaluation score of the articles.

RESULTS AND DISCUSSIONS

The diagram of the selection process is shown in Figure 1. The literature review revealed 7,415 articles in total. After the first analysis, 872 articles were excluded before screening, 107 duplicate articles, and 4,000 for other reasons (insufficient data, inconsistency with the theme). Of the 2,436 related studies, 16 were listed as potentially relevant, keeping the focus on the object of this research. Of these, 5 were excluded in the second phase and 11 were selected for the study. Of 11 selected articles, 5 (45.46%) investigated the impact of AI on medicine and 6 publications (54.54%) evaluated AI education in medicine.

Figure 1 - Flowchart for selecting studies in the PRISMA 2020 format, developing RCT selection phrases from this systematic review.



Source: Prepared by the authors.

Chart 3 describes the distribution of articles used according to author/year, title, theme, objective, results, and quality evaluation grade.

Chart 3 - Distribution of articles according to author/year, title, theme, objective, results and grade for quality evaluation.

AUTHOR/YEAR	TITLE	THEME	OBJECTIVE	RESULTS	GRADE FOR QUALITY EVALUATION
Scherr *et al.*, 2023	*ChatGPT Interactive Medical Simulations for Early Clinical Education: Case Study*	Medical education	This paper models ChatGPT 3.5's ability to perform interactive clinical simulations and shows the benefits of this tool for medical education.	Two initial prompts were chosen. Prompt 1 was developed through 3 test simulations and successfully used in 2 simulations. Prompt 2 was developed through 10 additional test simulations and successfully used in 1 simulation.	10
Hu *et al.*, 2023	*An Artificial Intelligence Training Workshop for Diagnostic Radiology Residents*	Artificial intelligence in medicine	Develop, implement, and evaluate feedback for an artificial intelligence (AI) workshop for radiology residents that was designed as a condensed introduction of AI fundamentals suitable for integration into an existing residency curriculum.	Twelve residents participated in the workshop, with 11 completing the survey. An average score of 4.0 ± 0.7 (SD), indicating agreement, was observed when asking residents whether the workshop improved AI knowledge. Confidence in understanding AI concepts increased after the workshop to 16 out of 18 (89%) comprehension questions (P-value range : 0.001 to 0.04 for questions with higher confidence).	10
Ostherr *et al.*, 2022	*Artificial Intelligence and Medical Humanities*	Medical education	This article explains four main areas of concern related to AI and the role that medical/health humanities research can play in addressing it:	The potential benefits of AI for diagnosis, treatment, and drug discovery generate optimism and hope for new insights and better patient outcomes. The	9

			definition and regulation of "medical" versus "health" data and applications; social determinants of health; narrative medicine; and technological mediation of care	potential harms of algorithmic bias and further dehumanization of healthcare prompt calls for transparency and accountability in how these systems are deployed.	
Egert *et al.*, 2020	*Machine Learning and Artificial Intelligence in Surgical Fields*	Artificial intelligence in medicine	Explore how artificial intelligence is being used to assess and improve surgical skills, diagnose various surgical pathologies using images and tissue specimens, and how surgeons can utilize these technologies in the field of telemedicine to improve access to care and resources.	Machine learning and artificial intelligence are rapidly being incorporated into multiple aspects of medicine related to surgical fields. This technology can benefit surgeons in assessing surgical skills, as well as teaching trainees the best methods during the operation, especially during robotic procedures.	9
Saad *et al.*, 2022	*Medical Students' Knowledge and Attitude Towards Artificial Intelligence: An Online Survey*	Medical education	To investigate the attitudes of Jordanian medical students towards Artificial Intelligence (AI) and Machine Learning (ML). Also, estimate the level of knowledge and understanding of the effects of AI on medical students.	89% of students believed in the importance of AI in the medical field, and 71.4% believed in the benefit of teaching AI in a medical career. 47% of students had an understanding of the basic principles of AI, 68.4% of students believed that it is mandatory for medical students to receive knowledge of AI. Statistically, students who received AI teaching/training were more likely to consider radiology as a career given the	10

				advancement in AI.	
Liu *et al.*, 2023	*Surviving ChatGPT in healthcare*	Artificial intelligence in medicine	Provide a comprehensive yet succinct summary of this subject to stimulate broader discussion and insights into the future of medicine in the age of Artificial General Intelligence (AGI).	By recognizing and mitigating these challenges, AGI can be leveraged to enhance patient care, medical knowledge, and healthcare processes, ultimately benefiting society as a whole.	9
Von Ende *et al.*, 2023	*Artificial Intelligence, Augmented Reality, and Virtual Reality Advances and Applications in Interventional Radiology*	Artificial intelligence in medicine	Describe the current and possible future applications of artificial intelligence, radiogenomics, and augmented and virtual reality in interventional radiology, while describing the challenges and limitations that must be addressed before these applications can be fully implemented in common clinical practice.	Integrating these techniques would not only benefit procedure planning and performance, as well as treatment follow-up, but is also poised to improve the patient experience, decrease radiation exposure for both the patient and operators, and potentially decrease hospital costs and adverse events. The benefits of AI in IR are far-reaching and can help at an individual patient level, improving the scheduling and effectiveness of minimally invasive procedures, but also at an international level, optimizing global radiology education.	10
Hamilton *et al.*, 2024	*Artificial Intelligence and Healthcare Simulation: The Shifting*	Medical education	Deepen the current impact of AI on healthcare-related training	Artificial intelligence will not put trained doctors out of business, but it will change the	9

	Landscape of Medical Education.		and education (HCS).	way they do business. Trained doctors are here to stay, but not necessarily in the current numbers in all specialties. Some will be more pressured by AI than others and, in this sense, AI may start to affect the career choices that our students and trainees will make in the coming years. Artificial intelligence will continue to be a disruptive agent in health education.	
Ali *et al.*, 2023	*A systematic literature review of artificial intelligence in the healthcare sector: Benefits, challenges, methodologies, and functionalities*	Artificial intelligence in medicine	Describe the application of AI in healthcare.	It has been identified that AI continues to significantly outperform humans in terms of accuracy, efficiency, and timely execution of related medical and administrative processes. The benefits for patients are mapped directly into the relevant AI functionalities in the categories of diagnosis, treatment, consultation, and health monitoring for self-management of chronic conditions.	10
Shoja *et al.*, 2023	*The Emerging Role of Generative Artificial Intelligence in Medical Education, Research, and Practice*	Artificial intelligence in medicine	It examines current trends in the use of GAI models in medicine, outlining their strengths and limitations.	Medical education seems to focus on the role of GAI models in assessments and essay writing, as well as their	10

				interaction with students in the classroom and with assignments. Other applications, such as automatic scoring of student essays, creating content for quizzes, and assisting in facilitating learning, should be explored. More consensus-based guidelines are needed to govern the appropriate use of GAI, not only in medical education, but also in research, scholarship, and clinical practice.	
Leng, 2024	*Challenge, integration, and change: ChatGPT and future anatomical education*	Artificial intelligence in medicine	Discuss the application of ChatGPT in anatomy teaching and its various levels of application based on our own teaching experiences, and discuss the advantages and disadvantages of ChatGPT in anatomy education.	ChatGPT increases student engagement and strengthens students' ability to learn independently. At the same time, ChatGPT faces many challenges and limitations in medical education. Medical educators must keep up with the rapid changes in technology, taking into account the impact of ChatGPT on curriculum design, assessment strategies, and teaching methods.	9

Source: Prepared by the authors.

Artificial intelligence plays a crucial role in enhancing training, planning, and treatment strategies in areas already well-established in healthcare simulation. AI enhances one-on-one training and bedside skills and decision-making with individual patients. In addition, they are also applied in the training of tasks or procedures. To the extent that practice with a task trainer generates familiarity and sufficient handling of the instruments imparts practical experience to the healthcare professional, simulation is commonly used to assess surgical or technical proficiency. Because healthcare simulation is intertwined with computer technology, it offers opportunities for rapid scalability with AI and will therefore be the most practical place to test new AI applications (Ostherr, 2020; Hamilton, 2024).

The maturation of AI technologies has changed the roles of physicians, and new decision-making processes in medical settings and innovative AI-based protocols have the potential to provide diagnostic and treatment decisions through the analysis of complex data sets. It also includes benefits for people that consist of automated decision-making; patient monitoring, especially monitoring of elderly patients; and simplification of processes. It also includes benefits to organizations consisting of workflow aid, performance improvement, cost reduction, and fraud detection. In addition to bringing benefits to the sector that consist of saving time, reducing resource consumption, and providing professional training, data sharing, and availability (Sapci & Sapci, 2020; Ali *et al.*, 2023).

The current application of AI in medical education is focused on clinical specialized training and continuing education, with the main areas of application being radiology, diagnostics, surgery, cardiology, and dentistry. The primary role is to help doctors improve their efficiency and accuracy. In addition, the field of combining AI with medicine/medical education is constantly expanding, and the most urgent need is for policymakers, experts in the medical field, AI and education, and experts in other fields to come together to reach consensus on ethical issues and develop regulatory standards (Sun *et al.*, 2023).

AI has the ability to further revolutionize healthcare, specifically for the field of interventional radiology (IR), not only to improve image processing, but also to guide and predict the outcomes of your minimally invasive procedures, through accurate diagnoses, personalized treatment plans, and real-time procedural support. In addition, while not a direct form of AI, similar fields such as augmented reality (AR) and virtual reality can improve physician education and training, improve patient understanding, and improve procedural guidance, as well as reduce procedural risks and complications (Ru *et al.*, 2023; Von Edde *et al.*, 2023).

ChatGPT is rapidly developing and has a profound impact on medical education. More and more studies are beginning to explore the possibility of applying ChatGPT in

medical education. The integration of ChatGPT with medical education is a continuous and gradual process, its emergence offers exciting new opportunities for educational innovation (Sherr, 2023; Leng, 2024).

One of the main concerns regarding AI in healthcare is the risk of providing inaccurate medical advice. Since AI-generated content (AIGC) is based on large amounts of data from the internet, there is a possibility that the information provided may be misleading or outright incorrect. For example, ChatGPT may offer treatment suggestions that are outdated or inappropriate for a patient's specific condition. Such inaccuracies can cause patients to receive inadequate treatment or even aggravate their health problems (Liu *et al.*, 2022; Leng, 2024).

In addition, there is the potential for the violation of patients' privacy, such data can be compromised, leading to unauthorized access, collection, and sharing of sensitive personal information. They also include challenges related to legal/privacy issues, which consist of privacy issues, legal issues, and government regulations. This risk highlights the importance of ensuring that AI technologies (such as: ChatGPT) meet stringent privacy standards before their widespread adoption in healthcare (All Saad *et al.*, 2022; Ali *et al.*, 2023).

Medical education must evolve because future doctors will encounter patients in health contexts that are quite different from the present. Ubiquitous and digitized healthcare systems allow doctors and patients to access biomedical information easily. The exponential expansion of medical knowledge requires physicians not to remember, but to update, what they know and select the right information from a surplus of options. Artificial intelligence will reduce the efforts needed by physicians to interpret digital data and improve their ability to establish a diagnosis and prognosis (Liu *et al.*, 2024).

Therefore, the non-analytical, humanistic aspect of medicine will be more emphasized because it is difficult to replace it with technology. Moreover, advanced medical technology leads doctors to encounter an increasing number of elderly and latent patients with chronic conditions and comorbidities due to their extended life. Globalization has led physicians to face unknown disease profiles or contexts that were not common in regional communities. Future medical education must be restructured to align with these inexorable changes, considering students who will work in digitized health systems (Hah *et al.*, 2019).

CONCLUSION

The potential benefits of AI for diagnosis, treatment, and drug discovery generate optimism and hope for new insights and better outcomes for professionals and patients. It

should be noted that AI also plays an important role in the training of medical professionals by allowing a more autonomous, independent and targeted study, so it is essential that strict criteria are established for adequate filtering of the information obtained through these technologies and whether they come from totally reliable and evidence-based scientific sources. In view of the above, more studies are needed on the subject, for a better understanding of the use of AI and to determine the feasibility, effectiveness and cost of the use of AI, since it is an emerging topic with wide and rapid dissemination of its use even in the face of opportunities for improvement and maturation that allow ensuring the rationality and sustainability of its implementation.

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BIODIGESTER IN BEEF CATTLE FEEDLOT

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ABSTRACT

This study addresses the implementation of biodigesters in beef cattle confinement systems, an economic activity of great relevance, however, which faces significant challenges in waste management. The research highlights the transformation of waste into valuable resources, such as biogas and biofertilizers, and the promotion of sustainable agricultural practices. Through a systematic literature review and documentary analysis, a theoretical research was carried out, which covered academic literature from several decades. The results indicate that biodigesters offer an effective solution for waste management in beef cattle, contributing to the reduction of waste and harmful emissions and promoting the circularity of resources on the farm. However, the implementation of these systems is not without challenges, including the need for qualified personnel for operation and maintenance, corrosion of equipment by hydrogen sulfide gas, and the complex logistics of livestock management and leachate treatment. Despite these challenges, the integration of biodigesters into beef cattle is a promising approach that offers substantial benefits for crop production and environmental preservation. The adoption of this technology can contribute significantly to the sustainability of beef cattle, turning challenges into opportunities and promoting a more balanced and efficient production model. Continuing these efforts can pave the way for more sustainable farming practices in the future.

Keywords: Sustainability. Waste Management. Biogas. Biofertilizers. Good Agricultural Practices.

INTRODUCTION

Beef cattle production is a crucial component of the global agribusiness, providing essential protein for the human diet. According to Cepea (2023), beef production in Brazil reached a record 8.91 million tons in 2023, an increase of 11.2% compared to 2022. This places Brazil as one of the main beef producers in the world, with an industry that is both quantitative and qualitative, with technological and sustainable facilities that guarantee more quality, waste reduction and maintenance of animal welfare.

However, despite this significant growth, the industry faces considerable environmental challenges, especially when it comes to waste management. With the growing discussions about carbon credits and climate change, the need for good agricultural practices and sustainable innovations in agribusiness, the agro-industrial market has been urgently seeking new sustainable solutions. In this context, the construction and operation of a biodigester in a cattle confinement system emerges as a promising strategy for the proper management of waste and for the generation of new revenues for the property, with biogas and biofertilizers, closing a cycle of energy autonomy (Carvalho and Zen, 2017).

The agricultural confinement system produces a significant amount of waste, bringing with it a health problem that can transmit diseases to humans and animals. Biodigesters, when correctly designed and implemented, can transform waste into valuable resources, closing the nutrient loop and minimizing waste (Fernandes, 2021). During the finishing phase, the confinement system becomes a favorable scenario to deal with the waste produced by beef cattle. The implementation of technologies such as the biodigester in this context brings considerable benefits to producers and the national livestock sector. These advantages include the transformation of cattle manure into biogas and biofertilizers, which helps to reduce the amount of solid waste while minimizing negative environmental impacts. In addition, this practice provides an opportunity for diversification of revenues on the property.

From the anaerobic digestion of cattle manure, biogas is produced, a versatile energy source that can be used for heating, electricity generation or as an alternative to conventional fuels. This contributes to meeting the energy needs of the property, reducing energy costs (Lins, Furtado and Mito, 2022). The use of biogas as a substitute for fossil fuels not only contributes to the reduction of CO2 emissions, but also plays a crucial role in decreasing methane, a potent greenhouse gas. This benefit is particularly relevant in the context of the management of waste from various sources, especially animal waste. (Manso and Mendes, 2007 and Silva 2024).

The solid waste resulting from the digestion process, called digestate, is a nutrient-rich organic fertilizer that can be applied in agriculture, strengthening soil sustainability and reducing dependence on chemical inputs (Nicoloso, 2019). The implementation of biodigesters and other sustainable practices not only improves the image of the property in society, but also adds value to agricultural products and strengthens the producer's competitiveness in the market.

However, the widespread adoption of this technology faces challenges, such as high upfront costs, the need for specialized technical knowledge to operate the system, variation in biogas production, and the logistical complexities associated with collecting and transporting manure on medium and small properties (Lins, Furtado, and Mito, 2022).

The objective of this paper is to examine the application and impacts of the implementation of biodigesters in beef cattle confinement systems in Brazil, highlighting the transformation of waste into valuable resources, such as biogas and biofertilizers, and discussing the challenges and opportunities associated with this sustainable practice.

METHODOLOGY

This study employed a methodology that encompasses a systematic literature review, based on the principles of the PRISMA methodology (Galvão, 2015), and a documentary analysis. The theoretical research covered academic literature from several decades, with research sources in English and Portuguese obtained through the Google Scholar database. The keywords used were "waste treatment in beef cattle confinement". Due to the lack of sufficient results, the search was expanded to "beef cattle confinement" in the period from 1980 to the present date, resulting in 177 publications.

In addition, databases from renowned research institutions, such as Itaipu, Embrapa and Emater, as well as websites of biodigester companies throughout the country, were consulted. Initially, 50 publications were selected based on reading the abstract or introduction. After a more careful analysis, 24 of these publications were chosen for a more detailed reading. The selected publications cover a period from 1980 to the current year 2024. This methodology enabled a comprehensive and current analysis of the most recent practices and technologies in the field of waste treatment in livestock, the use of biodigesters and the interrelationship of both in beef cattle feedlots.

In addition to the literature review and documentary analysis, empirical analyses were carried out on two farms located in the state of Paraná, Brazil. The first farm is located in Cascavel and the second in Leópolis, both in the state of Paraná. These field analyses allowed the direct observation of waste treatment practices and the use of biodigesters in

beef cattle feedlots, providing complementary and practical data that enriched the theoretical research. The information collected on the farms was compared with the data obtained in the literature review, allowing a more comprehensive and detailed evaluation of the technologies and practices used in the treatment of waste in livestock.

The empirical analyses involved visits to the farms, where the waste management practices and the operation of the biodigesters were observed. Data were collected on the amount of waste generated, the efficiency of biodigesters in the production of biogas and biofertilizers, and the challenges faced in the implementation and operation of these systems. The field observations were complemented by interviews with the owners and operators of the farms, providing a practical and detailed view of the technologies and practices used.

DEVELOPMENT

CURRENT PERSPECTIVES OF BRAZILIAN CATTLE FARMING

The cattle farming scenario in Brazil presents significant challenges that demand innovative and sustainable solutions to ensure the economic and environmental viability of the sector. As highlighted by Lopes, et al (2022), the search for more sustainable agricultural practices has become a priority, in response to the growing demands for responsible food production. In this context, the adoption of technologies such as biodigesters in beef cattle confinement systems emerges as a promising strategy to minimize negative environmental impacts, while promoting the generation of renewable energy and biofertilizers.

With a critical look at the current situation of cattle farming in Brazil, opportunities are identified to integrate sustainable practices that not only meet the needs of the industry, but also contribute to the mitigation of adverse effects on the environment. According to Menezes, et al. (2023), the implementation of effective waste management systems, such as biodigesters, can not only reduce the carbon footprint of livestock activity, but also boost the energy autonomy of properties and favor soil fertility through the use of biofertilizers resulting from the anaerobic digestion process.

HANDLING OF TWO BEEF CATTLE DEPOTS

Beef cattle generate waste that needs to be properly managed to avoid negative environmental impacts. Waste from beef cattle farming involves feces, urine and food scraps. These wastes have recycling potential, but need treatment to avoid environmental damage due to the high levels of BOD and COD (Biochemical Oxygen Demand and

Chemical Oxygen Demand) present, as pointed out by Ramasamy and Abbasi (2000) and Ramasamy et al. (2004).

Responsibly managing beef cattle manure is essential to mitigate their environmental impact. In many cutting properties, manure management is carried out in solid form, by scraping the floor of the facilities, resulting in manure with approximately 15 to 20% total solids (TS) (Fulhage, 1997). Unlike countries with large herds in feedlots, in Brazil, the predominance is extensive breeding and smaller herds, which can facilitate the issue of proper waste management (Xavier, 2005).

According to Xavier (2005), the factors that influence the amount and composition of manure include the production system, climate, animal weight, physiological state and production level. The variation in animal feed also plays an important role in the composition of manure. Nutritional strategies aimed at feed efficiency are essential to minimize economic and environmental losses related to the nutrients present in waste (Xavier, 2009).

The concern with the proper management of beef cattle manure extends to avoid environmental contamination. As in dairy farming, manure contains biological agents that can cause damage to human and animal health, in addition to representing economic losses (Chadwick et al., 2008). Therefore, measures such as the proper treatment of waste and the prevention of direct application to the soil are essential to avoid contamination of the environment and ensure the health of surface and groundwater (Oliveira, 2011).

The management of cattle manure continues to be a relevant concern, as evidenced since the early 2000s. With the increase in livestock production and the concentration of animals on farms and feedlots, proper waste management has become crucial to mitigate environmental impacts (Costa and Zenatti, 2023). In this context, biodigesters emerge as a promising solution. These systems convert waste into biogas, a renewable energy source, and biofertilizers, reducing waste and providing valuable resources for agriculture (Matos, 2016).

FUNCTIONING AND BENEFITS OF BIODIGESTERS

The biodigester is a system that plays a key role in the anaerobic degradation of biomass, resulting in the production of biogas and biofertilizers, essential resources to promote environmental and energy sustainability. As mentioned by Barrera (1993), the biodigester consists of a closed chamber where methanogenic bacteria degrade organic matter, releasing methane gas as the main component of the biogas. This simple and

efficient technology contributes to the valorization of organic waste and the generation of renewable resources.

The benefits arising from the installation of a biodigester on a small rural property are numerous and positively impact several activities (Silva, Porto and Silva, 2024). The use of biogas reduces or eliminates the need to remove firewood from nearby forests, preserving the environment and preventing problems such as soil erosion, pest proliferation and ecosystem imbalance. In addition, the production of biofertilizers stimulates agriculture, improving soil fertility and increasing the quality of crops, as highlighted by Costa, Silva and Gomes (1985).

Replacing cooking gas with biogas results in financial and environmental savings, eliminating costs with transportation and storage of fossil fuels, in addition to providing a more hygienic and sustainable option for food preparation. The application of the biodigester is not restricted only to animal waste, but may also include human excrement, which contributes significantly to improving hygiene and sanitation in rural areas, as highlighted by Gaspar (2003).

In addition to the benefits linked to cost reduction and environmental preservation, the use of biogas in various daily activities, such as lighting, water heating, and equipment activation, demonstrates the versatility and energy potential of this renewable resource. The production of biofertilizers is also crucial for the development of agriculture, providing an organic fertilizer rich in nutrients and contributing to the sustainability of crops, as highlighted in Tolmasquim (2007).

In the state of Paraná, the implementation of biodigesters on farms dedicated to beef cattle has proven to be an effective strategy for sustainable waste management and renewable energy generation. The facilities, such as those at Fazenda Santa Alice in Leópolis - PR and Fazenda São Domingos in Cascavel - PR, are pioneers in the conversion of cattle waste into biogas and biofertilizers, exemplifying a circular economy model that values by-products and minimizes environmental impacts. The energy production of these systems reaches an average of 1.5 kW per animal per day, as reported by the farms, evidencing a significant contribution to the energy self-sufficiency of the farms.

In the farms analyzed, the integration of sustainable practices with beef cattle is evidenced by accurate environmental monitoring and efficient biogas production. The collection of climate data, carried out monthly, is essential for understanding the environmental conditions that directly influence agricultural production and energy generation. The data, which includes average temperature, relative humidity, precipitation

and solar radiation, are obtained via the internet from the nearest weather station, thus ensuring the accuracy of the information.

Biogas production is monitored through a computerized system that records the average energy generation in kWh/day, correlating it with the climate variables collected. This system allows a detailed analysis of the energy performance of the biogas produced from cattle manure. The estimated biogas production per animal is a determining factor in the farm's operating costs. It is estimated that each animal produces an average of 1.5 kW per day, contributing to a total production of 650 kW/day in a feedlot of 450 animals. This production is converted into energy by a motor adapted to biogas, operating 10 to 12 hours a day with a capacity of 60 kW/hour.

In addition, the transformation of waste into solid and liquid biofertilizers enhances soil fertility and agricultural productivity, reinforcing environmental sustainability. However, challenges such as corrosion of equipment by hydrogen sulfide gas, the need for qualified personnel for operation and maintenance, and the complex logistics of livestock management and leachate treatment require attention and careful management. The experience of these farms demonstrates that, despite operational obstacles, the integration of biodigesters into beef cattle is a promising approach that offers substantial benefits for crop production and environmental preservation, paving the way for more sustainable farming practices in the future.

INTEGRATED WASTE MANAGEMENT IN LIVESTOCK: THE VITAL ROLE OF BIOGAS PRODUCTION IN MITIGATING GREENHOUSE GAS EMISSIONS

The efficient management of livestock waste, especially in relation to biogas production and the mitigation of greenhouse gas emissions, is vital for the environmental sustainability of the sector. The energy use of biogas from the organic decomposition of animal waste can be a solution both for generating energy in isolated farms and for reducing environmental impact. Companies in the poultry and pig farming sectors have already adopted this practice, transforming their waste into biogas and, later, into energy (Lora and Venturini, 2012).

Considering the national scenario, where the agricultural sector is responsible for a significant portion of greenhouse gas emissions in Brazil, the use of biodigesters to treat waste such as animal waste can be an effective strategy. It is estimated that this practice can reduce emissions by up to 40%, contributing to the mitigation of environmental impact and representing an opportunity to reward the sector due to the benefits for the environment (Lins, Furtado and Mito, 2022).

Another factor is that when integrating biogas production with cattle farming, it is important to consider the biogas production capacity from the different types of animal waste. Among the herds evaluated, cattle and horses stand out for the amount of manure produced daily, presenting a significant potential for biogas production. In general, biomass from pigs shows a higher yield in biogas production, followed by cattle manure. The animals' diet and the environment in which they are stable also influence the concentration of methane present in the gas produced (Colatto and Langer, 2011).

Integrated waste management in livestock involves not only the production of biogas, but also the consideration of environmental variables that influence the efficiency of the process. The seasons, for example, play a crucial role, as lower temperatures in winter can reduce microbial activity and, consequently, biogas production. On the other hand, summer can accelerate organic decomposition, increasing methane production (Lins, Furtado and Mito, 2022). Therefore, it is essential to develop strategies that optimize biogas production throughout the year, considering seasonal fluctuations and their impacts on the microbiology of biodigesters.

In addition, animal feed is a determining factor in the composition of manure and, therefore, in the production of biogas. High-protein diets tend to result in waste with higher potential for methane production, while high-fiber diets can suppress the activity of methanogenic bacteria (Alves, 2016). Understanding these interactions is essential to maximize the efficiency of biodigesters and minimize environmental impacts, contributing to a more sustainable livestock farming.

RESULTS AND DISCUSSION

The critical analysis of the current situation of cattle farming in Brazil reveals opportunities to integrate sustainable practices that meet the needs of the industry and contribute to the mitigation of adverse effects on the environment. The adoption of biodigesters in beef cattle confinement systems emerges as a promising strategy to minimize negative environmental impacts, while promoting the generation of renewable energy and biofertilizers. Effective waste management through biodigesters can reduce the carbon footprint of livestock activity, boost the energy autonomy of properties and favor soil fertility.

As observed in the farms visited, the implementation of biodigesters, however, presents challenges, such as the initial installation costs, the need for technical training for operation and maintenance, and the proper management of waste and by-products. It is

essential that public policies and financial incentives are implemented to support rural producers in adopting this technology.

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maximize the efficiency of biodigesters and minimize environmental impacts, contributing to a more sustainable livestock farming.

Biogas production not only contributes to the reduction of greenhouse gas emissions, but also offers a renewable energy source that can be used in various activities on the farm (Menezes et al. 2023). The energy generated can be used for heating, lighting, and powering equipment, reducing dependence on non-renewable energy sources and farm operating costs.

The implementation of biodigesters also promotes the circular economy, where waste is transformed into valuable resources, closing the cycle of production and consumption in a sustainable way. The production of biofertilizers from animal waste improves soil fertility and agricultural productivity, reducing the need for chemical fertilizers and promoting more sustainable agricultural practices (Matos 2016).

In summary, integrated waste management in livestock, with a focus on biogas production, is an effective strategy to mitigate greenhouse gas emissions and promote the environmental and economic sustainability of the agricultural sector. Continuing these efforts and conducting more research could pave the way for more sustainable farming practices in the future.

CONCLUSION

This study examined the application and impacts of the implementation of biodigesters in beef cattle confinement systems in Brazil. The transformation of waste into valuable resources, such as biogas and biofertilizers, contributing to the sustainability of beef cattle was highlighted. However, challenges such as the need for qualified personnel for operation and maintenance, corrosion of equipment by hydrogen sulfide gas, and the complex logistics of cattle management and leachate treatment were identified.

Despite these challenges, the integration of biodigesters into beef cattle is a promising approach that offers substantial benefits for crop production and environmental preservation. The adoption of this technology can contribute significantly to the sustainability of beef cattle in Brazil, transforming challenges into opportunities and promoting a more balanced and efficient production model. Therefore, the implementation of biodigesters in beef cattle confinement systems meets the objective of this study.

The results obtained in this research can help society and academia by providing concrete data on the benefits and challenges of implementing biodigesters in beef cattle. This data can be used to develop more sustainable public policies and agricultural

practices, promoting the environmental and economic sustainability of the agricultural sector.

RECOMMENDATIONS FOR FUTURE WORK

To expand knowledge about the implementation of biodigesters in beef cattle, it is recommended that future studies explore the application of this technology in different regions of Brazil, considering the climatic and operational variables specific to each location. In addition, it is important to investigate new technologies and practices that can complement the use of biodigesters, as well as to assess the long-term economic and social impact of implementing this technology in beef cattle. Continuing these efforts can pave the way for more sustainable farming practices in the future.

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YELLOW FEVER: A WORD THAT EVOKES MEMORIES OF SUFFERING IN ITALIAN IMMIGRANTS FROM BRAZIL

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ABSTRACT

Yellow fever is still one of the most widespread diseases in tropical countries. Thanks to the discovery of a vaccine, which occurred in 1937, the number of deaths due to this disease reduced enormously. However, by the time mass vaccinations began, it had caused numerous epidemics and killed hundreds of thousands of human beings. European immigrants who arrived in Brazil were exposed to this disease, and in many cases it tragically interrupted the hope of a better future. The main objective of this work is to show the importance of yellow fever in the collective imagination of Italian immigrants who came to Brazil. In the first part of our work, we will show a brief history of this disease and its current diffusion. Subsequently, we will see, through historical reports and documents, the impact that this disease had on the migratory movements of Italians who came to Brazil, and how it marked their collective imagination, leaving memories of fear and suffering.

Keywords: Yellow fever. Immigration. Italian immigration. Immigration in Brazil.

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INTRODUCTION

Yellow fever – also called *yellow typhus*, *icteroid typhus, American typhus* or even *black vomit* (alluding to a characteristic symptom of the disease) – is an acute infectious zoonotic arbovirus, caused by the yellow fever virus, known scientifically as *Arbovirus*, of the genus *Flavivirus*, family *Flaviviridae*.

In Brazil, the transmission of yellow fever occurs in different ways, depending on the environment, that is, in the city "the transmitter of the disease is the *Aedes aegypti mosquito*, the same as dengue. In the forests, yellow fever occurs in monkeys and the main transmitters are mosquitoes of the genera *Haemagogus* and *Sabethes*, which preferentially bite these primates" (ABC DA SAÚDE, 2008); man can be infected by a mosquito that has bitten a sick monkey, but wild yellow fever usually occurs when man is in the monkeys' habitat.

The yellow fever vaccine brought the epidemics of this disease, which decimated thousands of Brazilians in the second half of the nineteenth century and the first half of the twentieth century, to end and, until recently, the population no longer lived the terror of this disease (FRANCO, 1976). In 2007, however, some cities in the Brazilian Midwest once again experienced the fear of the return of a yellow fever epidemic. The health centers were almost invaded by the population, who queued waiting to be served. This picture of despair occurred throughout Brazil, even in regions that were not considered at risk.

The situation was controlled by the health authorities, but this feeling of fear, coming close to psychosis, finds an explanation in the roots of the history of Brazil, particularly at a time when immigrants arrived en masse. The literature on the history of Italian immigration in our country is marked by allusions to this public health problem, which came to modify the destiny of several people and even entire colonies. Many historical studies on Italian colonization in Brazil address the problem and, above all, the despair experienced by these immigrants. The simple lexical unit yellow *fever* evokes, in older people, frightening memories or, in younger people, transmitted by relatives who lived at the time of the epidemics.

In this work, we present elements of the history of yellow fever and Italian immigration in Brazil and proceed to a study on the reminiscences, in the collective unconscious of this population, of fear and suffering in relation to the yellow fever epidemics that occurred in our country. Economic aspects will also be analyzed, as they were at the base of the main problems that immigrants experienced in Brazil.

ELEMENTS OF THE HISTORY OF YELLOW FEVER IN THE WORLD AND IN BRAZIL

Yellow fever is a very old disease and was first identified in 1648 in Guadeloupe and Yucatan. This disease hovered like a ghost over every vessel that crossed the Atlantic Ocean, linking Africa to the Americas during the seventeenth century.

The migratory movement towards the Americas facilitated the proliferation of the mosquito vector of the disease, repeating a process that was not new to humanity:

> Historically, we know that population movements accompany the transmission of diseases. Prof. Giovanni Berlinguer recalls how this issue occurred in a dramatic way, for example, with the conquest of America, an event that caused the microbic unification of the world. The whites "exported" smallpox, measles and influenza, which immediately caused devastation in that population that, not knowing the causal agents, did not have specific immune defenses. From America, the conquistadors "imported" syphilis and this caused in Europe (particularly in Spain, France and Italy) an epidemic that lasted many years and was acute and lethal. Another migration of peoples (and agents of infection) occurred from the 1600s onwards, when black slaves deported in the Americas saw the spread of yellow fever. In this case, a dramatic evolution also occurred, although less slow for a biological reason: the disease is not transmitted by breathing, skin or sexual contact, but through an insect vector, the *Aedes aegypti* mosquito. With the slave ships that crossed the Ocean arrived not only diseases, but also mosquitoes, which took some time to adapt to the new world and reproduce in sufficient numbers to be able to reach the appropriate density to determine the appearance of the disease. (GERACI, 2006, p. 19)[3]

In 1848, American physician Josiah Clark Nott (1804–1873) was the first to be convinced that yellow fever was spread by mosquitoes, but the first to present a scientific theory about the transmission of the disease was Cuban physician Carlos Juan Finlay (1833–1915). During the Cuban-American-Spanish War (.....-1898), yellow fever became such a problem that U.S. authorities created the Yellow Fever Commission, headed by military surgeon Walter Reed (1851-1902). The work of this Commission finally proved that it is really a mosquito that transmits the disease and described the contamination process (WHO, 1989, p. 13).

In the different countries of tropical America, several epidemics devastated cities and turned entire villages into deserts, even reaching the United States. In the eighteenth and nineteenth centuries, this country was the scene of yellow fever epidemics: 20 in Philadelphia, 15 in New York, 8 in Boston and 7 in Baltimore, having strongly affected the industry and commerce of the time (WHO, 1999, p. 12).

In Brazil, there are many historical records of epidemics, but, according to the Oswaldo Cruz Foundation, those with the greatest impact, especially because they affect large urban centers with high population density, occurred from the mid-nineteenth century onwards:

[3] Our translation from Italian.

> Witnesses related the outbreak of the epidemic that broke out in the mid-19th century in the capital of the Brazilian Empire to the arrival of a slave ship from New Orleans, which had made stops in Havana and Salvador before docking in Rio de Janeiro, on December 3, 1849. In February 1850, yellow fever had taken hold of the city and had already spread to the beaches of Mineiros and Peixe, Prainha, Saúde and beyond. According to estimates, it affected 90,658 of the 266,000 inhabitants of Rio de Janeiro, causing 4,160 deaths, according to official data, or up to 15,000 victims, according to unofficial accounting. (FIOCRUZ, 2008)

This was only the first major epidemic recorded in Brazil, but yellow fever was raging throughout the national territory and new large epidemics returned to haunt the then capital of the Empire. In fact, in 1873 Rio de Janeiro recorded 3,659 deaths from yellow fever and, three years later, another 3,476, in a population that was around 270 thousand inhabitants (FIOCRUZ, 2008).

Under the baton of hygienist Oswaldo Cruz, already in the Brazilian Republic, the fight against yellow fever, smallpox and other diseases began. However, Public Health measures alone were not enough, but these were closely linked to the need for a total reformulation of urban life, involving architecture, urbanism and popular education:

> The hygienists then began their program, which included a wide repertoire of actions aimed at reforming both the city's natural landscape and the practices, habits and creations of its residents. They highlighted most of the Gordian knots that the engineers would try to untie. The city built without method and without taste should be submitted to a rational plan that would ensure the removal of the poor from the central area, the expansion to more salubrious neighborhoods, the imposition of norms to make the houses more hygienic, the streets wider and straighter, etc. (...). The first urban plan for Rio de Janeiro was then prepared by an Improvement Commission. The sanitation of the soil and the drainage of the subsoil of Rio de Janeiro were, therefore, the measures considered most urgent among those voted at the Second National Congress of Medicine and Surgery, in 1889, to clean up the Brazilian capital. (FIOCRUZ, 2008)

Conditions in Rio de Janeiro improved considerably with these measures, with the guidelines of the sanitary physician Oswaldo Cruz and his team always at the forefront of the modifications. The twentieth century was entered with the conviction that epidemics, especially in the large urban centers of the time, were under control and that the national situation showed considerable improvements. New variables emerged, however, further complicating the yellow fever scenario in Brazil:

> Viscerotomies and immunity tests carried out in various regions of the country confirmed the evidence that the disease was a more complex problem than previously imagined. Masses of people displaced by internal migrations were transporting the virus to the coast and multiplying the infection of non-immune people in large cities, which would fatally result in the recreation of an epidemic situation as serious as that of the 19th century. The Revolution of 1930 changed the institutional bases of the campaign, which began to be directed against the two modalities of yellow fever, urban and wild. It acquired national coverage under the direction of the Rockefeller Foundation.

> An increasing number of elements have been incorporated into the yellow fever imbroglio. It had started with a few coastal centers, a single vector, a clear correlation of litigants, and began to incorporate numerous inland cities, more vectors, new ecological scenarios, an undetermined number of potential hosts and a succession of vaccines, which would culminate, in 1937, in the one in use until today, made from the 17D virus. (FIOCRUZ, 2008)

Despite the difficulties, the fight against yellow fever was fought insistently and precautionary measures were taken, including mass vaccination, which has been available in Brazil since 1937. In 1958, the 15th Pan American Sanitary Conference, held in Puerto Rico, recognized that Brazil had total control over yellow fever and that the *Aedes aegypti* mosquito had been eradicated from its territory. The excess of self-confidence turned into recklessness, having given rise to epidemics of another disease, also transmitted by *Aedes aegypti*:

> In the following years, the number of personnel engaged in the campaign against yellow fever was drastically reduced. The efficient system structured by the Rockefeller Foundation and maintained by the National Yellow Fever Service was gradually unraveling. In 1967, the Aedes aegypti reappeared in Pará. The following year, it was also found in Maranhão; in 1976, in Bahia. The country was unequipped to face the problem, and the mosquito was reconquering its primitive territory: it arrived in the cities of Rio de Janeiro and Natal in 1977; to Santos in February 1980; It would be present in 226 municipalities six years later, when it burst into the headlines of the newspapers as the protagonist of a "new" type of urban epidemic, dengue. (FIOCRUZ, 2008)

Today, dengue is a serious problem faced by the population, more serious than yellow fever. This continues to be a problem, but infinitely in smaller proportions than in ancient times in Brazil. There are outbreaks, but they are controlled and the number of victims is not even comparable to those previously recorded: in 2000, for example, 85 cases were registered, of which 40 died (FORMENTI; SANTOS, 2008).

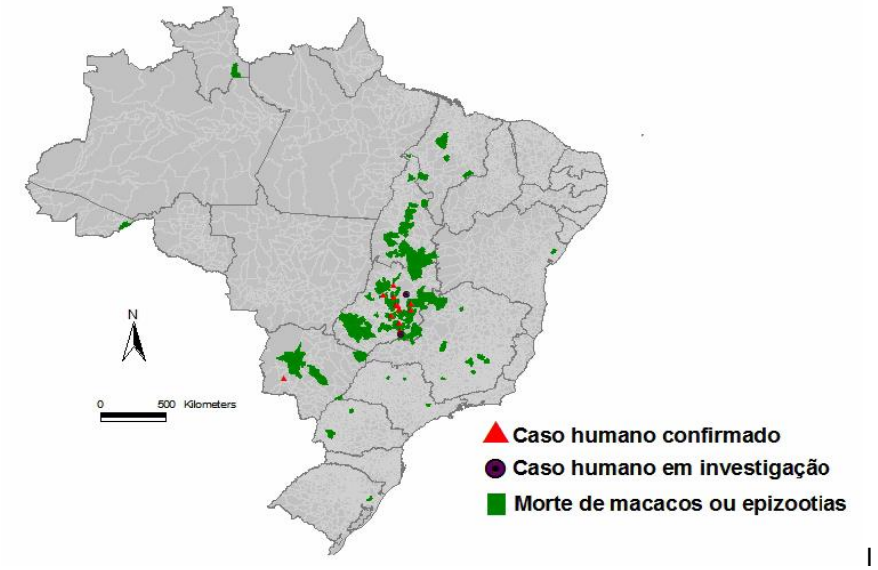
In 2007, yellow fever came back to haunt Brazil, but in many states no cases were recorded; in others, cases occurred after a few years without problems, such as in São Paulo:

> The State of São Paulo recorded the first death from yellow fever in the last eight years. The victim is a bricklayer from Cravinhos, in the region of Ribeirão Preto, who died last April, but only now have the tests confirmed the disease. A second suspected case of death from yellow fever is being investigated in Rincão, also in the Ribeirão region. (FOLHAONLINE, 2008)

The geographic distribution over the Brazilian territory of cases of wild yellow fever that turned into humans between 2007 and 2008 shows that the problem was restricted to some states and isolated cases or in small numbers were recorded in others, as shown in

the map of the yellow fever outbreak below, prepared by the Brazilian Ministry of Health (MS-SVS, 2008):

Figure 1: Distribution of municipalities with records of monkey deaths, epizootics due to yellow fever and human cases (Dec./2007 to Jan./2008)



Source: Brazilian Ministry of Health (MS-SVS, 2008)

Preventive measures were quickly taken by the health authorities, especially with regard to vaccination:

> From December 2007 to date, 10,056,000 doses of yellow fever vaccine have been distributed to 27 federated units and 6,207,830 doses have been applied, of which 5,677,254 doses were applied in January. Partial data received from the Federal District and Goiás indicate that 1,376,230 and 2,022,917 doses of yellow fever vaccines were administered in December and January, respectively. The criteria for the distribution of vaccines have strictly observed the occurrence of human cases of sylvatic yellow fever and epizootics due to sylvatic yellow fever and the data on vaccination coverage, according to the parameters referred to below. (MS-SVS, 2008)

In other times, especially in the nineteenth and twentieth centuries, among the population attacked by yellow fever, there was a very high number of foreigners, generally immigrants who had recently arrived in Brazil, as we will see later. The picture has changed considerably since then, not only with regard to the occurrences of yellow fever but also with regard to the number of foreign victims. In the 2007 outbreak, only one case was recorded:

> The Spaniard Salvador Peres de la Cal, who died on the 12th, would have been contaminated on a farm in Cristianópolis, 103 km from Goiânia. He arrived in the country on November 25, passed through Salvador and, in December, arrived in Goiás. (FORMENTI; SANTOS, 2008).

Although human cases of yellow fever were restricted to a few Brazilian states and measures were quickly taken, the population of Brazil panicked and went to health centers to get vaccinated, even though their region did not present a danger. The collective panic created difficult and even conflicting situations, as huge queues formed at health centers, which generated fatigue and irritation in many who wanted to get vaccinated. The doses available were not always enough for the number of people who showed up and the protests in front of these places sometimes generated confusion, which was controlled by the police forces. Hospitals and blood banks resented the situation of collective panic, since a vaccinated person cannot donate blood immediately, needing to wait a few days to do so. Thus, blood reserves for surgery and emergency care were close to zero.

This picture demonstrates the collective hysteria of the population in the face of a ghost of yellow fever that hovers over the collective memory and unconscious of a people that has known desperate epidemics of this disease throughout its history.

YELLOW FEVER AND ITALIAN IMMIGRATION IN BRAZIL

Throughout the nineteenth century, several yellow fever epidemics occurred in Brazil, at the same time that the doors of our country were opening to immigration and Italians were arriving en masse. These immigrants – as well as the other inhabitants of Brazil – were victims of these epidemics.

The literature on the history of Italian immigration in Brazilian territory frequently refers to the problem and describes several testimonies of the serious situation faced by immigrants in the different regions of Brazil.

Rio de Janeiro was the city that suffered the most from epidemics caused by mosquitoes, especially smallpox and yellow fever. The ships crammed with Italian immigrants had, for the most part, as their immediate destination after crossing the Atlantic, the port of Santos and the capital of Brazil. Within this context, it is normal that Italian immigrants have had the unpleasantness of contact with yellow fever as soon as they arrived in Brazil, bringing consequences not only for the lives of these populations but also for future migratory waves. An episode that even harmed the Brazilian policy of attracting Italian labor was the following:

> In 1895, 240 crew members of the frigate "Lombardia", visiting the city, fell under yellow fever. In one week, 144 of them died, including the ship's commander. How to call immigrants (then official state policy resumed by the 1889 regime), to come to Brazil with that? Still, any more energetic action was postponed. (SHILLING, 2018)

Foreigners living in Rio de Janeiro were the main victims of the disease, mainly due to their lack of previous contact and, consequently, lack of biological immunity. In fact, in the period from 1890 to 1903, 23,000 people died in this city because of yellow fever and 88% of the deaths were of foreigners, mostly immigrants, among them, a large number of Italians (TELAROLLI JUNIOR, 1996, p. 267). The situation provoked protests from immigrants and even Italian authorities:

> In 1886, shortly before the beginning of the mass migration, the Italian Ministry of the Interior issued a circular to the country's mayors expressing itself against the shipment of Italians to Brazil, especially to the province of São Paulo, pointed out as one of the "most unhealthy and inhospitable in the Empire" (Hutter, 1972, p. 118). In 1888, the Hospedaria dos Imigrantes came to house nine thousand people, as a result of the difficulty of the São Paulo provincial administration in efficiently distributing those arrived in Santos throughout the countryside. As a consequence of this large crowd, on that occasion there was an outbreak of yellow fever in the inn and several foreigners died, with immediate repercussions in Italy. (ALVIM, 1986; TELAROLLI JUNIOR, 1996, p. 270)

In 1889, the Italian government prohibited emigration to Brazil as a measure to defend its citizens against the yellow fever that was raging in Rio de Janeiro. This prohibition caused a reduction in the entry of immigrants from that country between that year and 1890, but, as the economic reality of Italy left no other way out for the poor population of that country, the flow of immigration never stopped completely and the prohibition decree was revoked in 1891.

In the state of Espírito Santo, the immigrants who had just arrived found themselves facing a desperate situation:

> The yellow fever epidemic that devastated the nucleus of Santa Cruz is one of the darkest chapters of Italian immigration in Espírito Santo. The outbreak of the disease coincided with the felling of the forests, when the insects descended from the canopies to the ground. In March 1878 it was at its peak. The settlers began to have victims in October of the previous year and from then on the disease reached frightening rates, so that, by the end of 1878, there were more than 200 deaths. From the ship Clementina 111 people died, in a ratio of one in four. No family was spared and no one in the colony failed to contract yellow fever. All available quinine sulfate was ordered from the Santa Leopoldina nucleus. It is not true that the colonists were abandoned to their fate. From the beginning, a doctor accompanied the immigrants. What there was was a delay in medicine and its resources. Today, the carelessness of medical care is accused, but it was nothing other than a result of the cultural backwardness of Brazilian society. With the death of the head of the family, the woman either returned to Italy or married a widower, under the same conditions. When the couple died, the orphans were distributed among the other families. Often relatives from Italy requested, through the consular representative, the repatriation of the minors. (BUSATTO, 2008)

Thus, entire families were left unstructured with the deaths caused by yellow fever and other diseases, which began to generate revolt among immigrants. In fact, in 1893, the Italians who were still on the ships arriving from Italy rebelled against the authorities'

intention to install them in the New Leocadia Colony (today New Venécia), since this locality was heavily attacked by the yellow fever mosquito. In 1895, Italian immigration to that state was officially prohibited.

Once they arrived at Brazilian ports, notably the ports of Vitória do Espírito Santo and Rio de Janeiro, the immigrants were sent to different locations in Brazilian territory. The displacement of these cities was made sometimes by land, towards the interior of these states or others, sometimes by ship, to more distant states:

> Landing in the city of Rio de Janeiro, [the Italian immigrants] were not well received by the local bourgeoisie and yellow fever continued to cause victims. Thus, a large number of immigrants spread throughout the internal areas of the State of Rio de Janeiro and also through other states, reaching Valença and the region of the middle Paraíba, region of the marquises and coffee barons, to work in the coffee plantations and in the construction of the railroad, according to the interests of the nobility, that called for a new demographic policy and needed labor to replace black slaves. (SAVASTANO, 2008)[4]

Thus, the trip did not always end in the first Brazilian city where they landed. In fact, ships were often re-embarked for the south of Brazil. These trips offered no better conditions than those already experienced by immigrants crossing the Atlantic and diseases were also factors of suffering:

> Yellow fever and plague often decimated hundreds of people, as happened with the Brazilian steamship "Pará", 5which in a single trip had 39 deaths on board, almost only children, victims of measles. The immigrant throws himself on the bed with his clothes and shoes; it deposits packages and suitcases in it: children dirty it with urine and feces; all, or almost all, abandon their vomit there. After a few days of travel, it resembles a kennel bed. At the end of the crossing, when it is not changed – something that rarely happens – it remains as it was left: filthy and a nursery of insects, ready to receive a new customer. (GRANVILLE, 2008)

Rio Grande do Sul was, at least for a while, a refuge for immigrants who were desperately fleeing the yellow fever epidemics that were raging in Rio de Janeiro and Espírito Santo, where ships from Italy usually disembarked. There are several personal testimonies, recorded in documents of the time or in *blogs* of families of Italian origin from Rio Grande do Sul. This is the case of Father Domenico Antonio Munari, a native of Gallio, Vicenza, parish priest of the small town of Fastro, province of Belluno, Italy, who, on December 27, 1876, left for Bordeaux, France, accompanying a group of 275 emigrants from *Belluno,* among whom 58 from his small town, managed by a certain Antonio Rech, in order to take the ship that would take them to Brazil to live the dream of a better life. A storm caused the vessel, which was in very bad condition, to sink a few days later near *La*

[4] Our translation from Italian.
[5] This ship transported Italian immigrants from Rio de Janeiro to Rio Grande do Sul.

Rochelle, an important port in western France. Except for one child, all passengers were saved. In April 1877, they left the port of Le Havre for Rio de Janeiro, this time aboard the steamship Portena (BRAVA GENTE, 2008). Father Munari wrote to his fellow Italian parish priests from his arrival in Brazil until his death on March 27, 1878 and his letters constitute, today, historical documents on the living conditions of Italian immigrants in Rio Grande do Sul; "from Italian to Brazilian customs; from the formation of the Gaucho colonies to government policy; from the language of the time to the clearly disillusioned and indignant tone; from hope to challenges; everything is the portrait of a daily life that official history does not always tell us" (BRAVA GENTE, 2008). In the letter written to the Archpriest of *Enego, Vicenza* in 1877, the priest recounts his adventures, mentioning the problem of yellow fever:

> After my unfortunate departure and my shipwreck off the coast of France (a fact known to the whole world) I had the courage and temerity to risk the second experience of crossing the Atlantic, and on April 18, 1877, I left Le Havre aboard the steamer called Portena, which on May 10 (the day of the Ascension of Our Lady), after 3 days of delay between Lisbon and Santa Cruz das Canarias, fortunately it made me touch land in Rio de Janeiro. I stayed there for about 12 days, but since the drought was around there, which with the yellow fever scythe threatened to send me to fertilize the turnips for the gravedigger, I fled, that is, I got on a steamer and went to Rio Grande do Sul; I returned through the canal from Porto Alegre and was sent to the parish of Conde D'Eu, an Italian colony of 4,000 or so inhabitants. Then I was also annexed the Dona Isabel Colony of many other Italians; but considering the impossibility of being able to administer this task, especially with the indifferentism and atheism of the voracious Harpies who lead that unfortunate colony, I presented to the Government my resignation to receive from the Bishop a new parish, as I was promised and await. (BRAVA GENTE, 2008)

In this excerpt from his letter, Father Domenico Munari shows that he resents both yellow fever and the atheism of the Italians who inhabited the colonies under his parish responsibility. Most likely the priest came across the fact already known in the History of Brazil of the installation of anarchist colonies in the territories of the South, authorized by the Emperor.

Many Italians arrived in the State of Paraná, especially Venetian, who began to suffer sanitary problems, among them, yellow fever:

> In March of the same year, some ships arrived from Rio de Janeiro and with them patients with yellow fever. On March 20, the city of Antonina was hit by an epidemic of this terrible disease, which, despite efforts to contain it, quickly reached Morretes and Paranaguá, and the news of the first deaths.
> The New Italy Colony was badly hit by the yellow fever epidemic and the deaths were many. However, other serious diseases claimed the lives of the first immigrants: anemia due to worms that especially affected children, diseases transmitted by mosquitoes that infested that area and by other parasites, less known, such as the bug, which made the life of those pioneers a living hell. (PIAZZETTA, 2007)

Yellow fever was, apparently, only one of the health problems of Italian immigrants in Paraná, although it was one of the most frightening and dangerous.

The epidemics of yellow fever and other diseases in Rio de Janeiro also led the migratory flow to the State of São Paulo: "in a way, the publicized calamitous sanitary situation that characterized Rio de Janeiro for decades collaborated in this process, by repelling and transferring a good part of the immigration flow from that state to São Paulo". (SALLES; SANTOS, 2008, p. 65)

In the State of São Paulo, the proliferation of yellow fever accompanied the path taken by Italian workers towards coffee farms and railroad expansion lines. Thus, economic development, migratory movement and epidemics were not always desirable partners. Telarolli Júnior explains some steps of this process:

> Despite the existence of other epidemiologically significant problems (from the current point of view), the priority of state sanitary action in the early days of the Republic was the control of epidemics, especially yellow fever, which destabilized all political and administrative life, threatening coffee growing activities at different stages, as well as other urban activities. Having had an epidemic incidence in the country for the first time in the eighteenth century (Santos Filho, 1947), yellow fever crossed the natural barrier represented by the Serra do Mar for the first time in 1889, rising from the port of Santos to the Planalto (Studart, 1895). From then on, the disease devastated most of the coffee-growing zone of São Paulo, integrating itself into the nosology of the region, until its temporary elimination from the State, in 1904. The internalization of the disease in 1889 began with two major epidemics, in Campina and Sorocaba. From Santos, cases of the disease were taken to the interior of the state, along with families of foreign immigrants, initiating a succession of epidemics (Franco, 1976). The entry of a large number of foreigners, related to the occurrence of epidemics of communicable diseases, is a process that occurred in several states of the Federation at the beginning of the republican period, with variable demographic and health repercussions.
> Among the large number of victims of yellow fever were foreigners, who were more sensitive to the disease, probably due to the absence of previous contact with the causal agent. The defense of the flow of foreign immigrants, guaranteeing the indispensable labor for coffee, is an aspect of the demographic dynamics that has always been present for the state power, from legislators to health service technicians. (TELAROLLI JUNIOR, 1996, p. 267)

In 1892, Campinas, one of the main cities in the State of São Paulo, was the victim of a strong epidemic of yellow fever, during which 30% of the population died from this disease. The city became known as the phoenix city, for its revival after the outbreak of yellow fever. Among the dead, a large number of Italians (BRASILTURISMO, 2008; VITA MIA, 2008).

For 15 years (from 1889 onwards), the State of São Paulo faced epidemics of yellow fever, smallpox and typhoid: "the most affected regions were Santos, on the coast, the port of disembarkation of immigrants; the coffee cities of the interior, especially in the Central, Paulista and Mogiana regions, and, to a lesser extent, the capital and the valley of the Paraíba" (SALLES, 1996).

Faced with such a great calamity spread across several cities in the state, the political authorities of São Paulo decided to invest in Public Health and began to need a larger contingent of doctors, which was not possible to obtain only with qualified professionals trained in Brazil:

> ... on the one hand, the growth of the city [of São Paulo] due to the continuous flow of immigrants and, on the other, the flourishing of the coffee economy, with the increase in pressure on the demand for labor, forced the State to assume responsibility for subsidized immigration. At the same time, the serious health problems created by population growth and the outbreak of epidemics – including the fear of the spread of epidemics from other regions of the country to the territory of São Paulo – forced the state government to develop a series of public policies in this field, especially after the Republic (Castro Santos, 1993: 372-377,381; Hochman, 1998). This circumstance conferred one of the main characteristics of São Paulo medicine at the time, making São Paulo a pioneer in the policy aimed at public health reforms. This fact conditioned, in turn, the concentration of foreign doctors, mostly Italians, in the capital and in the interior of the state. (SALLES; SANTOS, 2008, p. 66)

The hiring of Italian doctors thus helped in the care of a large part of the population, which identified nationally with them. In this way, immigration was not only made up of unqualified Italian labor to work in the countryside and in Brazilian cities, but also opened up a market for Italian doctors, who would serve, among others, a clientele of compatriots. Italy found itself on Brazilian soil, linking patients to doctors of the same origin.

The strong outbreaks of yellow fever brought despair to the cities of São Paulo because of the disease and deaths, economic problems – as they killed workers on coffee plantations – and even public security problems, involving Italian immigrants. As an example, we can cite the case of the gang of the Calabrian bandit Mangano, who acted with impunity for more than two years in São Carlos:

> We believe that the success of this gang resulted from the combination of two factors, namely, a certain concentration of Calabrians in São Carlos, especially in some neighborhoods of the city, and the yellow fever epidemic between 1896 and 1898, which seriously affected the municipality and neutralized the forces of order. (...)
> The epidemic scared away the wealthiest, disorganized the police and opened space for the gang's action. The advantages of properties without residents and of sick or dead soldiers are evident. In addition, the absence of the elites allowed for a more open action, because the group most likely to collaborate with the police and most interested in denouncing the gang ended up absenting themselves from the city. In this way, the epidemic that spread through São Carlos temporarily provided the bandits with the same impunity that their counterparts in Italy and the United States enjoyed because of the protection of part of the elites or police corruption. (MONSMA; TRUZZI; CONCEIÇÃO, 2006, p. 92)

Thus, as if the fear of death by yellow fever were not enough, the inhabitants of São Carlos suffered from the fear of banditry that met with no opposition due to the situation of social disorganization caused by the disease.

Yellow fever began to find a powerful enemy in 1937, after the discovery of the vaccine based on the 17D virus, which was applied en masse throughout the Brazilian territory. Thus, the new waves of national migration and foreign immigration (among them, Italian), which occurred in the post-World War II period, were no longer faced with the same despair experienced by foreigners who came until the beginning of the twentieth century.

One might think, then, that once the danger of death had disappeared, fear would have disappeared, but what we see is that this feeling has been transformed into memories transmitted from father to son or even expressed by survivors of the time through the modern media. An example is the case of the Brazilian soap opera *Terra Nostra*, authored by Benedito Ruy Barbosa, which told the saga of Italian immigrants in the late nineteenth and early twentieth centuries in the State of São Paulo. The author is from São Paulo and knows the universe of Italians well, since he is the grandson of people who came to "make America" in Brazil. "During my childhood, in the city of Vera Cruz, I lived a lot with the immigrants who lived in the region" (REDE GLOBO, 2008). The author also had the collaboration of the public, who sent him reports of experiences with diseases and near-death situations:

> In order to illustrate the great moments of our century, Benedito used in his research news from newspapers of the time. History enters as a backdrop in the characters' lives, and can interfere in some moments of the plot's daily life. The yellow fever epidemic, for example, which devastated the coffee plantations at the end of the last century, is told. "I will take the opportunity to show the symptoms of the disease, the medicines that were used, the treatment, as well as the scientific research developed in the period in the country and in the world, facts that few know today", he anticipates. In addition to newspapers, the author also creates situations from true stories that he has been collecting for several years." Many people write to me telling facts that happened in their family, sending me documents and even photos of their ancestors. I keep all these memories with great affection and sometimes I use them in my plots". In the very first chapter of "Terra Nostra", Benedito includes one of these real stories in dramatic scenes of the crossing. When the plague takes over the vessel, everyone believes that a baby, son of Leonora (Lu Grimaldi) and Bartolo (Antônio Calloni), is sick and decide that he should be thrown overboard, to avoid contagion. The mother, dissatisfied, hides in the engine room and days later, she is found with little Rosa in her arms, alive and free of the disease. "The one who told me this story and authorized me to put it in the soap opera was a very old lady, who had been, one day, that child", he reveals. (GLOBO NETWORK, 2008)

Thus, it can be seen that the relationship *between yellow fever and Italian immigration – pain, fear and sadness*, although distant, has not disappeared from the conscious or the collective unconscious of the Brazilian population, especially Italian immigrants. The simple pronouncing of the word *yellow fever* brings up memories and hard feelings for many people.

FINAL CONSIDERATIONS

Yellow fever is, unfortunately, still very present today, especially in tropical countries. For Italian immigrants, yellow fever was a great fear, in view of the fact that, until the discovery of the vaccine, epidemics of this disease occurred with great frequency, especially in the city of Rio de Janeiro. Sometimes, death occurred soon after arrival, wiping out entire families. Yellow fever therefore left very important traces in the collective memory of Italian immigrants, and the memory of this historical period and these events appears in letters, reports, newspapers, and books of the time, and continues today in different ways, including in soap operas.

The amount of scientific bibliography found, especially in the form of doctoral theses, master's dissertations and scientific articles on yellow fever and Italian immigration in Brazil, also shows that the theme is still relevant for research works.

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MAINTENANCE OF COLONIES OF *CORNITERMES CUMULANS* (BLATTODEA: TERMITIDAE) FOR PREFERENCE TESTING

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ABSTRACT

Termites are social insects, with differentiated castes for specific functions within the colony, and play an important ecological role, contributing to the recycling of nutrients and soil bioturbation. The species Cornitermes cumulans is known for its economic damage to forest plantations, especially eucalyptus seedlings.

Keywords: Termites. Bioturbation.

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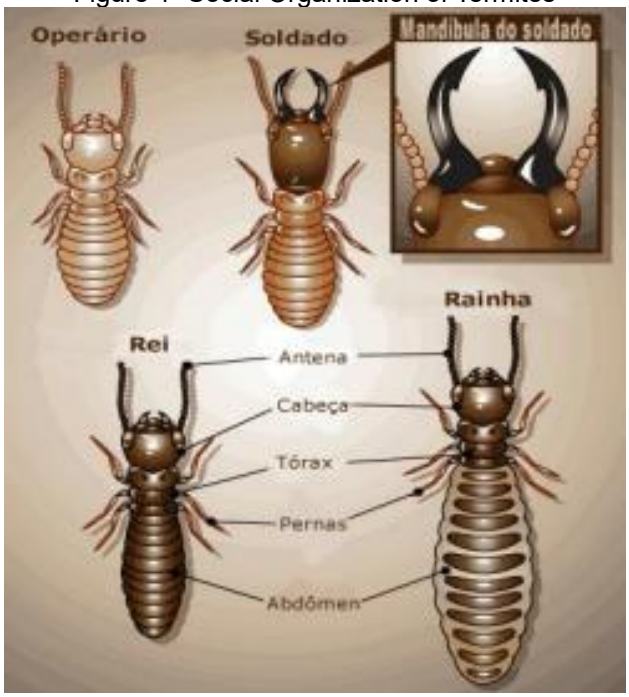
INTRODUCTION

Termites are eusocial insects, they form colonies of individuals with overlapping generations, cooperative care of offspring and division of labor. The social structure of these insects is composed of individuals that develop by paurometabolia, morphologically distinct (polymorphic) and classified into castes with specific functions within the colony (Oliveira et al., 1986).

They were classified as belonging to a separate order (Isoptera), but studies have shown that termites have genetic and molecular similarities to cockroaches, and were included as part of the order Blattodea, with Isoptera being an infraorder or epifamily. Because they are a clearly monophyletic group and the name Isoptera is well established, this terminology is still accepted and can be used to refer to these insects (Constantino, 2020).

In a termite nest three distinct castes are found: 1) Worker caste, the most numerous caste that performs all routine functions such as obtaining food, building and repairing the nest and tunnels, caring for the offspring and providing food to the other castes; 2) Caste of soldiers and are responsible for the defense of the nest and the protection of workers during foraging; and 3) Caste of breeders who are responsible for the generation of new individuals and the multiplication of colonies. According to Costa-Leonardo (2002), among the reproductive individuals is the royal couple, king and queen, who found the nests and remain in them throughout the life of the colony (Figure 1).

Figure 1- Social Organization of Termites



Source: Wilson, T., 2008

Cornitermes cumulans (Kollar, 1932) is a species of termite known as "mound termite" because of the huge termite mounds it builds and its high incidence in pastures, constituting an exception when found in homogeneous plantations with forest species (Perez Filho et al, 2012). In pastures, the term "mound termite" has been associated almost exclusively with this species (Valério et al., 2020).

There are three stages in the development of the termite mound: the initial one, totally underground; the intermediate portion, when a small epigeal portion appears, and the final one, when most of the nest is epigeal. The nest of C. cumulans is fragile and totally underground in the initial stage of growth. Little by little, it emerges at ground level and its surface then becomes resistant and hard (Valério, 2006) (Figure 2).

Figure 2 - Nests of *Cornitermes* sp. in pasture areas of *Brachiaria brizantha*. Parauapebas-PA.



Source: Patrícia Leitão Lima

In areas of natural vegetation, termites play an important ecological role, as they actively participate in the recycling and decomposition of nutrients in the ecosystems where they live. The action of termites can modify the porosity and structure of the soil, improving aeration, which provides greater water infiltration and propagation of plant roots (Costa-Leonardo, 2002).

These activities of digging, building nests, forming tunnels and moving organic matter, called bioturbation, physically alter the soil, which can have important effects on soil structure, nutrient cycling and even ecosystems, so just like ants, beetles and earthworms, termites are called ecosystem engineers.

The basic food of termites is cellulose, but the source of cellulose used varies according to the species (Vasconcellos, 1999). Most species feed on wood in the most varied stages of decomposition, others may feed on humus, lichens, herbivore feces, or fungi grown inside the nests (Medeiros, 2004; Lima and Costa-Leonardo, 2007a; Zorzenon et al., 2011).

However, the feeding habits and damage caused by Cornitermes, in forest nurseries or in transplanted seedlings, are little known (Peres Filho et al., 2012). Termites can feed on wood (living or dead, in different stages of decomposition), grasses, herbaceous plants, leaf litter, fungi, nests built by other species of termites, to even excrement and animal carcasses, as well as lichens, organic material present in the soil, and in some cases, cultivate fungi, thus revealing their ecological importance is as significant as the economic one (Lima & Costa-Leonardo, 2007), becoming pests due to ecological imbalances (Núñez, et al., 2011).

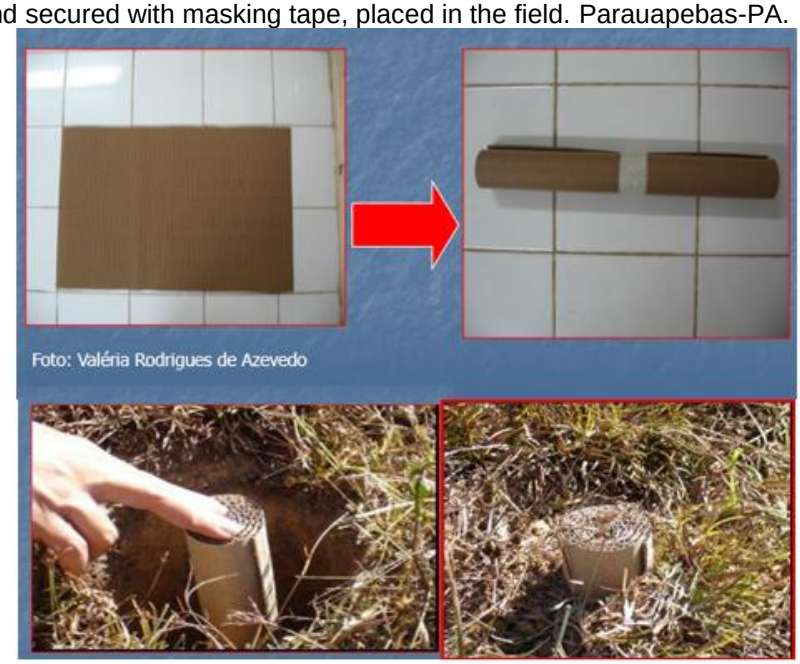
Termites are more destructive in eucalyptus plantations in the seedling phase, as they cut roots and roots, removing the bark from the main roots, causing damage to plants up to one year of age (Junqueira, et al., 2008). In general, the presence of termites of the species C. cumulans on the roots of eucalyptus can cause direct damage, consuming the root system, and, consequently, indirect damage such as the reduction and delay in root growth and in the aerial part of eucalyptus seedlings, where from 60 days after exposure to the attack there is a reduction in variables such as length, root surface and diameter (Leitão-Lima et al, 2013).

USE OF BAITS FOR TERMITE MONITORING

Almeida & Alves (1995) tested different types of cellulosic materials and found that corrugated cardboard was the most attractive to termites of the genera: Cornitermes, Syntermes, Procornitermes, Coptotermes and Nasutitermes. Junqueira (1999) suggests that cardboard baits, monitored in reforestation areas, do not have the same efficiency as in agricultural areas, because in reforestation soils there are roots, bark, wood remains, etc., which are more attractive to termites.

Leitão-Lima et al. (2012) observed that corrugated cardboard was unattractive to the species C. cumulans both in the laboratory and in the greenhouse. Leitão-Lima et al. (2014) in pasture areas tested the standard corrugated cardboard baits of the Termitrap type, where they were cut to the measurements: 50 cm x 30 cm, then rolled in the shape of a "cigar" (Figure 3).

Figure 3 - Corrugated cardboard baits cut to the measurements: 50 cm x 30 cm, then rolled up and in the shape of a "cigar" and secured with masking tape, placed in the field. Parauapebas-PA.



These baits were taken to the field to carry out the monitoring of termites Parauapebas-PA; in three rural properties, where 20 standard cardboard baits were distributed by area, buried vertically in the ground at a depth of approximately 20 cm, distant 4m from each nest (5 nests with 4 baits/nest), in a total of 60 baits, remaining in the field for 30 days in the dry season and 15 days in the rainy season (Figure 4). Termite monitoring consisted of removing the baits from the soil and checking for the presence of C. cumulans, according to the following criterion of scores: (0) absence of termites; (1) 1 to 10 termites; (2) 10 to 100 termites; and (3) presence of more than 100 termites.

Figure 4 - Representation of the placement of corrugated cardboard baits, buried vertically in the ground at a depth of 20 cm.



There was a higher occurrence of termites of the genera Nasutitermes and Heterotermes inside the baits, with a predominance of Heterotermes and absence of species of the genus Cornitermes. The corrugated cardboard bait is efficient for monitoring subterranean termite species such as the genus Heterotermes. However, for mound termite species, corrugated cardboard baits were not efficient.

TERMITE MAINTENANCE IN THE LABORATORY

In the preference tests of Cornitermes cumulans, in the laboratory, using the methodology of Leitão-Lima et al. (2012), for each arena, the following were separated: 300 workers + 50 soldiers + 50 nymphs, to compose each block and its treatments (Figure 5).

Figure 5 - Separation in the laboratory (300 workers, 50 soldiers and 50 nymphs) to perform the foraging tests of *Cornitermes cumulans*.



Source: Patrícia Leitão-Lima

Each arena, consisting of a plastic pot (26 cm in diameter and 12 cm in height), with side holes, for fitting glass tubes (2 cm in diameter and 8 cm in length) containing the tested treatments of eucalyptus root and components for the seedling substrate (Figure 6).

Figure 6 - System called "arena", used for the maintenance of *C. cumulans* in laboratory conditions, where: (a) glass tube containing one of the treatments and (b) nest fragment on a gypsum base and covered by a plastic container, Botucatu-SP, 2003.

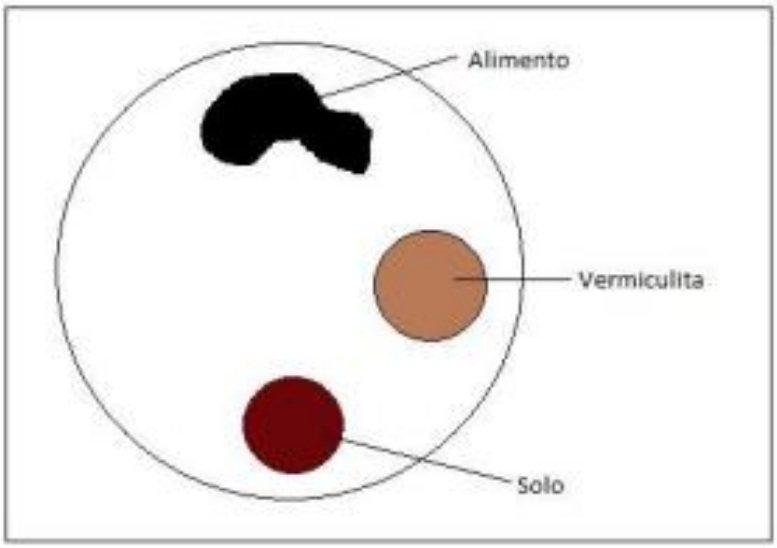


Source: Patrícia Leitão-Lima

Leitão-Lima et al. (2012) also evaluated, in the laboratory, the preference of Cornitermes sp to different structures of B. brizantha (leaf, stem and root), "in natura" and dry, from degraded pastures in the Amazon compared to cardboard baits,

Schönhaus (2012) evaluated, in the laboratory, the feeding habits of C. cumulans in relation to different food items, for each experiment five Petri dishes of 9 cm in diameter were used, in which a plastic lid with moistened vermiculite and a small portion of moistened soil were placed. On each plate, 30 workers and 3 soldiers were placed and the food item to be tested, which included four different foods: dry grass leaves, healthy pine sawdust, decomposing pine sawdust, and the food itself that is stored inside the nest (Figure 7).

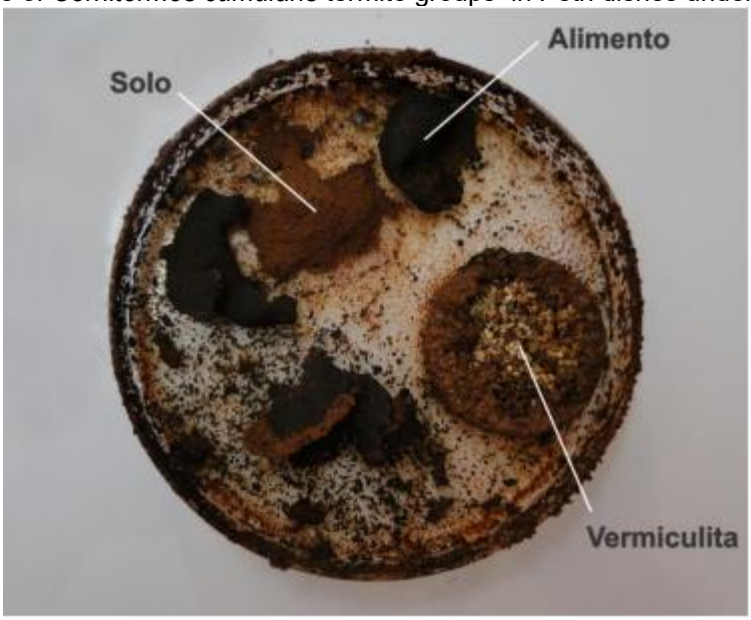
Figure 7 - Scheme representing the arena used for the development of bioassays with different foods.



Source: Schönhaus (2012)

According to Schönhaus (2012), it was not possible to clearly quantify consumption, as the insects showed a behavior of covering food with feces and soil. Often, clumps of soil were observed that surrounded the pieces of food, forming hard spheres of soil and food (Figure 8).

Figure 8 - Maintenance of *Cornitermes cumulans* termite groups in Petri dishes under laboratory conditions.

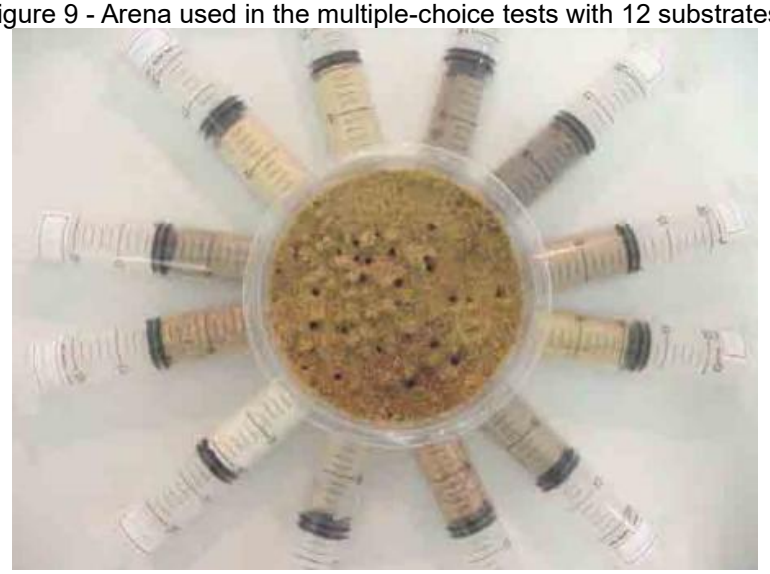


Source: Schönhaus (2012)

For Schönhaus (2012), termites of the species C. cumulans have a very complex eating habit, based mainly on foods of plant origin. Morphological adaptations in the jaws and alimentary canal allow these insects to consume these components. In addition, this species has a feeding preference for decomposing materials, as in the case of aged sawdust, which has shown excellent results for termite survival under laboratory conditions.

Lima (2006), in the selection of attractive cellulosic substrates for the termite Coptotermes gestroi, tested several substrates in arenas composed of a central round plastic container (10cm in diameter and 3.5cm in height - volume equal to 240mL), a "nest" chamber, in which 12 syringes of 20mL each, equidistant from each other - 30º angulation between the syringes, were connected. Each syringe was filled with a different substrate, totaling 12 substrates per repetition (Figure 9)

Figure 9 - Arena used in the multiple-choice tests with 12 substrates.



Source: Lima (2006)

After evaluating the 12 substrates, Lima (2006) performed multiple-choice tests with 4 substrates (ground dry corn stalk, rolled corrugated cardboard, dry cattle manure and chopped cork). Each syringe was filled with a different substrate, totaling 4 substrates per repetition, and the position of each of these substrates was randomly defined by lottery. 10 replications were performed, and in each one 550 forage individuals (500 workers + 50 soldiers) were used (Figure 10).

Corrugated cardboard was the substrate most consumed by Coptotermes gestroi, followed by chopped cork and cattle manure, the least consumed substrate was corn stalk. Corrugated cardboard was the most indicated substrate.

Figure 10 - Arena used in the multiple-choice tests with 4 substrates.



Source: Lima (2006)

MAINTENANCE OF TERMITES IN A GREENHOUSE

Leitão-Lima et al. (2012) conducted preference tests with ten entire colonies of C. cumulans, approximately 20 cm in diameter and 30 cm in height, in a greenhouse. Each colony was kept in 30 L plastic pots, completed with soil, and the set was kept under 50 % shading. In each vessel, a hole was made to fit a transparent plastic hose 2 cm in diameter and 30 cm in length, which connected the colony to the "arena", where there were holes for fitting the glass tubes containing the same treatments evaluated in the laboratory (Figure 11).

Figure 11 - System used for the maintenance of *C. cumulans* in greenhouse conditions, where: a- colony of *C. cumulans*; b- 30 L pot; c- plastic hose and d - "arena", Botucatu-SP, 2003.



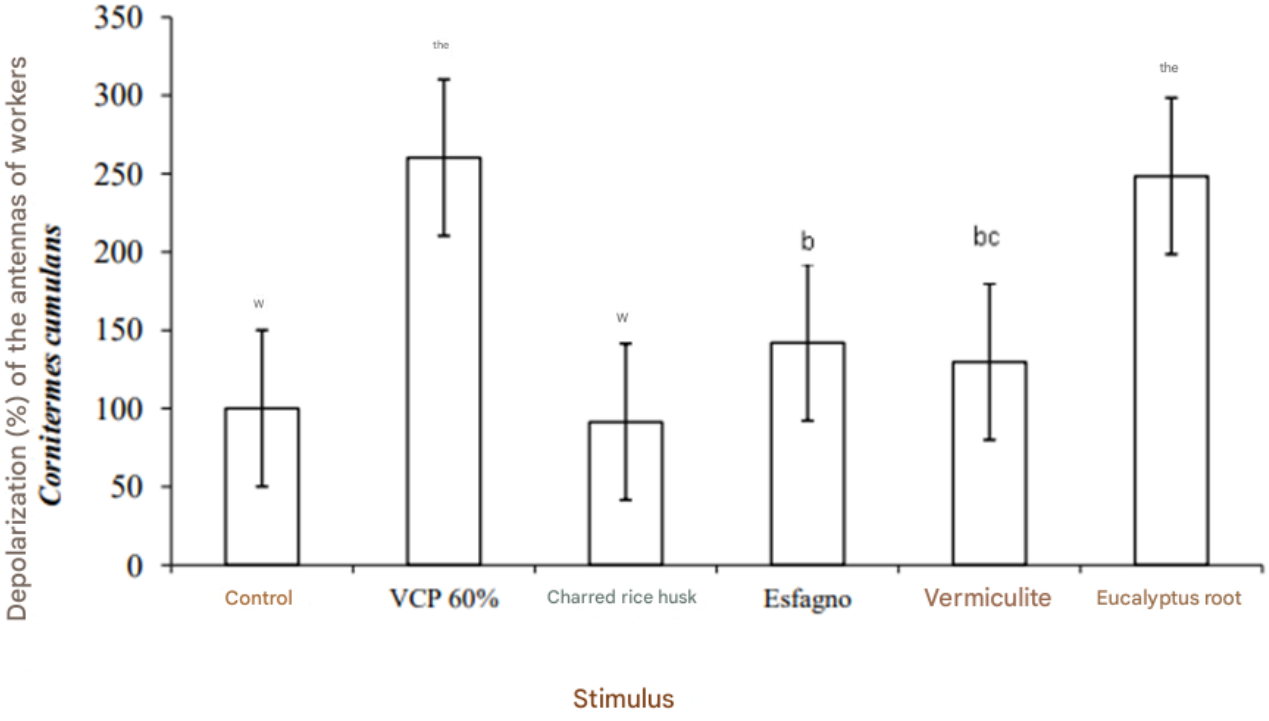
Source: Patrícia Leitão Lima

After the laboratory and greenhouse tests, the electroantenography (EAG) technique was used, which evaluated the sensory response of termite workers, to elucidate the selectivity and sensitivity of the antennal receptors of C. cumulans workers, to the extracts from the materials of the treatments used. It is noteworthy that the materials tested were the same as those used in the experiments carried out in the laboratory and in the greenhouse (Leitão-Lima et al., 2014).

To perform the EAG electroantenography technique according to the methodology described by Batista-Pereira et al. (2004) for the species H. tenuis. When testing the individualized antennae of C. cumulans workers, it was found that they were highly attracted to eucalyptus roots both in the laboratory, with a restricted number of individuals tested, and in entire colonies in the greenhouse condition.

According to the results of the electroantenography (EAG) (Figure 12), the eucalyptus root and the 60% VCP provided the greatest stimuli to the antennae of C. cumulans, due to the greater sensitivity of the antennal receptors to the volatiles present in the root and in the 60% VCP, which corroborates the results of attraction (laboratory and greenhouse) only for the root.

Figure 12 - Electroantnography (EAG) of the antenna of a C. cumulans worker in relation to the control, substrate for eucalyptus forest seedlings (VCP 60%), carbonized rice husks, sphagnum, vermiculite and eucalyptus root. The values are means ± standard errors, where equal letters do not differ from each other by Tukey's test (P< 0.05).



Cornitermes cumulans showed high attraction of eucalyptus roots "in natura", and this attraction can be enhanced by the presence of the substrate for forest seedlings tested. Leitão-Lima et al. (2013) evaluated, in a greenhouse, the damage to Eucalyptus grandis x Eucalyptus urophylla seedlings, using 10 entire colonies, kept in pots, connected to the nests by means of plastic hoses (Figure 13).

Figure 13 - Plastic pot containing an entire colony of *Cornitermes cumulans* connected to four eucalyptus seedlings (PVC pipes), by means of plastic hoses, to determine the damage, with the respective seedlings not exposed to attack (without connections to the colony.



After 24 hours of connection of the pots with the colonies of C. cumulans with the PVC tubes containing the eucalyptus seedlings, it was possible to observe intense activity of the termites between the two structures. Initially, there was the formation of galleries through transparent plastic connection hoses, that is, they were covered with soil, avoiding the direct incidence of light on the termites. Subsequently, before the first evaluations, it was already possible to verify the presence of termites on the soil surface near the eucalyptus seedlings. Also, at the time of removing the seedlings from the pots to separate the roots, the presence of C. cumulans workers in the roots was verified.

The presence of termites in eucalyptus roots interfered in the morphological structure of the root system of the plants where, in general, a reduction in the variables root length, surface and diameter was observed from 60 days after exposure to C. cumulans attack. These changes in the configuration of the root system, due to termite attack, were reflected at 90 days as verified by the decrease in root DM, shoot DM, leaf area and height of eucalyptus seedlings.

FINAL CONSIDERATIONS

The maintenance of termites, in controlled conditions for food preference tests, allows the development of more effective baits for monitoring these insects.

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HARM REDUCTION, WEAVING PLACES OF ACTION: PSYCHOLOGY AND PUBLIC POLICIES

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ABSTRACT

The relationship between Psychology and public policies in Brazil has evolved from welfare practices to the search for more inclusive and transformative models, especially in mental health. The insertion of Psychology in public spaces and its critical performance aim to promote an approach that integrates the subject and the social context, contributing to changes in care policies.

Keywords: Psychology in public policies. Mental health.

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PSYCHOLOGY IN PUBLIC POLICIES

Discussing the relationship between Psychology and public policies requires a brief review of the place and role occupied by Psychology in Brazil, where the demands historically produced express the answers given, whether theoretical, instrumental or practical. The proposal is not to reconstruct the paths taken by psychology as a science and profession, but to make it possible for the current relationship to be apprehended from the historical path, in addition to instigating the development of actions that make Psychology increasingly present and decisive in the elaboration and implementation of public policies.

Gonçalves (2010) says that the usefulness of Psychology was marked by different types of insertion in society, and to explain this, he identifies three moments of Psychology in Brazil: a) practices aimed at adaptation and adaptation, based on a naturalizing and normalizing theoretical framework, aiming to frame the subjects to the existing configurations; b) the construction of critical conceptions based on traditional knowledge, seeking an approximation with reality; c) attempts to break with traditional models in the conquest of alternatives that would guarantee the improvement of the quality of life of the subject and the population. The author's expositions allow us to highlight the crossing of models of action based on the control of the subject to the established social context for attempts to understand the subject inserted in his environment and the promotion of conditions to overcome limits and enable the development of potentialities, whether individual or social.

The insertion of the psychologist in institutions occurred in the nineteenth century, along with psychiatry. The medical model of care assumed a curative, assistentialist and individualizing emphasis (MENDES, 1994; MOCHEL, 2014). Psychology, based on the same paradigms, contributed with the references of adaptive normality of individuals, which was opposed to the pathological and deviant. This presence was consolidated in the twentieth century, with the entry into business spaces and insertion within education, where it revealed its condition of scientific knowledge, since it enabled the entry of practical and theoretical knowledge produced in the USA and Europe to Brazil (ANTUNES, 1999; GONÇALVES, 2010); In these spaces, the performance was also based on the disciplinary model. Psychology, in the opinion of Gonçalves (2010), assumed a commitment to strengthen welfare, pathologizing, curative, and individualizing policies.

Contrary to institutional practices was the individual clinical performance. The regulation of the profession in Brazil, through Law No. 4119, approved in 1962, established the clinical practice of psychotherapy, in the model of the liberal professional who works in

his private practice. Although this space granted the psychologist greater freedom of action and the possibility of approaching the real social demand, it was based on the same conceptions of adequacy, making the psychologist increasingly a "partner" of institutional services, distant from social issues and absent in public policies, since it affirmed his commitment to the dominant ideology and to the elites.

> To the extent that the intervention in other areas had as a guideline to correct deviant routes of individuals in their development and social insertion, a curative intervention was necessary, which would recover them to normality. Associated with hegemonic conceptions of valuing individualism, this perspective fed the practice of psychotherapy, which served two ideological axes: the curative and the scrutiny of intimacy (GONÇALVES, 2010, p. 88).

Analyzing the historical development, without the intention of simplifying the issue, it can be said that initially there was no place reserved for Psychology in public policies, but it was not completely absent; The place occupied by the psychologist was secondary, which made his practice only useful to subsidize other practices. Gonçalves (2010) points out as elements that contributed to this distancing the context of action, marked by impositions and conservatism of institutions and the universalizing, applicable and supposedly neutral theoretical conceptions produced about man. It is important to emphasize that, at the time, there were already divergent ideas that questioned the adaptive acting model, but these productions did not exercise supremacy (GONÇALVES, 2010).

In the 70s, there was an increase in the insertion of psychologists in public services in Brazil, with a significant part absorbed by the field of mental health. The entry of the psychology professional occurs at a time when the privatist-care model5 is at its apex, but also announcing its fall (DIMENSTEIN, 1998). Discontent with the services provided by Social Security triggered reformist movements in Brazil, in an attempt to change the precarious situation of health. In the field of mental health, the hospital-centered or asylum model was characterized by what Dimenstein (1998, p. 57) calls the "commodification of madness". The inefficiency in care and the negative effects resulting from prolonged hospitalization ignited criticism of the asylum model, and the flag of dehospitalization was raised.

The reformist movements were inspired by the mobilizations that took place in the United States and Europe, which sought to break with the current models and care transformations, through the establishment of care networks that replaced hospital centralization. The establishment of services that, in addition to effectiveness, had a lower social cost was also sought (DIMENSTEIN, 1998). Cerqueira (1984) points out that this

mobilization for the modification of care invited, in addition to the psychiatrist, the participation of other actors, such as psychologists.

It is important to emphasize that the entry of Psychology took place at a time of criticism of the asylum model, and the criticism also included the professional care provided by teams formed predominantly by physicians to the replacement by multiprofessional teams, with investment in professionals from other areas in order to materialize a new care model. It is in this moment of admission and discussion of the human subject constructed in integrality that psychology has the chance to conquer what Gonçalves (2010) calls "present presence" in public assistance policies.

The search for alternative models to the asylum was based on the recognition of autonomy, implication and emancipation of individuals, as analyzed by Gonçalves (2010), since the condition of having mental disorders did not subtract the condition of subject. This recognition crosses two elements not considered until then: the subjective and the social. As for the first, there was no place in the medical-psychiatric discourse for the subjectivity of the individual; generalist conceptions that disregarded the demand of the suffering subject predominated (MOCHEL, 2014). With regard to the second element, the understanding of health beyond its technicality filled the space occupied by the disease-cure dichotomy. Hence the need to discuss the integration of the social dimension, not as an external influence on the health-disease process, but rather health as an integral part of the social dimension (GONÇALVES, 2010).

In the social field, Psychology proved to be insufficient and unwanted, after all, how to admit that knowledge that serves the interests of the elites and dominant classes in the maintenance of an unjust and unequal reality could add to society? Gonçalves (2010) analyzes that the regulation of Psychology as a profession takes place in a context that favored a certain isolation of professionals in relation to social problems.

> Authoritarian regime, without spaces for public debates on social problems; absence of consistent social policies, a portion of psychologists, together with other intellectuals, began to discuss and criticize the general situation of the country and, more specifically, the situation of psychology and its place in the social (GONÇALVES, 2010, p. 91).

In this political situation, the soil was not conducive to the cultivation of a Psychology as an instrument of transformation for those who were involved in the task of building new actions. The type of science produced (neutrality, universalization and naturalization), the intervention (control and adequacy) and the submission to the contexts of practice, did not allow, in the perspective of Gonçalves (2010), an action that denounced oppression and social inequality. The emergence of Community Psychology, linked to practices in

community care centers, presented, from the perspective of Gonçalves (2010), the possibility of establishing contact with social demands.

In these gaps, Psychology approaches, participates and strives to add, and this meant the need to break with the old paradigms and assume a new posture in the face of social issues. Lane (1996) observes that more than a new place of action and problem-solving, the presence of psychology in social issues demanded advances in research, and, consequently, theoretical and practical advances. Thus, we see the second moment of psychology in Brazil, according to the propositions of Gonçalves (2010), being fulfilled: a psychology that does not adapt the subject to the environment, but that adapts to the social to understand the subject, based on the development of knowledge close to its reality.

The passage to the third moment, when Psychology establishes its commitment to social issues, is marked by the organization of the category, by investment in research to qualify and by the expansion of practice (GONÇALVES, 2010). Some events promoted in recent years by the Federal Council of Psychology (CFP) deserve to be highlighted, for their contribution to strengthening the dialogue between Psychology and public policies: the National Seminars on Psychology and Public Policies, which take place linked to the North-Northeast Congress of Psychology (CONPSI). With the published reports of the first five editions, we seek to make a succinct analysis of the progress in the debates.

In the I National Seminar on Psychology and Public Policies, held in 2001, the issues addressed were incipient, such as the historical construction of psychology; the reflection on the opening of space for action and practices in public policies; the lack of preparation resulting from academic training, which did not prepare the psychologist for the reality of public services; the deconstructions and constructions necessary for this practice; the psychologist as an instrument of social transformation, which for this required a new positioning, with new answers. In short, the discussions were more about the potentialities than consolidated realities in the public sector.

At the II National Seminar on Psychology and Public Policies, in 2003, talking about psychology in public policies became increasingly pertinent, because, among other things, it became a question of the future perspective of the profession, since the number of professionals grew and the public sector absorbed a significant amount. — Discussions about the social protagonism of psychology and the commitment to transformation were strengthened, which means the reflexivity that allows psychologists to recognize themselves as participants in a broad, diverse, unequal and cruel society in its inequalities, which calls the professional to recognize that his work must be offered to all those who demand attention, thus validating the construction and use of citizenship and social

development. The statements emphasized that investment in the social involves investment in the subject — a singular look that does not imply individualism and exclusion from the social.

The III Seminar, held in 2005, presented issues arising from experiences in the public sector, seeking to discuss not only what was practiced and known about psychology in public policies, but also about public policies in general. Among the topics addressed are: the construction of the psychologist's identity, considering the expansion of the area and the presence in the most varied fields; the need to articulate a corporate project to consolidate the profession in society; the dimension of relationship with the State was also the subject of discussions, since the development and strengthening of a profession needs to cross this relationship, but with a broader perspective, which is the struggle for social rights.

The IV Seminar, held in 2007, highlighted the creation of the Technical Reference Center in Psychology and Public Policies (CREPOP), which established a solid position of psychology in the public sphere, emphasizing the need to create references, in order to ensure ethical and competent performance. Questions about the need for psychology in the elaboration of policies for assistance to social rights and about the effectiveness of this commitment were present in the speeches, such as the statement of the lecturer Eliza Zanerato: "it is not enough to say only about the need for psychology to enter the field of public policies, but we need to say how we will do it, with what references" (FEDERAL COUNCIL OF PSYCHOLOGY, 2007, p. 71). Discussions about the conception of public policies have reappeared, as a general and specific theme of different areas: health, education, social assistance, security, among others, in their relationship with the rights of the citizen and the commitment of the public power to ensure them through the development of actions. The understanding of the subject of rights and care in its entirety, as well as the reflection on the need to expand the notion of individual clinic to the social conception, are among the discussions of the event.

The V Seminar, held in 2009, expanded the discussions held in previous seminars, increasingly defining the contours of this action. The round table coordinated by Rose da Rocha Mayer deserves to be highlighted, as it articulates four columns of this work: psychology, drugs, public policies and harm reduction. The lecturer emphasizes the importance of the articulation of the various social actors in the action that has drugs as a context

> [...] if I am from a city council, if I am in a health center, in a CAPS, if I am a harm reductionist, I will bet on the uniqueness, on the history of this person, I need to use interdisciplinarity and I have to keep in mind that I can promote health in any situation" (FEDERAL COUNCIL OF PSYCHOLOGY, 2011, p. 162).

As a result of this articulation, there are different forms of care that contemplate the subject who demands (or does not) help. For the lecturer, Harm Reduction can be understood from various points of view, but it is still a form of care that bets on the condition of subject.

> Some understanding harm reduction as a means to achieve abstinence and others understanding it as an exercise of right that has a dimension of pleasure that goes beyond the discussion of legality or illegality [...] To get out of the false duality of abstinence or harm reduction, it is necessary to see what the person's movement is, what they are interested in, how they understand care [...]. Between guilt and responsibility, let's stick to the combinations and we will recombine as many times as necessary. Between taking people as objects, as subjects, we will invest in relationships, and between equality and diversity, to see what is the uniqueness of this person, of this collective. (FEDERAL COUNCIL OF PSYCHOLOGY, 2011, p. 162-163).

Lecturer Mônica Gorgulho, also a member of the round table, addresses in her speech the role of the psychologist within the construction of public policies on drugs, in the promotion of strategies aimed at public health and in the appreciation of human rights, which subsidizes the first fundamental principle of the profession by stating that the psychologist will base his work on respect and the promotion of freedom, dignity, equality and integrity of the human being, throwing responsibility for a committed action in the context of drugs. From this perspective, Gogullho discusses four points for the psychologist to think about his presence in the formulation of public policies: the need for a deep knowledge of the subject before proposing to influence and work on the construction of a public policy; the recognition that an intervention model alone is not enough; the admission that those who work in public policy must be able to broaden their horizons; and the need to understand the problem in order to seek solutions.

If we considered each event that dialogues the interlocution between Psychology and Public Policies, the debate would be extensive and always allowing for new openings, as the discussion is expanded each time the space is granted. The objective of these highlights was to highlight the posture assumed by psychology when understanding its commitment to public policies, confirming that the demands that appear guide its construction as a science and profession. And what is the demand of this third and current moment? The consideration that public policies are not a neutral and merely technical field, but a political field that demands a critical presence of psychology (GONGALVES, 2010).

PSYCHOLOGY AND PUBLIC POLICIES ON DRUGS

In the previous discussions, the changes felt in public policies and the insertion of the psychologist in this field were addressed. It was found that the psychologist was not

reserved a place of relevance, but this is being conquered since the admission of his commitment to social demands. The proposal for this topic is to articulate the presence of the psychologist in public policies that assist the user of psychoactive substances, discussing the effects of expanding their space of action in the construction of anchor points that qualify their practice. Three axes were listed to guide the discussion: care models, users' rights and interdisciplinary practices, analyzed simultaneously.

For a long time, the only option for drug users was hospitalization in psychiatric hospitals or institutions with asylum characteristics that were based on the achievement of cure, reflecting, in the opinion of Tatarsky (2002), a view of drug consumption as a disease that needed to be eradicated. The logic of abstinence, by making the confrontation of the substance central, places the subject and his or her issues, whether emotional, social and/or economic, in a secondary position; and because it does not guide an action based on the demand brought by the subject, it imposes expectations and demands that make treatment abandonment probable.

Despite attempts to address the issue of drugs through another discourse, the model of total abstinence still exerts a great influence on the various paradigms of care. They are asylums, without walls, without bars, but with ideologies, reductionism and practices that imprison the subject, instead of developing his potential for autonomy and citizenship, suggests Dênis Petuco (CONSELHO REGIONAL DE PSICOLOGIA/SP, 2011). These are models of care that deny or ignore the complexity of the problem that has long been recognized.

Doneda (2009) argues that there have been few initiatives by psychology professionals to advance in the theorization and development of technologies and modes of treatment that consider the subjectivity of the individual who uses psychoactive substances. The taking of the lead in this field and the investments in initiatives for the prevention, promotion and treatment of drug users, based on the characterization of their historical, social and subjective context, are recent, emphasizing the search for understanding the relationship that is established between subject and substance.

In the Report of the National Seminar on Subjectivity of the Consumption of Alcohol and Other Drugs and Brazilian Public Policies, published by the Federal Council of Psychology (2010), Doneda states that subjectivity is the field of interest of psychology and that the rescue of the subject's autonomy would be the commitment of action. In the aforementioned seminar, Pedro Gabriel Delgado states that the psychologist's performance is guided by the issue of subjectivity, human rights and user participation. The ideas of Doneda and Delgado intersect on another point: the place that subjectivity occupies in

public policies and in care networks, and the consequences of disregarding this dimension, which would reproduce the criticized and rejected models that the current policies and service arrangements have come to replace. Doneda then raises the following question: "has our practice been inclusive? Or has it been exclusive, in the sense of contributing to the subject's distancing?" (FEDERAL COUNCIL OF PSYCHOLOGY, 2010, p. 59).

Doneda broadens the debate by questioning the psychologist's clinic. She is emphatic in saying that the discussion of the clinic belongs to Psychology and psychologists, not the clinic of the traditional model, which defends a treatment in the medical model of abstinence, says Mônica Gorgulho (CONSELHO FEDERAL DE PSICOLOGIA, 2010), but the clinic that refers to the subject, and this does not depend on the approach: preventive, intermediate or interventional. In Doneda's perspective, the confusion with the other actions and the loss of professional identity – in which the psychologist assumes the position of doctors, social workers, administrators – has left the clinic of subjectivity on the margins of practice. When this commitment is rescued, the discussion of the psychology clinic is in accordance with the proposal of harm reduction: the clinic that works on dependence to lead the subject to a state of independence (CONSELHO FEDERAL DE PSICOLOGIA, 2010).

Doneda's speech shows the clinic that is supported by speech and listening. In this relationship – listening to the word of the other and the word that demands help – lies the main specialty of psychology, the support of an action and the differentiation in a multidisciplinary context. For Macedo and Falcão (2005), the word opens up new possibilities for understanding human suffering; Listening is presented as an essential vector for identifying and analyzing the demand that is present in speech. Qualified, committed and contextualized listening implies listening to the subject in order to get to know him beyond the barriers established by drug use.

By removing the word from the use of the psychoactive substance and its implications, the psychologist seeks to give it to the subject so that he can talk about himself in the use of the drug, inviting him to take the lead in the process of constructing the treatment. This listening excludes vertical relationships, in which the professional knows and the subject accepts this knowledge. Velasco et al. (2013, p. 245) state that "the psychologist goes to meet the subject and, through successive meetings, builds the demand for work with him". When this practice is outlined, harm reduction, as a paradigm that gives voice and listens to the user, finds firm support in its articulation with psychology for the consolidation of a political clinic, as Doneda puts it (CONSELHO FEDERAL DE PSICOLOGIA, 2010). In the opinion of Totugui (2009, p. 148):

> In addition to being careful not to isolate the subject's desire, choices and thinking, and to distance ourselves from it, work in the light of harm reduction also implies that we bring him closer to his responsibility, both with regard to his treatment and with regard to the consequences of what he practices during use, either towards oneself or towards the other. Involving the subject in his choices means, above all, helping him to rescue the right to exercise his freedom, an essential requirement of the notion of citizenship, a right so protected in such a present past.

Although the psychologist acts from his core of knowledge, the experience of an interdisciplinary and multisectoral practice is indispensable for effecting an approach in the context of drugs; the psychosocial care network structures the consideration of subjectivity in the notion of integrality (CONSELHO FEDERAL DE PSICOLOGIA, 2013). It is important to emphasize that the openness to the participation of psychology in public policies on drugs was favored through the arrangement of devices that make up the care network and the valorization of the discourse of multidisciplinary action, allowing the psychologist the possibility of building a place of relevance.

For Totugui (2009), the construction of interdisciplinary attitudes and conducts is a systemic and integrated way of dealing with and surviving causes composed of very different aspects of nature. It is considered, then, that the provision of care in the field of drugs is consolidated when there is a conduct of sharing and receiving information that helps in the development of effective actions. The interdisciplinary attitude of professionals, in the author's perspective, is based on the desire and common search to transcend human suffering.

For Tatarsky (2002), the approach to the use of psychoactive substances should start from an integrative look and focus, which recognizes psychological, social and biological factors in their unique combination in the life of each subject. By considering the multiplicity of factors and recognizing their individual implications, paths can be developed that integrate strategies focused on each of these factors, presenting maximum possibilities of success. Thus, given the diversity of drug users, harm reduction interventions do not follow pre-defined scripts to which the user must adapt. The actions have different characteristics for each user, consolidating a practice directed from listening to the subject's demand.

This exercise relies on the use of devices, such as the Singular Therapeutic Project (PTS), often used in mental health and primary care strategies, and can be defined as a care tool that articulates a set of actions resulting from the discussion and collective construction of a multidisciplinary team and takes into account the needs, expectations, the beliefs and social context of the person or collective to which it is directed (BRASIL, 2007); it is recommended for more complex cases, considering the extent of the problems for the

subject, family and community; Its construction comprises the evaluation of the affected dimensions, whether biological, psychological and/or social. The proposal of the STP in the context of drug consumption is to detach the focus from the substance to the context in which the user is inserted, his individual history and his biological aspects. The PTS is not an exclusive tool of the psychologist; Its construction crosses the interdisciplinarity of views and integrality in care.

The psychologist's performance in the context of public policies on drugs is not characterized by isolation, with distanced practices, which do not make a reading of reality. In fact, discussing and working on subjectivity in the face of generalist policies is a challenge, but it is necessary to be clear when considering that the existence of parameters does not prevent the need for a structural analysis of the conditions that participate in the context-subject-substance relationship. With this reading, the elaboration of singular modes of intervention becomes more accessible.

Harm reduction as a policy and approach is in accordance with the aspects presented that consolidate effective actions in the field of drugs: it puts the substance aside to centralize the user, strives to build actions based on the sum of views and is based on respect for human rights, the foundation of the psychologist's practice. It offers, then, consistency to think about this performance, because if the current moment of psychology in public policies is the construction of alternatives that are interested in the quality of life of the subject and his surroundings, as Gonçalves (2010) attests, the "medical-psychological" conception no longer fulfills the psychologist's performance, if it ever did. In view of this, talking about the dialogue between Psychology and harm reduction is increasingly coherent, but being coherent does not imply its immediate acceptance, either by the services or by the professionals.

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ENVIRONMENTAL EDUCATION AND SUSTAINABILITY IN BASIC AND TECHNICAL EDUCATION IN AN EETEPA IN THE MUNICIPALITY OF BELÉM, IN THE STATE OF PARÁ, IN THE AMAZON REGION

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ABSTRACT

Environmental Education in schools in Pará is crucial to promote sustainability. Recently, the inclusion of a mandatory subject of Environmental Education in the curriculum of basic education was established, due to debates about the protection of the environment. The objective of this article was to explore the implementation of Environmental Education in a Technical Education School in the State of Pará - EETEPA in the municipality of Belém, highlighting its relevance for the formation of critical, reflective and responsible citizens, capable of contributing to the construction of a sustainable future. This is a descriptive and qualitative study carried out in a EETEPA, in Belém. Positive experiences of the institution stand out, which has implemented projects and pedagogical practices aimed at sustainability. Activities such as lectures, courses, workshops, vegetable garden, planting and awareness campaigns were carried out, positively impacting the school and the community.

Keywords: Environmental Education. Sustainability. Legislation. Environment and Basic Education.

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INTRODUCTION

Environmental Education can be understood as a joint methodology, where each person can assume and acquire the role of the main member of the teaching/learning process to be developed, as long as each person or group is an actively participatory agent in the analysis of each of the environmental problems diagnosed and thus seeking solutions, results and even preparing other citizens as transforming agents, through the development of skills and competencies and the formation of attitudes, through ethical conduct, consistent with the exercise of citizenship (Roos & Becker, 2012).

Environmentalism refers to collective behaviors and practices that aim to change perceptions and attitudes between the relationship between human beings and the natural environment. For environmental education to really occur as a form of sustainability, it needs to start in schools (Bortolon, Mendes, 2014).

Environmental Education in basic and technical education is essential to promote a sustainable environment. Recent debates at the global, national and local levels on environmental issues have led to the decision to make the inclusion of an Environmental Education subject mandatory in the curriculum of schools in the state of Pará. (Law No. 9,981 of 2023).

In this sense, the research was carried out at the State Technical School of Pará (EETEPA), in which there are projects and actions focused on environmental issues, playing an important role in incorporating Environmental Education into their curricula, promoting training that not only instructs, but also sensitizes students to the need for sustainable practices (Oliveira, Neiman, 2020).

It is important to emphasize that there are numerous environmental principles, and all of them aim to protect all species of life on the planet, providing a satisfactory quality of life for human beings for present and future generations (Bortolon, Mendes, 2014).

Thus, this work seeks to explore the implementation of Environmental Education in a EETEPA in the municipality of Belém, highlighting its relevance for the formation of critical, reflective and responsible citizens, capable of contributing to the construction of a sustainable future (Bortolon; Mendes, 2014).

With this, allow students a comprehensive view of the environment in which we live, understanding that we, human beings, are an integral part of it and in this perspective of sustainable development it is evident that material progress can be achieved with the preservation of ecosystem resources and services for successive generations. The contribution of this article is to allow the awareness of what sustainable development is through an Environmental Education perspective and thus the formulation of ideals, not

only for human well-being, but also for the sustainability of the environment (Roos & Becker, 2012).

In this logic, Environmental Education seeks to value the harmonious coexistence between the environment and the other species that inhabit the planet, helping a critical analysis of the anthropocentric principle, which has often led to the inconsequential destruction of natural resources and of various species (Ramos, 2010).

METHODOLOGY

For the realization of this article, a descriptive, qualitative methodological approach was adopted, with field research such as technical visits to the school area, workshops, and a bibliographic review carried out in databases, SciELO and PubMed. Materials on Environmental Education were used in basic education, especially after the mandatory nature of this discipline in public schools in Pará, according to (Law No. 9,981 of 2023). The objective was to identify articles and materials that discussed Environmental Education and sustainability, focusing on basic and technical education, even if not addressing all these aspects simultaneously.

The research included the selection of academic articles and the law that made Environmental Education mandatory in schools in the state of Pará and normative documents that explore the various nuances about the environment. A systematic search was used with specific terms, such as "Environmental education", "Sustainability", "environment", "Basic and Technical Education". Initially, a systematic search was carried out to collect relevant articles and texts, followed by the selection of the most pertinent ones. The preliminary selection was carried out based on the reading of titles and abstracts, resulting in 17 materials that directly addressed Environmental Education or presented relevant analyses on the theme. After a thorough reading, 6 of these materials were considered significant for the research objectives.

The analysis process consisted of categorizing the selected articles, taking into account their relevance and depth in terms of Environmental Education and sustainability. In addition, the normative documents were examined to understand the legislative basis that supports this theme, including the interpretation of the guidelines, laws and regulations that guide Environmental Education in Basic Education. Based on the review and analysis of the materials, articles and syntheses were prepared that highlight the main findings, offering a comprehensive and objective view of each segment related to the theme.

The research included the selection of academic articles, online texts and normative documents, using a systematic search with specific terms such as "environmental

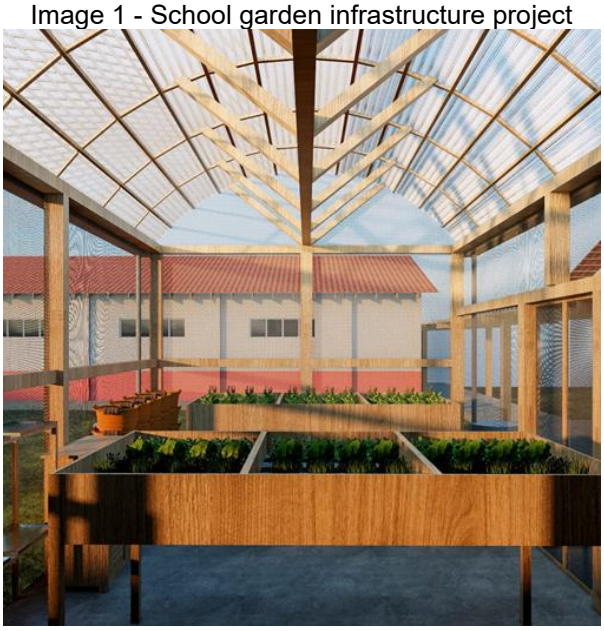
education" and "sustainability". After the collection, the most relevant texts were chosen for the discussion.

The stages of the projects included a cycle of lectures, preparatory courses, orientation workshops, education and health actions, plastic recycling practices, planting of legumes and native vegetation in the region and awareness campaigns in the school community.

RESULTS

EETEPA has generated positive and significant impacts on the community through its intra-school projects and pedagogical practices focused on the environment and sustainability. This corroborates Rosa, Kauchakje, Fontana (2024), when they argue that the school effectively plays its role as a social leader committed to improving the conditions of quality of life, in the sense of contributing to the sustainability of the community and to life on the planet. These are aspects that demand collective construction and theoretical-practical maturation of the Social Field of EE.

Image 1 - School garden infrastructure project



Source: The author, 2024.

Image 2 – Construction of the vegetable garden.



Source: The author, 2024.

Image 3 – Planting development.



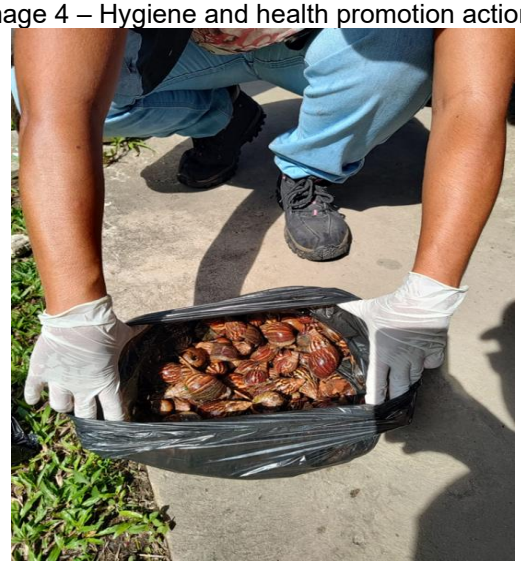
Source: The author, 2024.

It is noteworthy that the sustainable education projects had as their main objective to develop ecological awareness among students and teachers, a goal successfully achieved. According to Bortolon and Mendes (2014), Ecological awareness is linked to the preservation of the environment. The importance of preserving natural resources has become a global concern and no country can exempt itself from its responsibility. The evolution of man has been long until he reached a full and complete awareness of the need to preserve the environment, it is constantly seen, through the media, the contamination of the environment by nuclear waste, by the disposal of chemical waste, domestic, by the

greenhouse effect, deforestation among other causes that cause aggression to the environment.

In addition, the school offers an environmental course in two modalities of entry into the environmental area: integrated high school for students who attend high school and concomitant technical school, which covers students in the morning and afternoon periods, and the subsequent course for people who have already completed high school, also available in the afternoon and night shifts. It was also observed a 70% growth in active participation in workshops and projects, in addition to a 30% reduction in incorrect disposal in the institution and 50% that comprises are about sustainability.

Image 4 – Hygiene and health promotion actions.



Source: The author, 2024.

Image 5 – Tree planting actions.



Source: The author, 2024.

In this way, this experience report converges with what was presented According to Pinhabe, Cabral and Galvão (2022), when they state that Environmental Education and

sustainability can contribute to the realization of a culture that promotes sustainable development, in line with the 2030 Agenda. But, for this, it is necessary to reflect on the relevance of an education focused on the interdependent and interrelational vision of life on our planet, incorporating the sense of change in culture and responsibility of this and future generations.

Image 6 – Ecobag workshop.



Source: The author, 2024

DISCUSSIONS

Recent debates at the global, national and local levels on environmental issues have led to the decision to make the inclusion of an environmental education subject mandatory in the curriculum of schools in the state of Pará. (Law No. 9,981 of 2023). For Bortolon and Mendes (2014), in Brazil there is a great need for awareness in schools from the beginning to higher education, it is necessary to include a specific discipline of environmental education.

> In 1999, Environmental Education became Law No. 9,795 – Environmental Education Law, where in its Article 2 it states: environmental education is an essential and permanent component of national education, and must be present, in an articulated way, at all levels and modalities of the educational process, in a formal and non-formal character. It should be noted that Brazil is the only country in Latin America that has a specific national policy for Environmental Education (Bortolon, Mendes, 2014).

From this, EETEPA in Belém plays a fundamental role in promoting Environmental Education and sustainability, forming citizens who are aware and engaged in the protection of the environment. The Institution serves as a model for other schools and for society as a

whole, demonstrating that environmental education is essential for building a sustainable future in a globalized world.

Even so, the Institution encourages educators to incorporate Environmental Education into their curricula, promoting the formation of conscious and responsible citizens, in addition to demonstrating that environmental education is fundamental for building a sustainable future in a globalized world.

In this sense, the production, transmission and appropriation of knowledge in critical educational processes aim to contribute to the confrontation of alienated social relations and to overcome the environmental and societal crisis. The research shows this concern in the didactic transposition of the specific knowledge of Environmental Education with the local social practice for the development of practical, conceptual and attitudinal learning in favor of humanized relationships with nature (Loureiro, 2015).

Thus, Environmental Education promotes an awareness of what can really be understood about what sustainability is, since, when studying sustainable development, education should be aimed at as a basis for a conscious concept that really promotes sustainability (Roos & Becker, 2012).

According to Rosa, Kauchakje, Fontana (2024), discussing EE in school is to seek ways to overcome the contradiction in "thinking and doing" in school management. And, thus, to move forward to overcome the hegemony of "pragmatic actions" in the context of EE, in the sense of forging references of critical EE, in line with the guidelines expressed in the National Curriculum Guidelines for Environmental Education.

In this aspect, EETEPA associates theory with practice, when it operationalizes its educational projects aimed at protecting the environment in the various actions shown in this research, which enhances sustainable habits on the planet.

The various species existing on our planet deserve all our respect. In addition, the maintenance of biodiversity is fundamental for our survival, since it is necessary to plan the use and occupation of land in urban and rural areas, considering that it is important to have decent housing, work, transportation and leisure conditions, areas for food production and protection of natural resources (Roos & Becker, 2012).

CONCLUSION

From what was exposed in this work as sustainable practices in the school, it can be concluded that EE was developed as it should, producing positive aspects in the school community and surroundings.

In this way, EETEPA carries out a cycle of lectures, preparatory courses, orientation workshops, education and health actions, plastic recycling practices, planting of legumes and native vegetation in the region and awareness campaigns in the school community. Thus, this Institution should serve as an inspiration in the three spheres of government, and to our educators who incorporate Environmental Education as sustainable practices in the globalized world.

Therefore, it is in school that the socialization process occurs and what is (re)produced in it is valued and respected, becoming a social model of environmentally correct behavior that must be learned in practice, in the daily life of school, contributing to the formation of responsible citizens. Thus, Environmental Education is a way to connect such processes in the student's mentality, forming citizens who are aware and concerned about the environmental theme.

It is verified that the practice of Environmental Education in schools is the way to make society more culturally complete, through educational actions, adequate conditions and training for educators so that they can work on themes and activities of Environmental Education, in a way that enables the critical awareness of students, generating new concepts and values about nature, contributing to the preservation of the environment.

ACKNOWLEDGMENTS

We thank EETEPA for the services provided to society and the construction of knowledge about awareness, which contributes primarily to the awareness of citizens in the way they think and act about the environment that surrounds them. The institution demonstrates that Environmental Education is fundamental for building a sustainable future, and that everyone's participation is essential to achieve this goal.

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MAINTENANCE AND INSTRUCTIONS FOR VIRTUAL REALITY SYSTEM ASSEMBLIES[1]

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ABSTRACT

The main objective of this work is to create an integrated environment in virtual reality for simulation of maintenance processes, prototyping and assembly of customized industrial automation sets. For this, an application was developed using the UNITY software. The model was tested and simulated for various types of assemblies, using elements such as pneumatic cylinders, compressed air handling units and process automation valves. The results show that it is possible to create a new way to teach workers and students to adapt to these machinery and equipment, concluding a way to optimize future learning and instruction processes to facilitate the maintenance of components of a company and didactics of new members in the world of industrial automation, in addition to contributing to the advancement of technology and development of industry 4.0.

Keywords: Virtual Reality. Industry 4.0. Industrial Automation.

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INTRODUCTION

In the current global context, several companies need to achieve competitive growth to continue standing out in the market, in which this advance often involves the use of new technologies for process improvements and employee qualification. For Netto *et al* (1998, p 104), it would be necessary to replace obsolete and low-productivity equipment with more modern and productive ones, with restructuring of factory *layouts* and existing transport flow.

In the advancement of history, several artists and authors of characteristic works sought ways to portray the world and reality according to their own senses, but only achieved a great advance with the use of 3D perspective, where it was possible to create a progression to new notions of space and movement (LAVALLE, 2023).

The form of modern industry, called Industry 4.0, has as its main objective to maintain the man-machine relationship present in the process, to the point that it is possible to continue the exponential development with technology and conceptions of human understanding to facilitate general processes and incorporating the realistic perspective in the process.

According to Braga (2001, p5), the area of education is the sector where there is a greater focus on the introduction of new technologies, in which it can be seen as a process of discovery, exploration and observation. Multiple experiences may facilitate users with a new, more advantageous and expansive learning, allowing traditional methods to be modified and improved as studies advance. Thus, it would be possible to incorporate the studies with this new revolution of industrial improvements, allowing a great advance in both areas with a correlation that can further facilitate the growth of new technologies in the market of industries that wish to have an expansive increase in their competitiveness.

According to Casas (1996), research in the construction of intelligent education environments has been underway for almost three decades in which the main focus is the individualization or adaptability of the user in the involvement of interactive systems. The operation of any machinery or set requires the preparation of operator training, but it is often not possible to carry out this training due to various factors such as costs, lack of practicality and space, safety risk, and others (BUCIOLLI, 2006). Virtual reality systems provide a constant and coherent reaction to users' movements, making a consistent experience possible to enjoy a sense of presence in the virtual world (BOTEGA, 2009).

The work developed is of the modeling and simulation type.

The objective is to develop an integrated environment in virtual reality with 3D object simulation in order to use this technology to teach and improve industrial processes, to the

point of teaching employees and instructing students the handling and assembly of assemblies used in industrial automation processes.

The expected product is a 3D environment, with six degrees of freedom, capable of simulating assembly instructions and interaction with components, created by the UNITY software, with fundamentality in the development of the competitive advancement of companies, as well as progress in the area of technology aiming at the future of the automation industry.

LITERATURE REVIEW

The great challenge is to create a constant simulation of machines and industrial assemblies due to the implementation in the field of simulations and animations, with synchronization of stages, but it facilitates the understanding of the use of devices by observing from different angles of the process of a real machine, including those that are difficult to access or almost inaccessible (BUCIOLLI, 2006).

Virtual reality simulations are part of a new context that characterizes this revolution to change and transform the industry through digitalization, opening doors for the entry of new technologies widespread in this type of innovation.

The objective of this work is to develop an environment that allows interaction with 3D objects and enables the various personalized applications with assemblies generated by the integration of virtual reality.

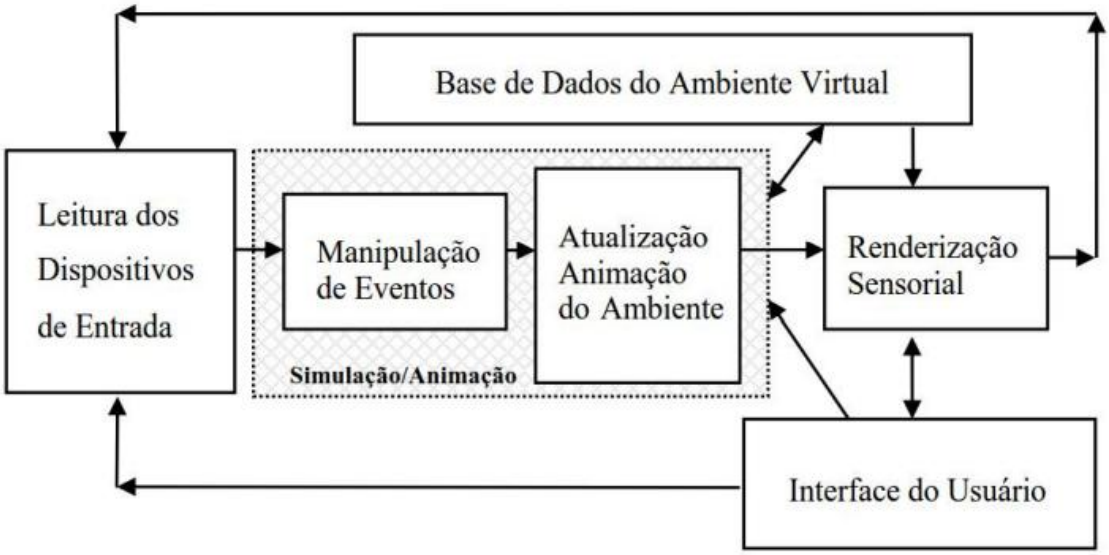
OPERATION OF DEVICES IN VIRTUAL REALITY

Virtual Reality (VR) can be described as an advanced user-computer interaction interface, as it uses different realizations of devices and peripherals with multisensory actions with aesthetic similarity of the real and physical environment (BORBA, 2021, p.754). This technology is capable of transporting the user to the simulation environment, allowing him to interact and feel fully immersed in a virtual world, capable of feeling reactions and interacting with objects (KIRNER, 2011).

This new technology is capable of introducing the user to various information through a processor that is capable of computerizing data so that there is a simulation of an environment capable of allowing the user to interact with what he is viewing. For this, a resource capable of creating a greater illusion of depth is used, making the user feel this perception from their own brain through their own senses in an environment totally recreated from computer modeling, which differs from Augmented Reality (AR), which uses the real medium to create this perspective.

In this virtual environment, it is possible to make people able to have expanded meanings of intensity, making it possible to see, hear, feel, activate and travel in a space with greater or lesser perceptions of depth, observing various occurrences and phenomena (TORI *et al.*, 2006, p.10). With this, data is read by sensors that perform event manipulation and create a basis for them to render and simulate the desired environment, from the interface between user and machine. Figure 1 shows what the diagram would look like for this cycle of data input and output from the device.

Figure 1 – System architecture diagram



Source: (Tari, Hounsel A. Kiron's 2018).

INDUSTRY 4.0 AND NEW TECHNOLOGIES

According to Santos (2018, p.2), "Industry 4.0 is one of the terms used to describe the high-tech strategy promoted by the German government that is being implemented by the industry". The introduction of new Internet technologies in industry can be seen as the great technological basis for Industry 4.0 (PEREIRA; SIMONETTO, 2018, p.2). This new industrial model allows new forms of production to be adapted so that in the future it will be possible to maintain a human-machine relationship present throughout the system, to the point that we can optimize processes and improve overall performance.

For Coelho (2016, p.18),

> The impact of industry 4.0 goes beyond simple digitalization, passing through a much more complex form of innovation based on the combination of multiple technologies, which will force companies to rethink the way they manage their business and processes, how they position themselves in the value chain, how they think about the development of new products and introduce them to the market, adjusting marketing and distribution actions.

The innovations that will be adopted in this new type of revolution demonstrate how important it is for us to have a significant evolution in the market, due to the various improvements present in the scope of this new model. According to Klaus Schwab (2017, p.3), there are three reasons why this new revolution will take hold: Speed (with a multiple exponential result due to the worldwide interconnection by new technologies capable of performing this type of characteristic), breadth and depth (results beyond industry, predicting improvements in the economy, society and business) and impact systems (transforming the relationships between systems, companies and countries as a whole).

Industry 4.0, therefore, is a large set of new technologies in growth for applications in the social environment of work and production. Among these technologies, examples such as virtual reality, augmented reality, artificial intelligence, nanotechnology, Internet of Things[9], automated vehicles, 3D printing, and others can be obtained. The combination of these technologies has the potential to enable the so-called *Smart Factories* [10](JUNIOR; SALTORATO, 2018, p.4).

According to Hozdić (2015, p. 4), a smart industry is an industrial solution that provides flexible and adaptable production that solves problems with fast and dynamic speed to change the complex conditions of the world. To reach this level, globalization allows us to create opportunities and improvements from technological advancement and thus introduce new methods of research and development in modern industry.

Collaborative virtual and augmented reality environments open up new possibilities for group collaboration (PRESTES; CLETO, 2019, p. 6). Industry 4.0 benefits from exploring these environments so that it is possible to collect data and encourage industrial practices remotely and interactively.

VIRTUAL REALITY IN THE TRAINING AREA

For LaValle (2023, p. 13), a first-person experience can revolutionize several areas of knowledge, including engineering, mathematics, and science in general. Virtual reality offers a solution for concepts of geometric dimensions and interpretation of more complex data, in order to be able to naturally develop learning from the use of this technology. In this sense, the importance of a need for the link between sectors of technology development and the area of education is perceived (PEDROSA; ZAPALLA-GUIMARÃES, 2019).

Virtual Reality will be a great advance for the way new students learn or for different occasions, such as factory operators, however, the process may be a little slower than

[9] Term that portrays the digital interconnection of objects with the internet, enabling data collection.
[10] Industries that have interconnected tasks between employees and machines with data collection and digitalization.

usual due to the insecurity of using this new equipment. According to Borges *et al* (2019), "only 18% of companies in high-performing industries are ready to act, according to surveys, while 29% are not fully prepared and 30% are only somewhat prepared". The big question is to highlight the benefits according to the entry of the simulation of environments in the market and in other sectors.

The training area will benefit the most due to the great benefit of the use of immersive technology with the ability to continuously improve processes. Within this area, not only teaching for didactic use stands out, but also the integration procedure for improving functionalities, such as in the health area.

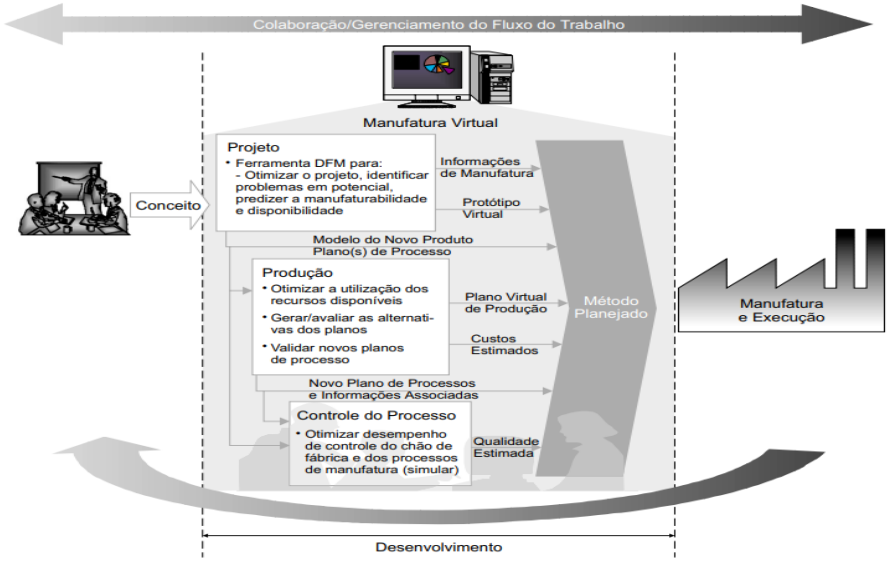
Lopes, Myskiw, Bós, Oliveira, Perpétuo, and Souza (2021) conducted a study with elderly people of different ages to use Non-Immersive Virtual Reality (VRNI) games, as training to stimulate functionality, showing in their studies that it is possible to use this technology as a safe physical intervention option, especially in tasks such as Palm Pressure Strength (PPF) tests, which significantly increased a difference from 21.1 ± 12.60 kg to 23.8 ± 13.51 kg. The same use of this technology allowed people with Parkinson's disease to be trained in virtual simulations. Among the various methods of motor rehabilitation, Virtual Reality can favor the use of motor training improvement, creating main benefits to learning through adequate training (SILVA *et al.*, 2019).

VIRTUAL REALITY IN THE INDUSTRIAL AREA

Virtual Manufacturing is understood, according to Porto, Souza, Revelli and Batocchio (2002, p.2), as a diversity of industrial processes and systems, defined as a modeling of systems and components by computers, audiovisual devices and sensors for the simulation of projects or environments in order to prevent real problems and inefficiencies. This concept has existed since 2002 and has played a fundamental role in providing an opening for the use of technologies in the industry.

It is noticeable that it is very similar to the use of Virtual Reality, since it integrates in its conception, the idea of creating a proper environment for simulation and verification of processes capable of improving or benefiting current procedures. Figure 2 shows an example of how virtual manufacturing would work by integrating computational processes and new technologies in the market in order to improve industrial processes.

Figure 2 – Virtual Manufacturing Environment



Source: (Porto, Souza, Ravelli, Batocchio (2002) based on the study by Porto and Palma)

For Netto, Machado and Oliveira (2002, p.26), the virtual environment can be applied in prototyping, which facilitates the product development cycle. As Virtual Reality guarantees the use of six degrees of freedom, it is possible for the operator or user to have better process control when verifying the prototype of items or assemblies as they are integrated into the simulated environment.

In the field of ergonomics[11], Virtual Reality can be an addition to the implementation of industrial processes with support for the evaluation of the operator's posture in the work field, allowing speed and instant optimization in a simulated station (WATANABE; CAPATAN; SIERRA, 2023). The introduction of virtual environments can be useful for users to adhere to an improvement in the way they behave during operation, thanks to the simulation of this same system.

Therefore, the effectiveness in the use of Virtual Reality can be useful so that several areas that require didactic and industrial can benefit from the use of the new technology, to the point of developing a new educational method of didactic and immersive training.

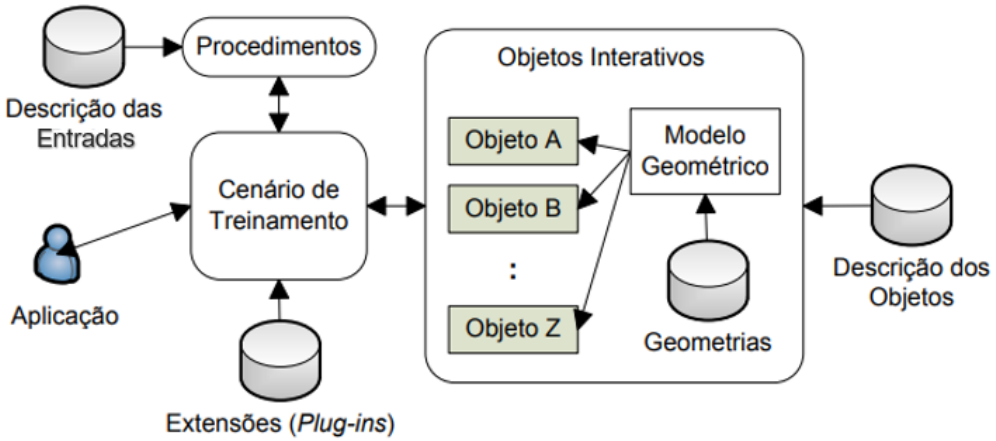
METHODOLOGY

In this project, an environment was created for learning about maintenance and instructions for assembling systems in virtual reality. For this, the methodology axes were divided between the use of software to create the environment, development of *assets* to adapt the environment and application in virtual reality hardware, which were broken down into three stages: training scenario, interactive objects and application. Figure 3 presents an

[11] Science that aims to understand the collaborative work between machines and human beings.

overview of the operation of the system from a graphical flowchart of the application of the scenario.

Figure 3 - Architecture Overview



Source: (Belloc, 2011)

The first phase of the project corresponds to the development of the setting and configuration of the virtual reality scenario for the training. In this stage, the development of a small prototype of a video game in a 3D environment was applied, as shown in figure 3, with application for software configuration in order to adjust the specific parameters for the use of virtual reality. The game was made using the . DXF and . FBX imported into UNITY 3D (CUPERSCHMID; RUSCHEL, 2013) in order to search for files and models with free and fast access. These files were obtained through UNITY's own template website, called the *Unity Assets Store*.

In this store, it was possible to download *assets*, such as textures, models and projects to facilitate the procedure and development of projects on the platform. The UNITY engine[12] allows these resources to be easily added and can be transformed into a 3D setting. In this model, a game object is specified through the composition of several functionalities, which are added (or removed) (PASSOS *et al.,* 2009, p. 9).

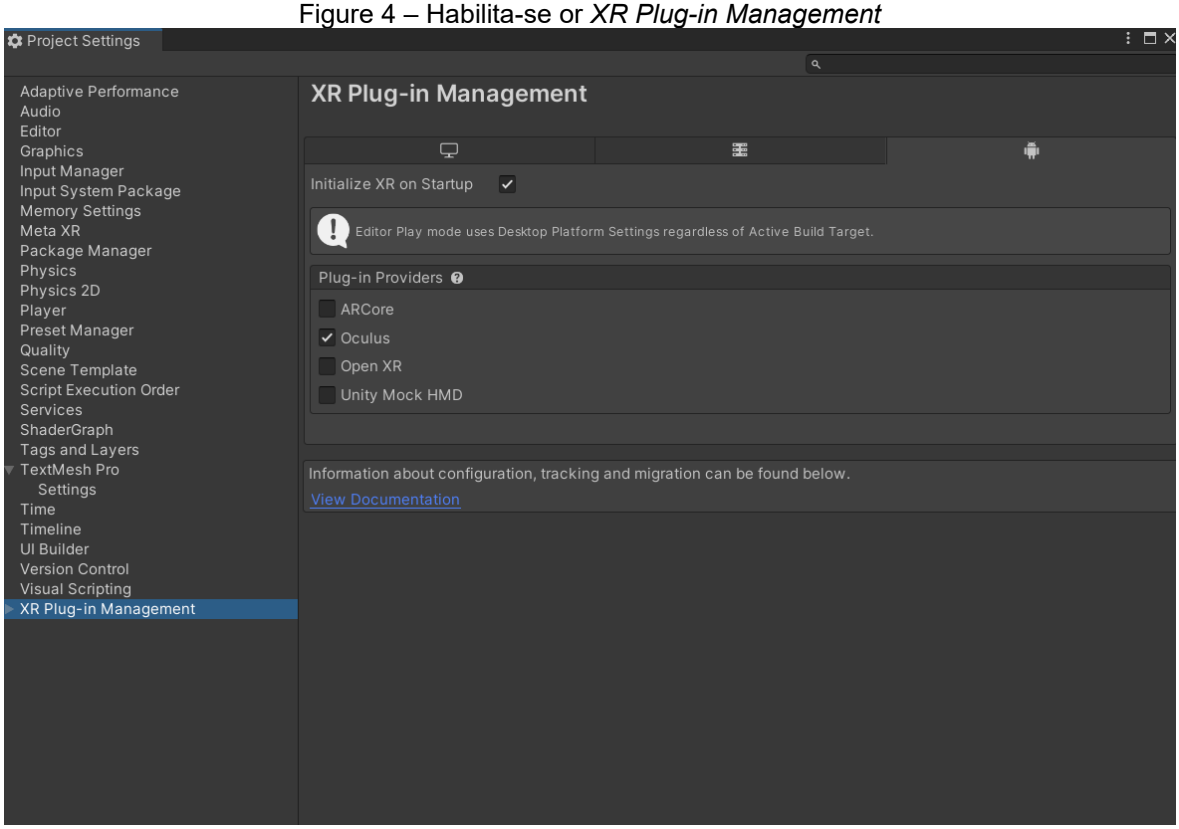
The game or application components have been inserted into an object that stores the information. A *Game Object*[13] is capable of storing the data of a scenario, which can be in the form of a scene object, texture, script or the user's camera configuration. The use of these *Game Objects* is essential for the visual components of the environment to be

[12] Engine that runs a game or software
[13] Object from a game developed in Unity that can store information

developed. These objects are all stored in scenes that together make up the structure of the environment.

Within UNITY, a project was created in version 2022.3.36f1 with the basic Virtual Reality model, which already allows you to test some ready-made assets from this test mold. In order to test the application of the objects in virtual reality, it was first necessary to enable the virtual reality modules within the UNITY creation environment. As shown in figure 4 below, *XR Plug-in Management* was enabled, which allowed the use of virtual reality options for devices such as computers and *Android* systems. This option is present within the edit tab and visible in project settings with plugins for various platforms.

Figure 4 – Habilita-se or *XR Plug-in Management*

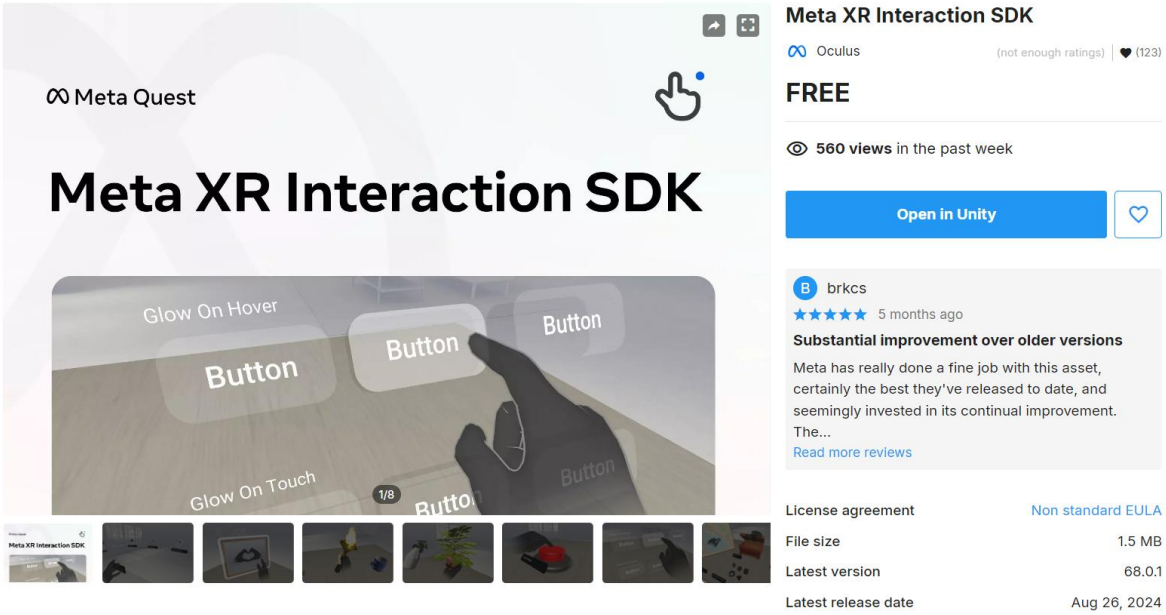


Source: (UNITY, 2024)

UNITY also allows you to download packages so that the projects developed can be done more easily, as represented in figure 5. These files called *Unity Packages* can be found both in the virtual store and in the development environment itself, allowing the import into the application. For the project, the *Meta XR Interaction SDK was used,* which allows for greater ease to configure the camera and hands that interact with objects from within the project and install it in its development environment. This package facilitates the

development of interaction with objects in virtual reality with the possibility of interacting with components in real size without the need to create [14] new or undeveloped scripts.

Figure 5 - *Meta XR Interaction SDK Download Page*



Source: (Unity Asset Store, 2024)

After that, just insert the desired elements or start the project from a prefabricated environment of items and *scripts*. The kit itself already contains a *driver configuration* with camera positioning that facilitates the movement of the user's head, in addition to containing the same configuration for monitoring the hands that can be used with or without the controls for interaction with objects. Buttons have also been created to improve interaction according to the type of simulation.

For all this to be configured, it is necessary to have the SDK (*Software Development Kit*) and JDK (*Java Development Kit*) packages updated in the versions that are consistent with the hardware that will be used. The first is a collection of tools that develop applications for *Android* and IOS with APIs[15] that allow this development, while the second has tools of the same type, but being a programming kit for JAVA, necessary to compile the codes.

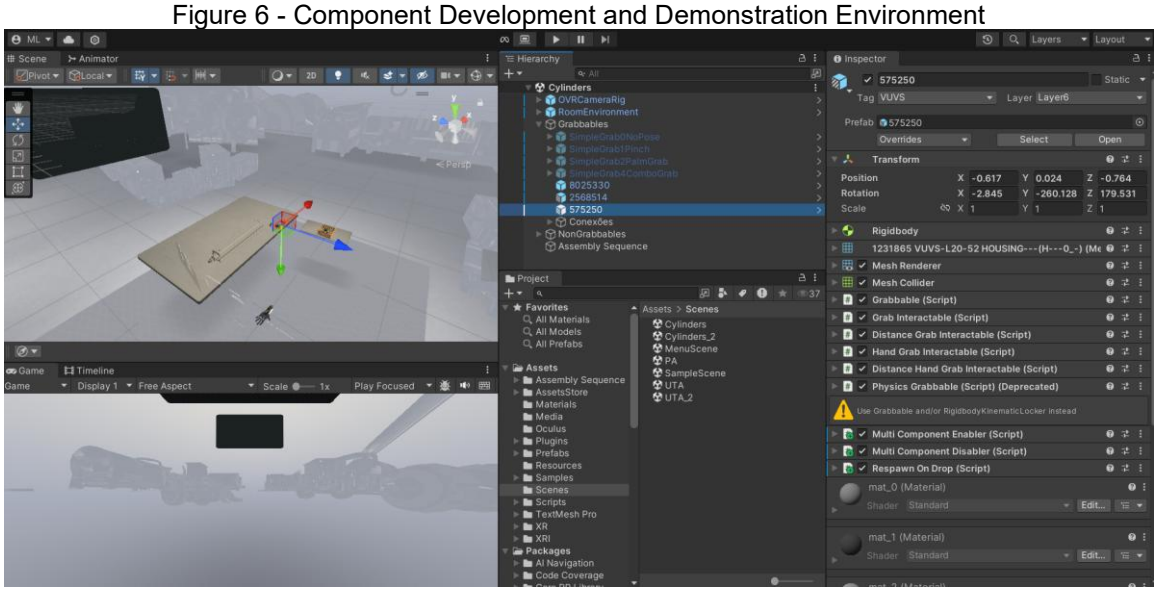
In the second stage, the objects and components were inserted into the project and changed so that it was possible to interact according to the commands of the *scripts*. It should be noted that within this procedure, all the geometries and descriptions of the *Game Objects* will be used so that there is an adaptability for the use of virtual reality in this game developed as a prototype. 3D modeling is extremely important, as it is what will give the user the first impression to the player (DOS SANTOS; CARUSO, 2011).

[14] Sequences of programming codes capable of automating or enabling an action/task
[15] Application Programming Interface

In the project, three free software were used that allowed to improve the adequacy of 3D objects within the virtual reality environment. *Quick Search Plus* allows you to download step *format files of* the components of the industrial automation company FESTO that will be used to simulate the assembly of the assemblies. It was necessary to enter the code of the desired items and open the *CAD* option to access the three-dimensional view of the objects. After that, in the export tab it was possible to select the file format to download. This model was passed on to the *Free Cad software* that made it possible to reintegrate the step document to the gltf *format*, improving its quality in 3D and allowing to perform the last modeling in the *Blender* software, capable of modeling and animating these files and preparing them to be imported into Unity. In addition, the use of the *Meta Quest 2* recorder was considered to develop videos to be placed in the background in order to teach the user how to assemble the sets. With the free editing app *Capcut*, it was possible to edit the videos and insert them into the environment in a way that is concise to visualize the montage. An image of the assembled set made available to the user was also considered.

With the models prepared and imported, it was enough to integrate them into the environment. Each has been changed, within Unity, with "components" of the META SDK that give the visual and physical characteristics, as well as allowing interaction with the user as shown in figure 6. In the image, we have selected the model of the solenoid valve VUVS-L20-M52-MD-G18-F7 with numerical code 575250 with collision components, hand interaction and user control, 3D physics and *scripts* to enable and disable the same elements assigned to the object.

Figure 6 - Component Development and Demonstration Environment



Source: (Unity, 2024)

For the last stage, the project will be suitable for the hardware and devices that perform the simulation in virtual reality. This process will be done after the implementation of the tests, and can be repeated several times as the software progresses and develops for the project. When finishing the insertion of the objects and *programmed scripts* , it was necessary to import the software to the desired device, creating a *build*[16] and implementing it in the hardware according to the specification. To do this, *Gradle*[17] was used to create and manage the projects according to the SDK and JDK settings. As it is a build and dependency management tool, the files were generated when building the projects for the chosen platform.

All the time, new applications arise, due to the demand and creative capacity of people through VR, the human-machine interaction has changed (RODRIGUES; PORTO, 2013). As technology advances, virtual reality has been fitted into a greater number of platforms, from cell phones to own devices.

The Meta Quest 2 *device will be used in the project*, being the latest virtual reality headset that has dominated the virtual reality device market since 2022. According to Raymer *et al* (2023), the device contains a Qualcomm Snapdragon XR2 processor and an LCD panel with a per-eye resolution of 1832 x 1920, with a frame refresh rate of 120Hz, along with an operating system based on *Android* 10, with 128 or 256 GB of internal memory.

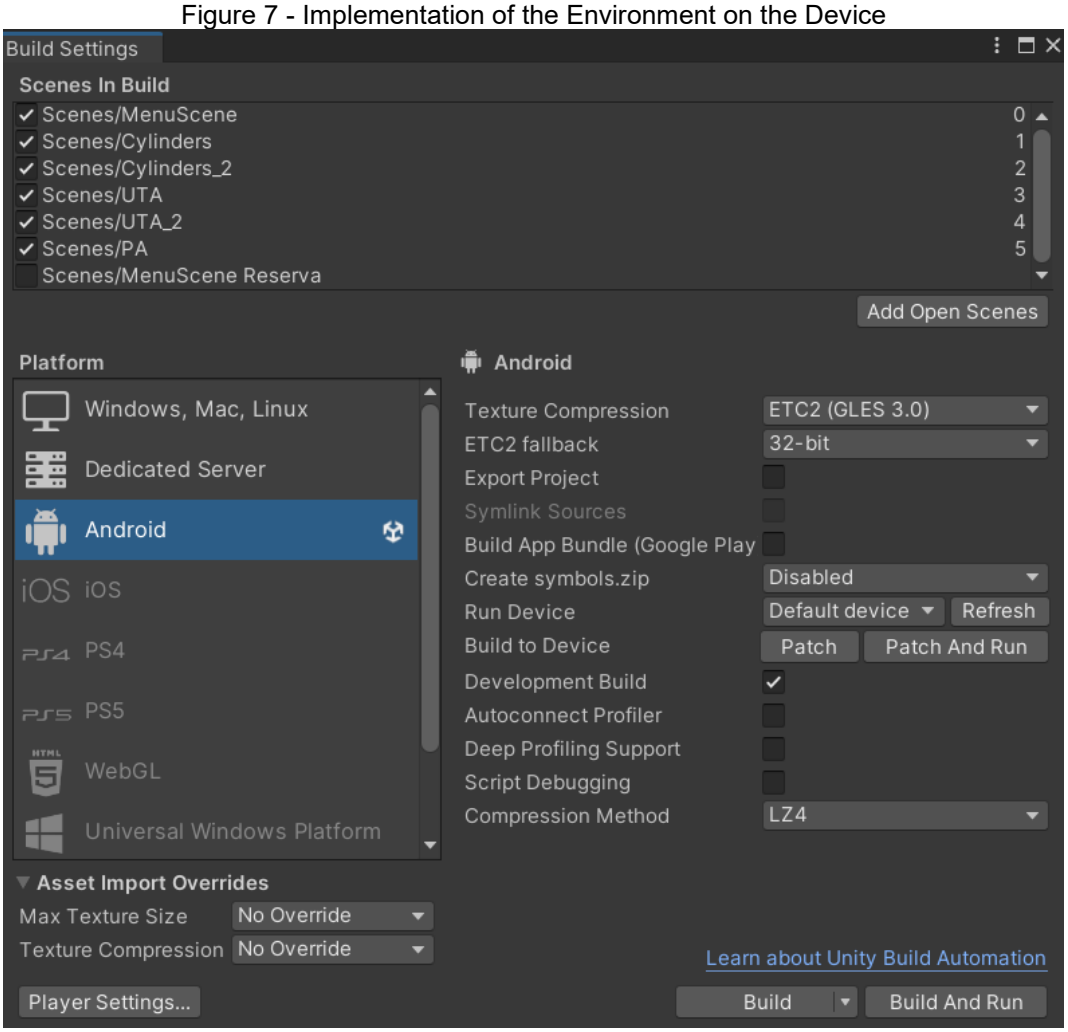
For modeling the environment in 3D, the *Meta Quest 2* will be a very useful device due to its ease in designing the software's frames in real time, with a very large realistic advance. The device will be a major key in advancing the project, enabling users who will be able to test the equipment with the integrated environment to have an immersive and deep experience of equipment maintenance and assembly assemblies. In order for us to use the device, it is necessary to activate the developer mode in the *Meta Quest* application, present in the menu and in the devices option, finding the device located and enabling this option.

For the implementation on the device, it is necessary to go to the *File* tab and select the *Build Project option*. After that, the Android option must be selected and change the platform to the chosen one. Within this option, it was essential to choose the scenes that will make up the environment so that they were all imported into the virtual reality glasses. All this configuration can be seen in figure 7. With the adjustments, the *Meta Quest 2 will be connected* to the computer from a USB cable and thus generate the *build* for the device.

[16] Converting the project into software
[17] Tool used for project conversion

After charging, it was possible to view the environment inside the device, enabling various interactions with objects.

Figure 7 - Implementation of the Environment on the Device

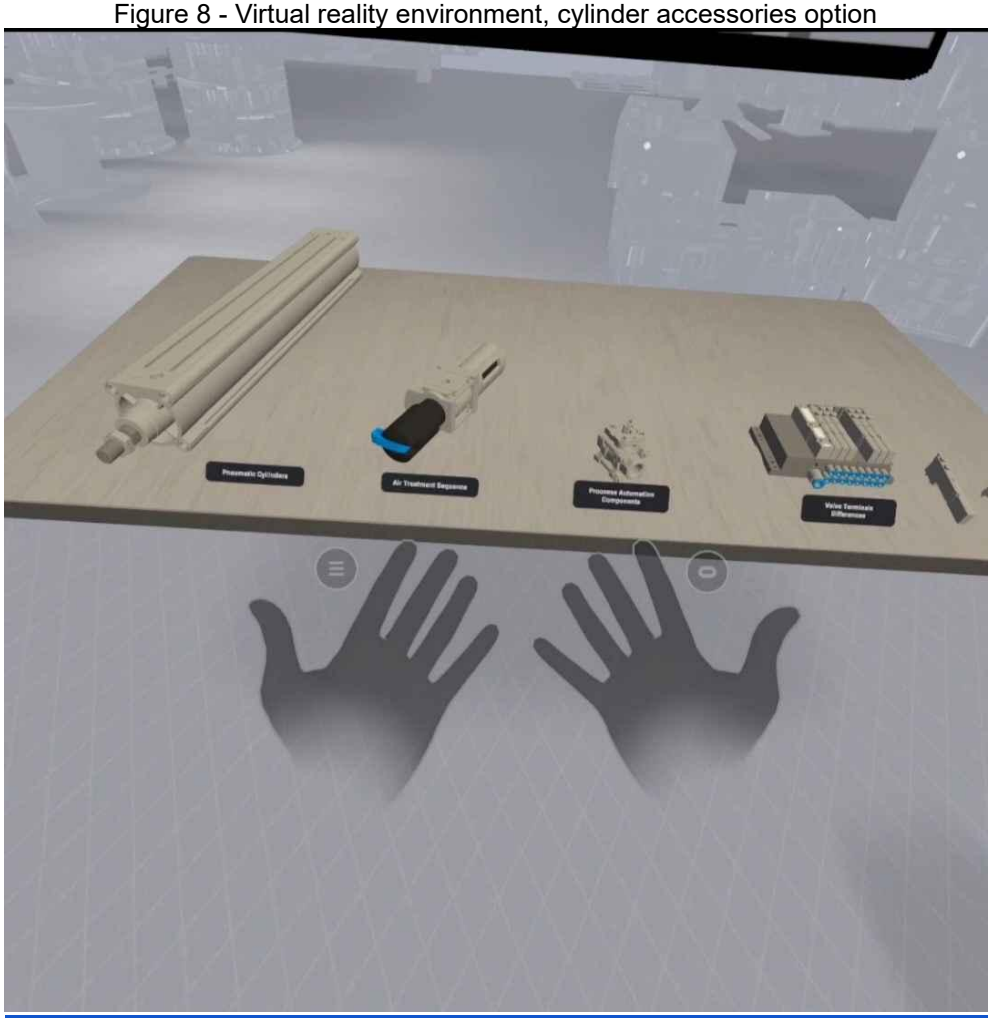


Source: (Unity, 2024)

RESULTS AND DISCUSSION

With the integration of the software created by UNITY, it was possible to implement the environment on the *Meta Quest 2 device*. The environment was configured to integrate virtual reality, along with scene objects in the background, which allows for a greater depth of an industrial scenario. Figure 8 has a *link* that leads to a video demonstrating the virtual reality environment developed according to the methodology of this article. You can access it by hovering over the image.

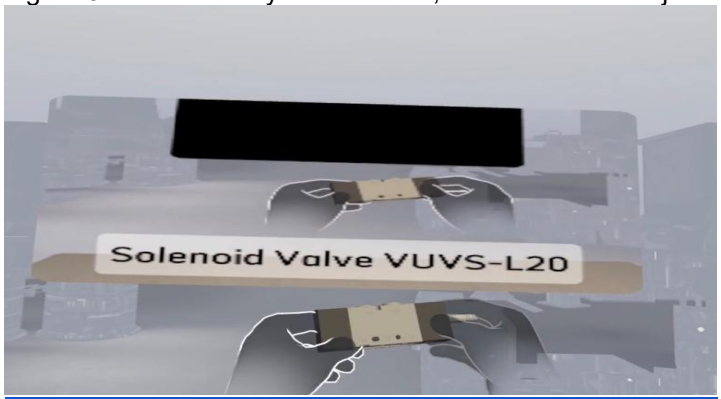
Figure 8 - Virtual reality environment, cylinder accessories option



Source: (Author, 2024)

It was verified that there were no problems in simulating the objects in the environment, keeping the scale at real size and allowing the user to easily interact with the objects in the scene. In figure 9 there is an example of how the user uses the explanatory video so that he can manipulate the scene objects, making it possible to perform the assemblies according to the instructions. In this image there is a *link* to a demonstration of the process of assembling a pneumatic cylinder with its accessories.

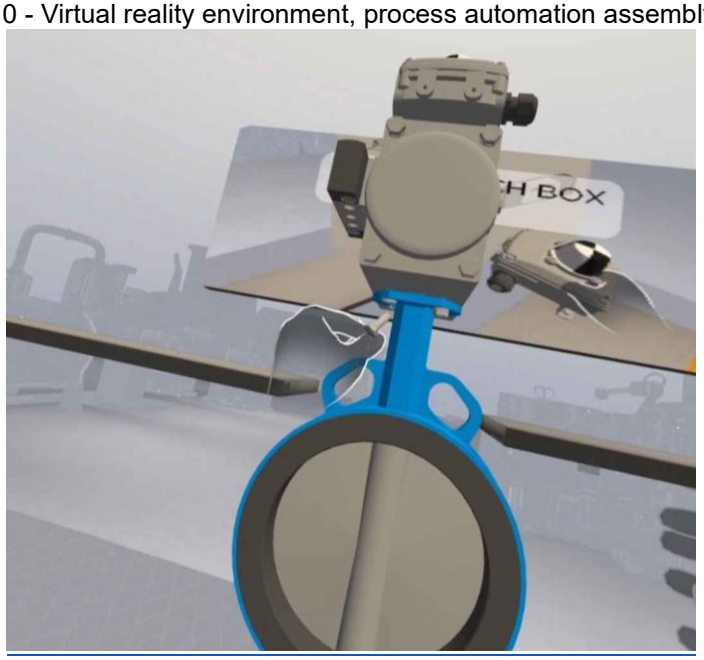
Figure 9 - Virtual reality environment, interaction with objects



Source: (Author, 2024)

With the interaction of objects, it was possible to make the assemblies according to the tutorial videos in the background with neutral and self-explanatory language. In figure 10 it is possible to see the assembly process of a rotary actuator in a butterfly valve, and this assembly is commonly used in process automation systems. A demonstration was inserted in the image through a *link* as in the other previous examples.

Figure 10 - Virtual reality environment, process automation assembly option



Source: (Author, 2024)

Through the developed model, it was possible to develop more scenes to apply different types of assembly solutions, only differentiating in the aspect of the assembly and in the way the steps are made to join the objects.

FINAL CONSIDERATIONS

It is possible to simulate an integrated environment in virtual reality capable of teaching the user how to assemble industrial automation sets and instruct them to use these learnings in their routine or for their own knowledge.

The model created allows the operator to interact with objects with physical properties and real sizes through touch, enabling him in the technical knowledge to develop assemblies and group objects according to the instructions given by the software. Therefore, it is possible to conclude that virtual reality is a great technology capable of integrating the user into the industrial environment through 3D simulations.

Some limitations still occur due to the UNITY platform because it is not a software totally focused on the use of virtual reality, which can create some problems and errors depending on the development that can be exhausting for the user and the developer.

Future updates may include a continuous improvement in the development of the application, allowing better user interaction with the system and increasingly integrating with the recurrent evolution of Industry 4.0 with the use of more technologies in order to enable the human being in the industrial environment.

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FROM INFORMALITY TO FORMALISM: THE BRAND AS A MEANS OF DRIVING SMALL BUSINESS

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ABSTRACT

Trademark registration has gained relevance, especially after the pandemic, being essential for small, medium, and large entrepreneurs to stand out in the market. Intellectual and Industrial Property are regulated by several laws, with a focus on the protection of innovations and trademarks.

Keywords: Intellectual Property. Trademark Registration.

INTRODUCTION

Since the 60s, when the World Intellectual Property Organization (WIPO) was founded, until shortly before the COVID-19 pandemic, a disease caused by the new coronavirus (SARS-CoV-2), entrepreneurs, third parties interested in the area and other citizens have never heard so much about the importance of trademark registration as they do today.

People have been interested in the theme and, mainly, in giving a new look to their businesses, drawing the attention of consumers not only to the simple consumption of their products and services, but to the exchange of the most different experiences and transmission of credibility by the brands they propagate. Undoubtedly, they seek financial ascension in the market, not by chance seeking qualification, formalization and a more fierce marketing.

With the accelerated exchange of Information and Communication Technologies (ICTs), provided by the unbridled use of the internet, during and after the COVID-19 pandemic moment, there has been a growing number of suppliers in the most diverse social networks, which, most of the time, start their business without a physical establishment for sales purposes, but only virtual, in view of the low cost for the enterprise. Many of these, in other cases, due to the lack of affinity with ICTs, but also due to the low cost, for example, still resort to informal work on the streets, fairs, squares, etc.

In this context, the question arises: what do both have in common? Now, the need to advertise their businesses through an identity, because it seems quite evident the fact that those who do not show up do not sell.

Through this work we intend to demonstrate that trademark registration is important for everyone and not just for the great entrepreneur; that having a registered and well-used trademark is essential to stand out in the market; that the national legislation does not privilege some to the detriment of others, and the small, medium or large may be penalized for the improper use of the trademark of third parties; and also, that there are support networks that can be welcomed by small suppliers capable of giving the due and necessary support regarding the registration of their trademarks.

To this end, we divided the study into five sections, including this introduction. The second has brief considerations on Intellectual Property (IP) and Industrial Property; the third, with relevant information about Trademark Law (concepts, applicable rules, legal principles, etc.); the fourth, with a compilation of data on the formalization of companies for small entrepreneurs, the importance of trademark registration with the National Institute of

Industrial Property (INPI) and the consequences of misuse; and finally, the fifth section with the conclusion.

INTELLECTUAL PROPERTY AND INDUSTRIAL PROPERTY

The World *Intellectual Property Organization* (*WIPO*), which is part of the 16 agencies of the United Nations, was founded on July 14, 1967 in Stockholm, Sweden, and is now the world's leading regulatory forum for IP protection policies based in Geneva, Switzerland (WIPO, 1967). It is responsible for the administration of 26 international treaties on IP, including the Paris Convention of 1883 - CUP (for the Protection of Industrial Property) and the Madrid Protocol (relating to the international registration of trademarks) (WIPO, 2024).

IP is defined by the WIPO Convention, in its Article 2, item VIII, as the rights related to literary, artistic and scientific works; performers' performances and performers' performances, phonograms and radio broadcasts; inventions in all domains of human activity; scientific discoveries; industrial designs; industrial, commercial and service brands, as well as commercial firms and trade names; protection against unfair competition; and all other rights inherent to intellectual activity in the industrial, scientific, literary and artistic domains. For Barbosa (2020, p. 7), it is a chapter of Law that comprises the field of Industrial Property, Copyright, in addition to other rights over diversified intangible assets.

The Federal Constitution (CF/88) ensures protection of IP rights, raising them to the level of fundamental rights, listed in its Article 5. Item XXII, for example, guarantees copyright protection; and item XXIX guarantees inventors the temporary use of inventions and protection of industrial creations.

Industrial Property, in turn, is defined by the CUP, in its Article 1, § 2, as the set of rights that includes invention patents, utility models, industrial designs or models, factory or trade marks, service marks, trade name and indications of origin or designations of origin, as well as the repression of unfair competition.

At this point, Barbosa (2020, p. 8) recalls that the CUP highlights the fact that, although the qualification of "industrial" has been adopted, Industrial Property is not limited to industrial creations and trade per se, as it extends to agricultural and extractive industries, as well as to all manufactured or natural products, such as wines, cereals, leaf tobacco, fruits, animals, ores, mineral waters, beers, flowers and flours.

In Brazil, the rights and obligations related to Industrial Property are regulated by the Industrial Property Law – LPI (Law No. 9,279, of May 14, 1996) and, according to its Article 2, it includes: granting of invention and utility model patents; granting of industrial design

registration; granting of trademark registration; repression of false geographical indications; and repression of unfair competition.

In any innovation-based economy, the IP system has strategic relevance. In the country, this role falls to the BPTO, the Ministry of Agriculture, Livestock and Supply (MAPA) and the Secretariat of Copyright and Intellectual Property (SDAPI) (BUAINAIN; SOUZA, 2019).

The BPTO, a federal agency created in 1970, is responsible for the improvement, dissemination and management of the Brazilian system for granting and guaranteeing IP rights to the industry. Currently, it is linked to the Ministry of Economy and aims to stimulate competitiveness and innovation, thus fostering the economic and technological development of Brazil (INPI, 2024). MAPA, on the other hand, operates in the area of protection and registration of plant varieties and SDAPI, linked to the Ministry of Citizenship, is the regulatory and supervisory body in the field of copyright protection (BUAINAIN; SOUZA, 2019).

Trademarks are inserted in the context of Industrial Property and serve to designate products and services, identifying their origin and distinguishing business activity from competitors, and can also be collective or certification, as will be seen in the following topic.

OF BRANDS

Trademark Law is governed by CF/88, by the LPI, as well as by treaties and conventions to which Brazil is a signatory, such as the CUP, the Trade Agreement Related to Intellectual Property Rights (TRIPS) and the Madrid Protocol. It is also possible to mention the Trademark Manual (INPI, 2023) and the Collection of Decisions of the 2nd Administrative Instance (INPI, 2021), which are key pieces for understanding trademark registration procedures.

In general, it is understood that the legal function of trademarks is to distinguish a product or service from competitors. However, to the common consumer, they have taken on the role of informing extrinsic attributes, related to credibility. This means that the consumer tends to trust the information provided by the producer through his brand. In this context, these signs came to be considered fundamental to the processes of choice by the consumer public (BARBOSA; CAMPOS, 2019).

The Magna Carta, in item XXIX of Article 5, ensures protection to industrial creations and, consequently, to brands, in view of the social interest and the technological and economic development of the country.[1]

According to the LPI, a trademark is any distinctive sign, visually perceptible, not included in the prohibitions contained in Article 124, whose main functions are to identify the origin and distinguish products or services from others that are identical, similar or similar of different origin.

Brands have presented the most diverse definitions by the main authors of works in the area. It should be noted that they are very much in line with the provision given by Brazilian law. The classical scholar, João da Gama Cerqueira, defines them as "any distinctive sign optionally affixed to the products and articles of industries in general to identify and differentiate them from other identical or similar ones of different origin" (CERQUEIRA, 2012, p. 253). Denis Borges Barbosa understands that, "when designating a product, merchandise or service, the trademark traditionally serves to signal its origin and, in relation to other trademarks for competitive items, to indicate the difference" (BARBOSA, 2017, p. 5).

However, Barbosa (2017, p. 17) also highlights that, primarily, the purpose of the trademark is to protect the entrepreneur's investment; and then, to guarantee the consumer the ability to discern the good and the bad product.

Now, thinking of a name is not always easy, as it can positively or negatively impact the business. With the choice of the name and the completion of the trademark registration procedure, the entrepreneur will incite consumption and value his business activity, consequently standing out from other competitors.

At this point, it is important to emphasize that "registration of the company's name" is not to be confused with "registered trademark", as the former concerns the filing of the company's articles of incorporation and respective registration of corporate name and trade name with the State Board of Trade; while the second concerns the registration of the trademark sign with the INPI at the national level.

This means that having a National Registry of Legal Entities (CNPJ) and making use of a trade name does not necessarily guarantee the owner the protection of his trademark, which is only acquired after the granting of registration by the competent federal agency. In fact, it is not necessary to have a company to obtain the registration of a trademark, as this

[1] **Article 5 (...) XXIX** – "the law shall ensure to the authors of industrial inventions a temporary privilege for their use, as well as protection of industrial creations, the ownership of trademarks, the names of companies and other distinctive signs, in view of the social interest and the technological and economic development of the country".

can also be requested by an individual, and one or the other must carry out a lawful activity related to the product or service that the sign aims to signal. On the subject, the Brazilian Micro and Small Business Support Service (SEBRAE) clarifies:

> The corporate name is nothing more than the name by which the company will be recognized in its official means when there is issuance of invoices, financial transactions, relationship with suppliers, accounting and legal issues and participation in contracts and notices.
>
> The trade name, on the other hand, is the one by which the market and customers will get to know the company in its essence, that is, it is its popular name. (...)
>
> What many do not know is that the creation of the trade name and corporate name and its registration with the CNPJ do not protect the trademark, since trademark registration and company registration are very different processes. (...)
>
> It is important, however, that the entrepreneur carries out both the registration of the company and the registration of the trademark, providing him with greater security and promoting the recognition of the business and the positioning that the market demands. This is because trademark registration facilitates its identification and memorization by the public, and is widely used for marketing purposes (SEBRAE, 2022).

As for the nature of the trademarks, it is possible to classify them as: product or service, certification and collective. Article 123 of the Brazilian IP Law defines, in its item I, a product or service trademark as one used to distinguish a product or service from an identical, similar or similar product, of different origin; in its item II, certification mark as the one used to attest to the conformity of a product or service with certain norms, standards or technical specifications, notably as to quality, nature, material used and methodology employed; and in its item III, collective trademark as that intended to identify and distinguish products or services from members of a given entity.

The BPTO's Trademark Manual (2023, p. 17), in turn, describes that the collective trademark has a different purpose from the product or service trademark, since its objective is to indicate to the consumer that the product or service comes from members of an entity representing the collectivity (association, cooperative, union, consortium, federation, confederation, among others), the real owner of the trademark, and its members may use it without the need for a license of use, respecting the provisions contained in the Regulation of Use (RU). And, in relation to the certification mark, it emphasizes that its objective is to inform the public that the product or service distinguished by the mark complies with specific technical norms or standards.

With regard to their form of presentation, trademarks are classified as: nominative or verbal (consisting only of words and combinations of letters and numerals, including acronyms and neologisms); figurative or emblematic (consisting of drawings, symbols, images, graphics and geometric shapes, which may include isolated letters and numerals);

mixed (consisting of nominative and figurative elements); three-dimensional (constituted by the distinctive plastic form itself, capable of individualizing the products and services to which it applies, and dissociated from technical effect); and position (formed by the application of a sign, in a strategic position, on a certain support, resulting in a distinctive set, which differentiates the product or service from other identical ones, and is not related to technical or functional effect) (INPI, 2023).

As a curiosity, the first Brazilian position mark was granted by the INPI to the company Osklen (Corporate Name: Terras de Aventura Industria de Artigos Esportivos S.A. / CNPJ: 35.943.604/0001-56), on 05/30/2023, through process no. 830621660**,** for the three eyelets positioned on the front of its famous sneakers.[2]

In some countries, the roar of a car's engine, the fragrance (odor) of a certain perfume, colors, flavors and textures are registered as trademarks, which does not occur in Brazil, notably due to the prohibition of national legislation, since the IPL makes it clear that "visually perceptible distinctive signs" are registrable as trademarks, which, from now on, it excludes what cannot be visualized, such as sounds and smells. The prohibition does not stop there, extending to 23 items of Article 124 of the same legal diploma, which include colors and their denominations, unless arranged or combined in a peculiar and distinctive way, as well as signs contrary to morals and good customs or that offend the honor or image of people or violate freedom of conscience, religious belief, worship, among others.

The BPTO, when analyzing a trademark application, evaluates the following criteria: lawfulness, distinctiveness, veracity and availability in relation to graphic, phonetic and ideological aspects; as well as conducting prior art searches, examining any oppositions, the Applicant's statement and other documents presented, and also proceeding with a market affinity search in order to avoid confusion for the consumer (INPI, 2023).

When we speak of lawfulness, it means that the trademark sign cannot go against morals and good customs; in distinctiveness, that all the circumstances capable of making the sign unique, different from the others when analyzed as a whole, are considered; in veracity, that the sign cannot be misleading as to its origin, origin, nature, purpose or usefulness of the products or services it aims to indicate; and in availability, that the sign must be free to be appropriated as a trademark, and cannot find an obstacle in another distinctive sign protected in any way.

In Brazilian Trademark Law, some principles are adopted, including Territoriality, Specialty, and Attributive System of Law (INPI, 2023).

[2] Decision in the application for registration of trademark no. 830621660, published in the Industrial Property Gazette (RPI) no. 2731, of 05/09/2023.

According to the Principle of Territoriality, the exclusive use of the trademark takes place in the country where the registration was granted, with an exception only in the case of the well-known trademark (Article 126 of the IP Law), which has international territorial protection and is sufficiently known in its field of activity. That is, it has registration in another country, but not necessarily previous registration in Brazil.

The Principle of Specialty, on the other hand, ensures that the protection of the trademark falls on products and services corresponding to the applicant's activity, that is, whoever applies for trademark registration has to carry out an activity compatible with the goods and services for which the trademark aims to sign, with protection by class. The BPTO adopts the Nice International Classification of Goods and Services (NCL), which has a wide list of 45 classes, among which the first 34 are for products and the others for services. Like the Principle of Territoriality, the Principle of Specialty also has an exception, namely: the case of the highly renowned trademark (Article 125 of the IPL), which must be registered in Brazil and which has protection in all classes.

And the Principle of the Attributive System of Law (also called *first to file*) guarantees the ownership and exclusivity of the use of the trademark to the first person to deposit/register it. The only exception to this principle is the so-called Right of Precedence or Right of the Prior User (paragraph 1 of Article 129 of the Brazilian IP Law), which prioritizes the second applicant if he proves that he has been using the same trademark as the first for at least six (6) months before the filing (or priority claimed) and this first applicant has not.

The LPI stipulates in its Article 133 that the term of validity of the trademark is 10 years, counted from the date of issuance of the registration certificate (publication of the concession in the Industrial Property Journal - RPI), and may be extended for equal periods indefinitely.

However, it is important to stick to the provisions of Article 142 of the same law, that the right obtained with the registration of the trademark may be extinguished by expiration of the term of validity (non-renewal), by total or partial waiver, expiration (non-use of the trademark for a period equal to or greater than 5 years) or non-compliance with the provisions of Article 217 of the Brazilian IP[3] Law; as well as to the provisions of Article 165, the trademark may be nullified through the Administrative Nullity Proceeding - PAN (within 180 days, from the date of publication of the granting of the registration in the RPI) or

[3] **Article 217 – "**The person domiciled abroad shall appoint and maintain an attorney-in-fact duly qualified and domiciled in the country, with powers to represent him administratively and judicially, including to receive summonses".

through the Nullity Action (within 5 years, from the date of publication of the granting of the registration in the RPI).

Thus, the ideal is to say that the trademark has a term of validity of up to 10 years, as it can be extinguished or annulled before completing the ten-year cycle.

It should also be noted that it is possible to license the trademark, which is the mere permission to use it for a fixed period (in the case of IP, corresponding to the period of its protection), without transfer of ownership, upon payment of *royalties* (ROCHA; SILVA, 2022); as well as the assignment of the trademark, which is nothing more than its sale, transfer, definitively, of its ownership (FREY; TONHOLO; QUINTELLA, 2019).

FORMALITIES FOR BUSINESS DEVELOPMENT

One of the characteristics of the Brazilian labor market, as well as of many developing countries, is the informality of a considerable part of the jobs, which constitutes a source of income inequality. Many workers do not have access to social protection mechanisms linked to formalization, minimum wage, the right to retirement, paid leave, etc. (IMBIMBO, 2022).

The informal business is commonly seen as one that has its productive activities outside the law. Some parameters are taken into account when defining informality: absence of declaration to the State of the activity performed; the way production is organized (small-scale productivity and simple technological process); the lack of employment relationships between those who work in informal organizations and a strong bond between their members and their families (MIRANDA et al, 2011).

The population employed in these activities has reduced access to government protection mechanisms, lower job security and greater volatility in income, requiring greater attention from the authorities, who should expand public policies in order to reduce the social vulnerability of the group, which usually has a greater participation of younger and older workers, among women and those with a lower level of education.

On the other hand, there is another group associated with informality, with a higher level of education or education, who often begin to undertake in their own homes, with a broader business vision, and who end up seeking to formalize themselves at a given moment.

Unquestionably, informality is present in two worlds: in that of those lacking information (due to illiteracy or lack of support from third parties) or public policies that cover this specific group; and in the case of those who, despite the higher level of education and

access to information, start their businesses in an amateur way in order to obtain an immediate income and only then start the formalization process.

It happens that businesses only begin to prosper, in fact, when the entrepreneur decides to challenge his own mind, nourishing it with information and, mainly, seeking support from those who can offer it: the public power (e.g., administrative and/or legal sectors of the executive or judicial bodies); private companies that provide services of public interest focused on social assistance, consulting, professional training, etc., such as the parastatals of the "S System" (e.g., National Service of Industrial Learning – SENAI, Social Service of Commerce – SESC, Social Service of Industry – SESI, National Service of Learning of Commerce – SENAC, SEBRAE); or private professionals specialized in the most varied areas that involve entrepreneurship.

For the second group of entrepreneurs, the formalization of their businesses seems to be a closer reality, given the framework of information they have access to, as well as a better financial condition to bear some investment costs, which, however small, will exist.

In the case of small businesses, companies can be registered according to three main frameworks: Individual Microentrepreneur (MEI), Microenterprise (ME) or Small Business (EPP).

The first is the basic form of incorporation of a company; it cannot have partners; it can have a maximum of one employee and the annual revenue is up to R$ 81,000.00 (eighty-one thousand reais). The second may have a single owner or a partnership with two or more partners, with annual gross revenue less than or equal to R$ 360,000.00 (three hundred and sixty thousand reais). And the third, as well as the second, can have one or more owners, but its revenue can vary from R$ 360,000.00 (three hundred and sixty thousand reais) to R$ 4,800,000.00 (four million and eight hundred thousand reais) per year (SEBRAE, 2023).

CF/88, through its Articles 170 and 179, ensures differentiated legal treatment to MEs and EPPs, with the aim of simplifying, eliminating or reducing their administrative, tax, social security and credit obligations, in order to stimulate the competitiveness and economic development of the country, in view of the generation of jobs, income distribution, social inclusion, reduction of informality, etc.

Other legislation also deals with the subject, such as the General Law, known as the National Statute of Micro and Small Enterprises, created by Complementary Law (LC) No. 123 of 2006 and modified by LC No. 128 of 2008 to include the figure of the MEI in its context. (OTTO; VIEIRA, 2020).

The advantages of formalizing as a MEI are: the professional will have no cost with its opening and closing, will acquire a CNPJ, will issue invoices, will have social security benefits and the right to bank credits with lower interest rates, will be able to hire an employee and participate in bidding processes. The disadvantages of remaining in informality include the lack of credibility in the market, lack of social security support, high bank interest rates and the risk of inspections and confiscation of assets (GILBERTO; SAINTS; FREITAS, 2020).

In addition to the entrepreneur observing his business as a company, he should not forget to protect his IP assets, especially his trademark, which, it should be noted, can be owned by an individual or legal entity and, in the words of IP specialist Daniel Chalhub, be valued at millionaire figures:

> The brand of an institution, company or person is an asset that can be valued in millionaire figures, representing not only its reputation and its identification with other institutions, but also being essential to present to the public its proposal and the values of that particular company or person. Due to the social and historical importance of the brand, it is essential to protect and manage it with the utmost care. (CHALHUB, 2020, p. 142)

In Brazil, the trademark application is made with the BPTO, exclusively on the internet, through the e-Marcas system, available on its portal. However, the procedure is not as simple as many think, as it requires in-depth specific technical knowledge or the help of specialists in the area, either through consulting, in order to enable the holder to perform it himself, or assistance as an attorney-in-fact, proceeding with all acts.

In research carried out by Neves (2023, p.71), "In 2022, about 25.40% of total trademark registration filings took place without an attorney-in-fact; of these, only 7.32% were successful". For him, the data suggest evidence of encouragement to the entrepreneur to file the trademark registration application without the constitution of an attorney-in-fact, even without the minimum of technical knowledge on the matter.

It is of paramount importance that a prior feasibility opinion is carried out, through a professional specialized in the area, to verify whether the trademark sign is registered or not, and, mainly, to know if it is registrable, in view, respectively, of the possible administrative and judicial negative repercussions, as well as the numerous specificities of Trademark Law. If it is not possible to hire a specialist, it is recommended that the entrepreneur seek help from SEBRAE for guidance on the procedures, in addition to the INPI itself, where the trademark registration application is made, because on its website the most diverse manuals and tutorials are available, which must be studied in depth to, Thus,

slightly reduce the chances of failure when filing the application for registration of a given trademark.

The improper use of a certain trademark by third parties may cause its owner property and moral damages (these are considered by doctrine and jurisprudence as in *re ipsa* or presumed damages, as they derive directly from the evidence that demonstrates the counterfeiting and dispense with the proof of actual damage); as a result, the victim may appeal to the judiciary to obtain compensation in accordance with Articles 207[4], 208[5] and 209[6] of the IP Law (NEVES, 2023, p. 90).

From this context, it can be inferred that every entrepreneur in Brazil, from small to large, has an obligation to know that he can be penalized for the improper use of a trademark, because the national legislation does not benefit some to the detriment of others because they are beginners in the market or are unaware of the law.

On the other hand, the responsible use of a certain trademark, resulting from the property obtained with the registration, guarantees its owner exclusivity of use, adds value to its products and services, generating credibility and prominence in the market, as well as enabling the generation of revenue through its licensing, which has been "reinforcing the balance sheet of companies, increasing the value of shares or being used as collateral for loans or financing" (BUAINAIN *et al*.; 2019, p. 76).

Having highlighted the possibilities of formalization of companies and the importance of trademark registration for all entrepreneurs, including those who are unable to afford the cost of specialized technical advice, then seeking support networks, one more benefit for small businesses must be considered: the BPTO also grants a special discount of up to 60% on fees and services for trademark and patent registrations for individuals (who do not hold equity interest in a company in the field to which the item to be registered belongs), MEI, ME, EPP and other specific groups (INPI, 2022).

Therefore, it is clear that the opportunities to leverage the business are arranged in the most diverse ways, requiring their owners only more awareness, organization and willpower to take advantage of them.

[4] Article 207 - Regardless of the criminal action, the injured party may file the civil actions it deems appropriate in accordance with the Code of Civil Procedure.
[5] Article 208 - The indemnity shall be determined by the benefits that the injured party would have received if the violation had not occurred.
[6] Article 209 - The injured party shall have the right to have losses and damages in compensation for losses caused by acts of violation of industrial property rights and acts of unfair competition not provided for in this Law, tending to damage the reputation or business of others, to create confusion between commercial, industrial establishments or service providers. or between products and services put on the market.

CONCLUSION

According to the study carried out, we found that many Brazilian workers still do not have access to social protection mechanisms linked to formalization, minimum wage, the right to retirement, paid leave, etc. (IMBIMBO, 2022) and that they end up resorting to the informal market as a means of subsistence.

Despite this, it was found that in Brazil there are support networks that can help beginner entrepreneurs to leverage their businesses, as well as legislation favorable to this group, being more difficult to occur with the totally laymen, who are unable to take the first step, because they do not know who to turn to and what measures to take, which must be fought through public policies aimed at the dissemination of the most varied rights and aids.

Of great value is the observation made by Sebrae (2022), regarding the importance of "that the entrepreneur carries out both the registration of the company and the registration of the trademark, providing greater security and promoting the recognition of the business and the positioning that the market demands. This is because the registration of the trademark facilitates its identification and memorization by the public".

Brands, in general, are IP assets that are extremely relevant to market perception, since it is through the signal that identifies the company, its products and services, that consumers glimpse the credibility, prominence and fame of the business.

In this area, small entrepreneurs who do not have the financial conditions to hire a technical assistance specialized in trademark registration, can turn to SEBRAE and INPI, which provide a generous framework of information and study materials on the subject, in order to assist them in the registration of their trademarks, in addition to the former, generally, providing support through professionals regarding the procedure for filing the application for registration with the INPI, and this agency, in turn, offers a discount of up to 60% on the fees and services of such registrations for some individuals, MEI, ME, EPP and other specific groups (INPI, 2022).

However, it is worth remembering that the procedures have to be carried out in a very responsible way, and the brand must be studied even before being disclosed in the market. Or rather, studied and registered, since the small, medium or large entrepreneur can be penalized for the improper use of the trademark of third parties, and only the value of the damage caused is discussed in court, since the damage itself is presumed.

That said, there is no doubt that the brand is a means that can boost small business, allowing the entrepreneur to earn value with the investment in the medium or long term, including through licensing or assignment of the brand, when it is well worked, adding value to the products and services offered and gaining public data.

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LEARNING METHODOLOGIES IN RHEUMATOLOGY: A TUTORIAL FOR INTEGRATIVE REVIEWS IN MEDICAL EDUCATION

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ABSTRACT

Objective: This tutorial aims to guide researchers in conducting qualitative studies and integrative reviews to interpret large volumes of textual data, showing the importance of establishing a clear research question that guides all subsequent steps. Method: The search for the selection of articles should be carried out in a systematic way, with well-defined inclusion and exclusion criteria, using guidelines to help in the preparation, planning and reporting of systematic reviews and meta-analyses, such as the "preferred reporting items for systematic reviews and meta-analyses" (PRISMA) to provide transparency and methodological rigor in the selection and organization of the included studies. Content analysis can be carried out using tools such as the IRaMuTeQ software, which organizes textual data, identifies recurring patterns and themes, uses diversified methods, such as similarity analysis and word clouds, to enrich the interpretation. Results: The results of the integrative review can be organized in the format of tables to summarize the information found, such as author, year, country, objective, methodology, and main results found, in a structured way. Discussion: The discussion stage involves interpreting the results and comparing them with other studies, including the limitations of the study and suggesting future research topics. Conclusions: In the conclusion, the most relevant contributions of the integrative review to the field of study should be highlighted, relating them to the research question initially proposed. In addition, the main practical or theoretical implications of the results should be described, reinforcing their importance.

Keywords: Integrative review. Medical education. Learning methodologies. Rheumatology.

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INTRODUCTION

Medical education in the twenty-first century faces major challenges, including the need to train professionals who are capable of working with the complexity of the health system. In this context, the integrative review on learning methodologies seeks to identify the most effective strategies to promote the development of skills and competencies in medical students. In a recent integrative review, the trends, challenges, and opportunities that shape this ever-evolving landscape were explored. Each aspect revealed valuable *insights* on how to adapt and improve medical educational programs through their learning methodologies. By analyzing the scientific articles, best practices and recommendations to boost the quality of medical training were highlighted. By sharing these findings, it is hoped to contribute to inspiring future innovations in 21st century medical education. To carry out an investigation regarding the current challenges and emerging opportunities in medical education in the twenty-first century, identifying the main trends and recommendations that can contribute to the improvement of learning methodologies.

In this sense, the objective of this tutorial is to present a script, describing the steps necessary to carry out an integrative review, based on a research theme. For the purpose of example, the focus of the tutorial will be on the use of learning methodologies applied in medical education in the twenty-first century, highlighting different approaches[3].

To qualify the teaching and learning process, we chose to describe the applicability of different approaches in the area of rheumatology, such as the use of the flipped classroom, mentor *x* apprentice, centered on humanized care and learning based on problem solving. Finally, a description of how to use the IraMuTeQ software, which was used in the integrative review.

METHODOLOGY

In this item, the type of research must be objectively described (whether qualitative, observational, cross-sectional, etc...); research protocols; software used; databases consulted; how content analysis will be carried out (whether manual or using specific software;); cite the bibliographic reference manager; cite whether there was access to standard qualitative research documents; cite the descriptors used in the research; describe the filters used in the research, and finally, follow the steps of PRISMA.

[3] Carvalho, L.F de; Guedes, A.L.G; Borges, D.T.; Peixoto, Y.G.; Width, C.S; Tuzin L. Challenges and opportunities in medical education in the XXI century: an integrative literature review. Federal University of the Southern Border. Medical Course, 2024. Article submitted to the *Brazilian Journal of Medical Education* (RBEM), awaiting the submission of the editorial decision.

For example, the research to be developed is characterized as an integrative review, with a qualitative and exploratory approach, conducted in accordance with the PRISMA protocol (Moher *et al.,* 2009). The process involved systematic searches carried out in databases such as Medline, SciELO, ScienceDirect, among others, ensuring methodological rigor in the selection and analysis of the evidence available in the literature. Content analysis was performed using the free software *Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires* – IRaMuTeQ (Camargo; Justo, 2013). Cite a bibliographic reference manager software, such as EndNoteWeb (Clarivate, 2024). Cite the guidelines used, such as the document *Standards for Reporting Qualitative Research* – SRQR (O'Brien *et al*., 2014).

The use of the descriptors used in the search for articles should be described, such as ("medical education"; "medical education"; "technology in medical education"; "medical educational innovation" and "educational medical trends"). The first filters applied in an integrative review include: selection of articles available in databases (e.g., PubMed, Scopus, Scielo, etc...), restriction to the defined publication period (e.g., last 5 years), specific languages (e.g., English, Portuguese, or Spanish), and previously determined types of publication (e.g., original articles, excluding editorials and conference abstracts). The next step is to perform the exclusion by duplicity followed by the exclusion by reading the title and abstract. Regarding eligibility strategies, ineligible records that did not meet the question of research problem, applicability approaches in other areas, incomplete text unavailable, among others, were excluded. After this process, all eligible records must be exported to the bibliographic reference management software.

At this point, it is necessary to define what information should be extracted from the records (e.g., author, year, place of study, study objectives, methodology, main results, etc...).

Regarding content analysis, it is important to describe how it will be carried out (e.g., with IRaMuTeQ, inform the relationships between the lexical segments, enunciated by the authors of the articles made available) (Clarivate, 2024). From IraMuTeQ, the textual analyses used (e.g., descending hierarchical classification (DHC), word cloud, etc...) should be cited. Specify the characteristics of the DHC (e.g., that dendrogram recognition was used with emerging classes, where the higher the χ^2, the more associated the word is with the class, disregarding words with $\chi^2 < 3.80$ ($p < 0.05$)[4]); specify the word cloud characteristics, which makes it possible, in addition to grouping them, to organize them

[4] χ^2 = quantitatively evaluate the relationship between the results obtained and the expected distribution. It represents the degree of association of the word with the class.

graphically according to their relevance, with the largest words being those that had a greater number of occurrences (frequency), considering words with a frequency equal to or greater than 10.

The following is the description of the steps developed in the integrative review, carried out by the authors Carvalho *et al*. (2024), in the article "**Challenges and opportunities in medical education in the twenty-first century**: an integrative literature review".

TUTORIAL DEVELOPMENT

Based on the study conducted by Carvalho *et al.* (2024), this tutorial offers a detailed roadmap that guides researchers in the planning, analysis, and execution of an integrative review, describing in a practical way the topics: (1) delimitation of the research question, (2) search and selection of studies, (3) eligibility strategies, (4) content analysis, (5) synthesis of results, (6) discussions, (7) limitations and gaps found, and (8) the chapter of conclusions, related to the theme of learning methodologies, applied in medical education in the twenty-first century.

Finally, this tutorial describes three applications of the learning methodologies applied in the area of rheumatology and the steps used in the implementation in the IraMuTeQ software.

DELIMIT THE RESEARCH QUESTION

The PICO strategy was used[5] to delimit the focus of the research question, guiding the study on the effectiveness of learning methodologies in the area of rheumatology for medical students. The steps developed based on this strategy are presented below:

a) **(P):** Medical students involved in learning processes in the area of rheumatology, <characterizes the research interest group>;

b) **Intervention (I):** Implementation of learning methodologies, such as active methods (e.g., Competency-Based Learning, humanized care, etc...), <refers to the type of study that will be investigated>;

c) **Comparator (C):** Traditional teaching methods, such as lectures or self-directed study without active support, <identifies comparisons that can be made in the study>;

[5] PICO represents an acronym for Patient, Intervention, Comparison and Outcomes, fundamental elements used in the construction of the question for the bibliographic search for evidence.

d) **Outcome (O):** Assessment of effectiveness in terms of learning, development of practical skills and impact on vocational training, <specifies the outcome to be proved>.

From the application of the PICO strategy, the research problem question arises under two situations:

(1) WITH the comparison variable, the questioning question could be: "What is the effectiveness of learning methodologies in medical students, compared to traditional approaches, to improve the understanding and application of concepts in the area of rheumatology?"

(2) WITHOUT the comparison variable, the question could be: "What is the effectiveness of learning methodologies when applied to medical students with the objective of qualifying the teaching and learning process in the area of rheumatology"?

SEARCH AND SELECTION OF STUDIES

From the search and selection of studies, cite the total number of articles found and the period, for example, that the search strategies resulted in 82,647 records in the Medline (78,999), Scielo (3,141) and Science Direct (228) databases, during the months of September to October 2023, with studies published from the periods of 2021, 2022 and 2023.

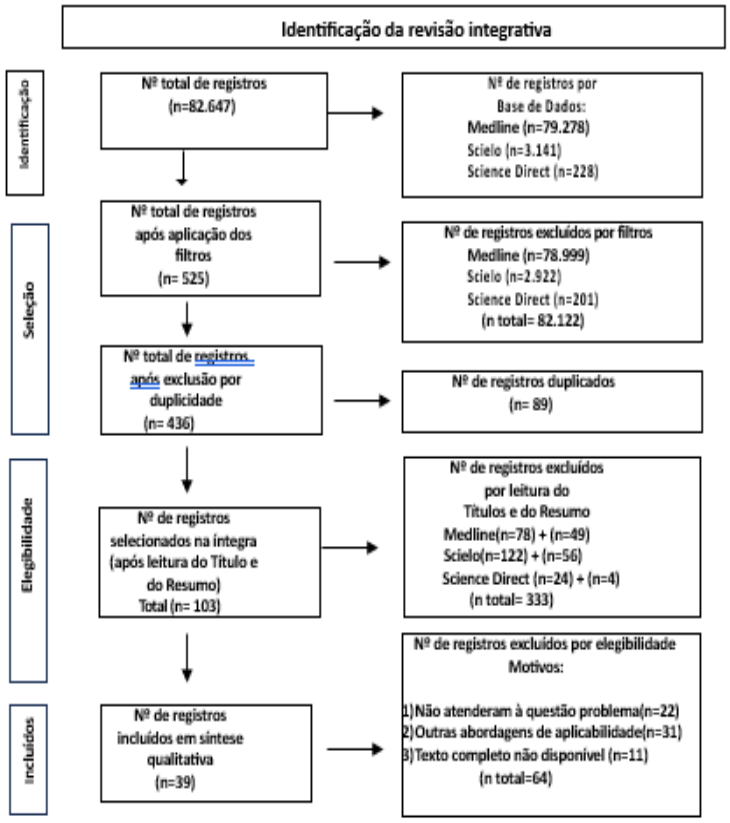
ELIGIBILITY STRATEGIES

The **eligibility strategies**, based on the **PRISMA platform**, consist of the criteria defined to select the studies that will be included or excluded in an integrative review. These criteria are essential to ensure quality in the process of screening and analyzing articles.

The inclusion criteria involve aspects such as type of study, period of publication, language, and relevance to the topic. The exclusion criteria consider factors such as lack of full text, studies outside the scope of the research, or duplicates. In addition, the PRISMA platform suggests the use of a flowchart to document each step, from identification to final inclusion, detailing the reasons for exclusions and promoting greater reliability in the results.

The Prisma platform made it possible to organize the articles based on the integrative review, as shown in Figure 1.

Figure 1 – Result of the integrative review from the Medline, Scielo, and Science Direct databases in September and October 2023.



Fonte: Adaptado do diagrama de fluxo disponibilizado por MOHER, D. *et al*[10]. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. BMJ, 2009;339: b2535.

CONTENT ANALYSIS

To mention the characteristics of how the content analysis was performed, that is, the content analysis was performed with the IRaMuTeQ software, which grouped 39 *textual corpus* into four distinct classes. To facilitate understanding, the steps taken will be described.

a) **Data prepared and imported,** the data were edited into 39 textual *corpus* in "txt" format and imported into the IRaMuTeQ software;

b) **Once the pre-processing of the texts** was carried out, the pre-processing was carried out through the following steps:

1) **elimination of common words** (*stopwords*, articles, prepositions: "the", "the", "the", "the", "the", "a", etc...*)*, as it helps to reduce noise and focus on the most important and meaningful words in the text;

2) **lemmatization** (reduction of words to their lemmatized forms, that is, transforming the word "running" into "running"), in this way the comparison and grouping will be more efficient.

c) Analysis of the frequency of words, to identify the most frequent words and their relationships, the word cloud and the generated dendrograms were explored;

d) Analysis of the word classes, the descending hierarchical classification (DHC) and the word cloud were verified;

e) Interpretation of the results, based on the results obtained in each stage, inferences were made to draw conclusions based on the results, relating them to the context of the study.

SUMMARY OF RESULTS

Describe the entire synthesis of the results. After processing the 39 *textual corpus, IRaMuTeQ organized the content analysis into four classes: competency-based learning (12); learning centered on humanized care (n=10);* interactive learning between mentor *x* mentee (n=12) and learning based on active methodologies (n=5). From this stage, tables were edited describing a summary of the learning methodologies, including: author/year/country; study objective; the methodology and the main results, as shown in Tables 1 - 4.

Quadro 1. Resultado da revisão integrativa nas Bases de dados Scielo, Science Direct e Medline, incluindo autor, ano, país, objetivo do estudo, a(s) metodologia(s) e os principais resultados, coletados no período de 1º de setembro de 2023 até 30 de outubro de 2023 referentes às aprendizagens baseadas em competências (n=10).

Autor, Ano, País	Objetivo do estudo	Metodologia	Principais resultados
1 - Day *et al.*, 2023, Canadá[15]	Compreender como os médicos residentes experienciam a **educação médica centrada nas habilidades dos alunos** para desenvolver intervenções futuras.	Entrevistas semiestruturadas com 16 residentes de sete programas de residência, com uma abordagem construtivista.	Os residentes demonstraram receptividade ao ensino médico centrado no aluno, mas apontaram desvantagens na avaliação e no *feedback*, como ansiedade em relação ao desempenho, falta de clareza nas avaliações e *feedbacks* genéricos.

Quadro 2. Resultado da revisão integrativa nas Bases de dados Scielo, Science Direct e Medline, incluindo autor, ano, país, objetivo do estudo, a(s) metodologia(s) e os principais resultados, coletados no período de 1º de setembro de 2023 até 30 de outubro de 2023 referentes às aprendizagens centradas no cuidado humanizado (n=10).

Autor, Ano, País	Objetivo do estudo	Metodologia	Principais resultados
1 - Blando *et al.*, 2023, Brasil[24]	Investigar como as **emoções e os sentimentos** afetam a relação entre os estudantes.	Estudo qualitativo com centros de apoio psicológico, emocional, terapia, orientação acadêmica e profissional para auxiliar os estudantes na vida acadêmica e profissional.	O estudo destacou a importância de capacitar os professores no auxílio aos alunos em seus conflitos emocionais, por meio de programas de orientação. O elemento afetivo não deve ser negligenciado no ensino superior, sublinhando sua relevância como fator motivador para fortalecer o processo de ensino e aprendizagem.

Quadro 3. Resultado da revisão integrativa nas Bases de dados Scielo, Science Direct e Medline, incluindo autor, ano, país, objetivo do estudo, a(s) metodologia(s) e os principais resultados, coletados no período de 1º de setembro de 2023 até 30 de outubro de 2023 referentes às aprendizagens interativas entre mentor *x* aprendiz (n=12).

Autor, ano, país	Objetivo do estudo	Metodologia	Principais Resultados
1 - Acherman *et al.*, 2021, Brasil[3]	Identificar áreas fortes e frágeis no ambiente educacional através da **mentoria entre pares.**	Estudo transversal com dados coletados com 1.470 estudantes do primeiro nível. Foram utilizadas a Escala de Satisfação com o Suporte Social e a Escala Dundee Ready Education Environment Measure.	Os resultados revelaram diferenças estatisticamente significativas em relação ao ciclo de curso, orientação sexual, coleta de bolsas de auxílio e prática regular de atividade física. Isso indica que programas de mentoria entre pares podem beneficiam a

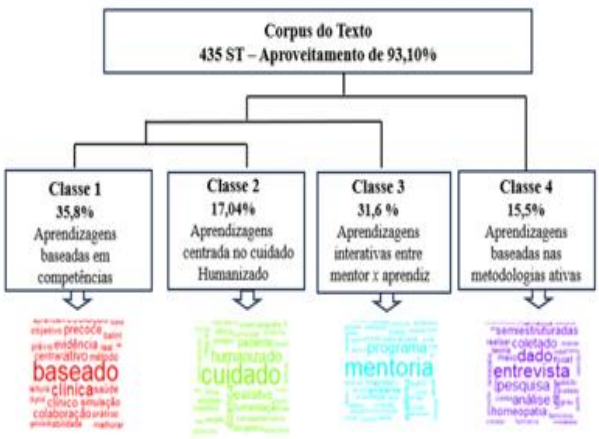
Quadro 4. Resultado da revisão integrativa nas Bases de dados Scielo, Science Direct e Medline, incluindo autor, ano, país, objetivo do estudo, a(s) metodologia(s) e os principais resultados, coletados no período de 1º de setembro de 2023 até 30 de outubro de 2023 referentes às aprendizagens baseadas nas metodologias ativas (n=7).

Autor, Ano, País,	Objetivo do estudo	Metodologia	Principais resultados
1 - Ahmad, Page e Goodsman, 2023, Londres[4]	Analisar o desempenho de uma equipe médica, apontando oportunidades de aprimoramento através da **aprendizagem médica baseada na simulação**.	Utilização da técnica *debriefing* (analisar/interrogar) num ambiente de emergência médica. Foram utilizadas palestras, *moulages*	A técnica de *debriefing* ofereceu oportunidades importantes para reflexão e aprendizagem. O estudo demonstrou que, quando bem administradas, as restrições de tempo podem aumentar a autenticidade e o aprendizado dos

Source: Own, 2024

Following the synthesis of the results, the next step is the description of the qualitative textual analyses generated by the IRaMuTeQ, applying the technique of descending hierarchical classification (DHC) where the following results were found: the *textual corpus* consisted of 39 records, separated into 435 text segments (ST), with a success rate of 93.10%, as shown in Figure 2.

Figura 2 – Dendograma das análises textuais da estrutura gramatical das metodologias de aprendizagem pesquisadas, informando as relações entre os segmentos lexicais com o uso do software IraMuTeQ.



Fonte: Própria, 2024

The next step is to describe the four classes found, from the results of the content analysis, generated by IraMuTeQ, including a small text segment (ST).

a) Class 1 - Competency-based learning:

It comprises 35.8 % (*f* = 145 ST) of the *total corpus* analyzed. Consisting of words and radicals in the interval between χ^2 = 59.12 and χ^2 = 3.87. Some words in this class are composed of "based" (χ^2 = 59.12); "evidence" (χ^2 = 22.43); "precose" (χ^2 = 22.17) and "simulation" (χ^2 = 14.63), represented by the ST:

"This program **based** on the students' competencies is based on constructivist theory through semi-structured interviews with 16 residents [...]". And, in this way, with the other classes.

b) Class 2 - Learning centered on humanized care

They comprise 17.04 % (*f* = 69 ST) of the total corpus analyzed. Consisting of words and radicals in the range between χ^2 = 188.37 and χ^2 = 4.68. Some words in this class are composed of "care" (χ^2 = 188.37); "humanized" (χ^2 = 96.09); "palliative" (χ^2 = 53.54), represented by the TS:

"Describe the use of cinematography as a tool in medical education in humanized patient care, especially in the study of the health-disease-care process [...]"[31].

c) Class 3 - Interactive learning between mentor *x* mentee

They comprise 31.6% (*f* = 128 ST) of the total corpus analyzed. Consisting of words and radicals in the interval between χ^2 = 215.47 and χ^2 = 4.87. Some words in this class are composed of "mentoring" (χ^2 = 215.47); "mentor" (χ^2 = 41.49); "pupils" (χ^2 = 22.18), represented by the TS:

"Participants in the mentoring program highlighted that the mentor played an important role as a supportive role model figure to help students overcome difficulties [...]"[34].

d) Class 4 – Learning based on active methodologies

They make up 15.5% (*f* = 63 ST) of the total corpus analyzed. Consisting of words and radicals in the interval between χ^2 = 125.16 and χ^2 = 4.66. Some words in this class are composed of "qualitative" (χ^2 = 125.16); "interviews" (χ^2 = 90.43) "research" (χ^2 = 59.35), represented by the TS:

"Descriptive research of a **qualitative** nature with focus groups [...] problem-based learning, which seeks to ensure the students' protagonism and dialogue with their previous knowledge [...]"[Death 46].

In relation to the word cloud, the words generated from its data should be analyzed to identify the most frequent keywords related to the theme of learning methodologies, describing the results obtained through the analyses involving the 39 textual *corpus*, described in charts 1, 2, 3 and 4, according to Figure 3.

Figura 3 - Nuvem de Palavras



Fonte: Própria, 2024

It was found that the most evoked words were: "student" (*f= 291), "doctor" (f* =167), "mentoring" (*f* =123), "learning" (*f= 118), "program" (f= 113), "medicine" (f= 113), "study" (f= 106), etc ...*

DISCUSSION OF THE RESULTS

In this chapter, the results are discussed from the reading of the 39 articles, analyzing the main results in relation to the research question, relating advantages and disadvantages of learning methodologies in medical education, referencing the authors. To discuss how learning methodologies are fundamental in medical education in the twenty-first century and how they can influence clinical practice, professional and personal development of medical students. Write how these ideas reflect the challenges faced by medical educators. Identify emerging themes from the research results. In this paragraph, references from other authors can be included in each class, such as, for example, learning methodologies found in the literature in the year 2024, considering that the integrative review was carried out in the periods of 2021, 2022, and 2023, if the articles are available.

LIMITATIONS AND GAPS FOUND

In this chapter, the limitations that the study may have are described, among them, (a) selection bias, i.e., the limited number of themes may introduce bias in the research and may lead to partial conclusions; (b) as the results showed very specific themes, the studies may have limited applicability in the development of broader educational policies or practices; (c) in relation to the limited search periods, allowing the inconclusiveness of the literature review, among others. Next, describe gaps found in the research, suggesting themes for future research.

CONCLUSIONS

Present the conclusions on the importance of learning methodologies, highlighting the main *insights* found from the integrative review. Present the implications of these ideas for educational practice.

For example, competency-based learning, centered on humanized care, mentor *x* apprentice and learning based on active methodologies showed that they can contribute to the qualification of health professionals. However, it is necessary to consider the limitations and potentialities of these methodologies, identifying opportunities for future research. We hope to have contributed to this tutorial so that it is useful and can serve as a guide for future researchers in the field.

Next, Appendix A **- Practical Applications in the Area of Rheumatology and** Appendix B **- Tutorial for the Use of the IRaMuteQ Software** will be described.

APPENDIX A - PRACTICAL APPLICATIONS IN THE FIELD OF RHEUMATOLOGY

Suggestions for the applicability of learning methodologies in the area of rheumatology[6].

ACTIVE LEARNING METHODOLOGY USING THE FLIPPED CLASSROOM - THEME: DIAGNOSIS AND MANAGEMENT OF RHEUMATOID ARTHRITIS

Prior preparation

Prior to the in-person class, students are provided with study material on the diagnosis and management of rheumatoid arthritis, including scientific articles, educational videos, clinical cases, and relevant online resources.

[6] The four types of learning methodologies described in these paragraphs integrate the result generated by the IraMuTeQ software, based on content analysis.

Self-study

Students are responsible for reviewing the study material before the face-to-face class. They can access the resources available online and ask questions through discussion forums or study groups.

Face-to-face classroom

During the face-to-face class, time is mainly dedicated to interactive activities and application of the knowledge acquired. Students are divided into small groups and carry out the following activities:

- ✓ Discussion of clinical cases: Students apply the concepts studied to analyze clinical cases related to rheumatoid arthritis, discussing differential diagnosis, treatment options and clinical management;
- ✓ Office simulations: Students participate in medical office simulations, where they have the opportunity to practice interviewing, physical examination, and clinical decision-making skills with simulated patients;
- ✓ Debates and presentations: Students present and discuss the scientific articles studied, sharing their interpretations and insights with the group.

Reflection and evaluation

At the end of the face-to-face class, students are encouraged to reflect on the learning process and their participation in the activities. They can also be assessed through quizzes, group discussions, or one-on-one presentations.

Benefits of the flipped classroom in rheumatology

Active engagement of students in learning, encouraging autonomy through learning itself; practical application of the theoretical knowledge acquired, preparing students for real situations of clinical practice; encouragement of collaboration and teamwork, promoting the exchange of knowledge and experiences among students.

METHODOLOGY: INTERACTIVE LEARNING BETWEEN MENTOR *X* APPRENTICE - THEME: CLINICAL CASE IN THE MANAGEMENT OF PATIENTS WITH RHEUMATOID ARTHRITIS

Role of the mentor

- ✓ The mentor, an experienced rheumatologist, guides an apprentice (undergraduate student and/or rheumatology resident) in the management of a patient with rheumatoid arthritis (RA);
- ✓ The mentor provides guidance on the diagnostic approach to RA, including the interpretation of signs and symptoms, relevant laboratory and imaging tests;
- ✓ He shares his experience in the management of RA, discussing therapeutic strategies, treatment options, and considerations about drug safety and efficacy;
- ✓ The mentor accompanies the mentee during the patient's assessment, providing real-time feedback and guidance on conducting the physical examination, interpreting clinical findings, and making clinical decisions;
- ✓ It encourages the learner to actively participate in the discussion of the clinical case, stimulating him to formulate diagnostic hypotheses and evidence-based treatment plans.

Role of the learner

- ✓ The apprentice demonstrates interest and commitment to learning from the mentor, taking the opportunity to acquire knowledge and practical skills in the field of rheumatology;
- ✓ It conducts a detailed review of the patient's medical history, investigating their clinical history, symptoms, risk factors, and the impact of the disease on quality of life;
- ✓ The mentee performs a thorough physical examination of the patient, under the supervision of the mentor, noting specific signs of arthritis, joint deformities, and extra-articular manifestations of RA;
- ✓ He collaborates with the mentor in the elaboration of an individualized treatment plan for the patient, taking into account clinical guidelines, patient preferences and therapeutic goals;
- ✓ The learner demonstrates initiative and communication skills when interacting with the patient, explaining the diagnosis, discussing treatment options, and providing emotional support during the consultation;

Benefits of Mentoring in Rheumatology

Transfer of knowledge and clinical experience from the mentor to the mentee, contributing to the professional and academic development of the resident in rheumatology; opportunity for hands-on learning and direct clinical experience, allowing the learner to gain essential clinical skills and confidence in the practice of rheumatology.

METHODOLOGY: HUMANIZED CARE-CENTERED APPROACH - THEME: CLINICAL CASE IN THE CARE OF PATIENTS WITH RHEUMATOID ARTHRITIS

Establishing an empathetic relationship

- ✓ The rheumatologist receives a patient newly diagnosed with rheumatoid arthritis in his office;
- ✓ He begins the consultation by welcoming the patient with a warm smile, showing genuine interest in hearing their story and understanding their concerns;
- ✓ The doctor adopts a welcoming and empathetic attitude, creating an environment of trust and security where the patient feels comfortable sharing their experiences and feelings.

Clear and accessible communication

- ✓ During the consultation, the doctor uses simple and accessible language when explaining the aspects of rheumatoid arthritis, including causes, symptoms, impact on quality of life; treatment options and in relation to the need for long-term follow-up;
- ✓ It avoids medical jargon and utilizes understandable analogies to help the patient better understand their condition and treatment recommendations.

Patient involvement in the decision-making process

- ✓ The physician takes a collaborative approach, actively involving the patient in the decision-making process about their treatment plan;
- ✓ It discusses different therapeutic options, explaining the benefits, risks, and possible side effects of each intervention;
- ✓ The doctor values the patient's individual preferences and needs, respecting their autonomy and ability to make informed decisions about their own health.

Emotional support and continuous monitoring

- ✓ In addition to providing treatment, the doctor offers emotional support to the patient, recognizing the psychosocial impact of rheumatoid arthritis on their life;

- ✓ It expresses empathy for the patient's suffering, validating their concerns and offering emotional support and encouragement throughout the treatment process;
- ✓ The doctor assures the patient that they are not alone in their journey of coping with rheumatoid arthritis, committing to follow them closely and provide ongoing support throughout the treatment.

Benefits of Humanized Care in Rheumatology

Strengthening the doctor-patient relationship, promoting a collaborative partnership in health care; improvement of treatment adherence and clinical outcomes, as the patient feels valued, respected, and supported in their needs and preferences, which contributes to the patient's emotional well-being and quality of life.

METHODOLOGY: PROBLEM-SOLVING-BASED LEARNING - THEME: DIAGNOSIS OF SYSTEMIC LUPUS ERYTHEMATOSUS

Prior preparation

Students receive a fictitious or real clinical case related to a specific rheumatological condition, such as the diagnosis of systemic lupus erythematosus.

Identification of key issues

Students read the clinical case and identify the key issues related to the diagnosis of the rheumatologic condition presented.

Group discussion

Students are divided into small groups and discuss the issues identified in the clinical case. They share their prior knowledge, clinical experiences, and research relevant to the diagnosis of the case.

Independent research

Following group discussion, students are encouraged to conduct independent research to deepen their understanding of the rheumatological condition in question. They may review scientific articles, clinical guidelines, and other sources of evidence to support their conclusions about the diagnosis of the pathology.

Classroom presentation and discussion

Each group presents its analyses and recommendations for the clinical case to the class. During the presentations, students are encouraged to question and debate the different diagnostic approaches proposed, promoting a rich and collaborative discussion.

Conclusions

After all the presentations, the professor summarizes the main conclusions and *insights* obtained from the discussion of the clinical case. It can highlight key points, important concepts, and areas of controversy in the diagnosis of systemic lupus erythematosus.

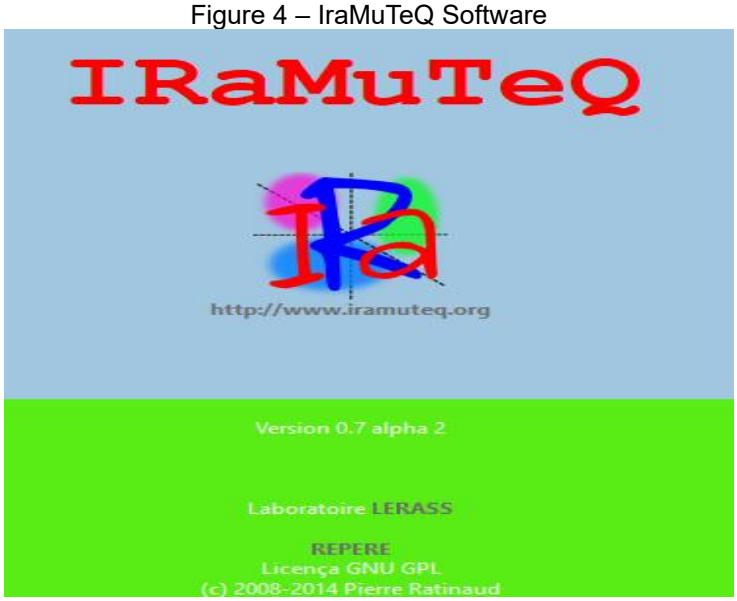
Benefits of problem-based learning in rheumatology

Encouragement of self-directed learning and independent research, developing skills in the search for evidence and analysis of information; practical application of theoretical knowledge in simulated clinical scenarios, preparing students for real medical practice situations.

APPENDIX B - IRAMUTEQ SOFTWARE USAGE TUTORIAL

The IRaMuTeQ software is a free and open source tool that uses features of the statistical software R, allows sophisticated analysis of texts, from basic analysis to more advanced methods to understand the structure and organization of discourse, developed by the French researcher Pierre Ratinaud in 2009. IRaMuTeQ allows different types of textual data analysis, from simple analyses such as word frequency calculation, to more complex analyses such as descending hierarchical classification and similarity analyses. Initially, it was used by the Laboratory of Social Psychology of Communication and Cognition of the Federal University of Santa Catarina/SC, as shown in Figure 4.

Figure 4 – IraMuTeQ Software



Source: Own, 2024

In this work, the following resources were used: descending hierarchical classification (DHC) and the word cloud. Its operation consists of preparing the data and writing *scripts* that will be analyzed by the IraMuTeQ software.

INSTALLATION OF IRAMUTEQ

To run the software, it is necessary to install the **R Statistical Software**, free software for graphing and statistical computing. The program offers a variety of graphical and statistical techniques, linear and nonlinear models, classical statistical tests, series analyses, classification, etc.

R 4.0.0 <HTTPS://CRAN. R-PROJECT.ORG/BIN/WINDOWS/BASE/>

Install R-4.0.0-win.exe file, preferably in the Program Files folder. During installation, choose whether 32-bit or 64-bit correctly. - Run **R** and install the R libraries (packages) specific to IraMuTeq, according to the following instructions: a) run R; b) choose from the main menu Packages/Install packages; c) choose the country (France/Paris2); d) choose from the list presented in alphabetical order, the first package to be installed (APE); e) click **Ok**. If the system asks to create a folder to store the library, choose to create it and let **R** choose the default folder. The system downloads the library and installs it. See the result of this operation on the operation screen (Console). After finishing the installation of the first one, install all the others (ca, gee, igraph, irlba, proxy, rgl, textometry, wordcloud) repeating steps **d** and **e**; f. Close **R**.

IRAMUTEQ <HTTPS://SOURCEFORGE.NET/PROJECTS/IRAMUTEQ/FILES/IRAMUTEQ-0.6-ALPHA3/>

Install the **setup_iramuteq-0.6-alpha3.exe file** in the same folder where R was installed. If not installed in the same folder, IraMuTeq does not recognize the R libraries, even if the path is provided in Iramuteq Preferences. Access IraMuTeq and wait for the R libraries to install automatically.

Note: If the installation of **R** as well as the libraries was correct, IRaMuTeQ will find all the libraries and be ready to proceed with the analyses. If you have any problems installing **R** or libraries, IRaMuTeQ will not be able to bring them and will continue to prompt you to update them every time you log in to IRaMuTeQ. The solution to this problem usually involves uninstalling Iramuteq and **R** and reinstalling them in the correct folders.

NOTION OF *CORPUS*,

Corpus is a set of texts constructed by the researcher and that forms the object of analysis. For example, in a documentary research in the medical area, the corpus could be a set of articles that were published in a certain period in the health section of a newspaper. Another example would be a set of 40 transcripts of interviews on a topic that is the subject of a case study. And it can also be, for example, a corpus composed of 200 responses to an open question, which is part of a questionnaire of a poll-type survey (Camargo; Justo, 2013).

a) **Stemming:** is the process, effectively, of deflecting a word to determine its lemma (inflections are called lexemes) For example, the words cat, cat, cats, cats are all forms of the same lemma: cat.

b) **Chi-square:** the χ2 or chi-square distribution is one of the most widely used distributions in inferential statistics, especially to perform **χ2 tests**. This test serves to quantitatively evaluate the relationship between the result of an experiment and the expected distribution for the phenomenon. That is, it tells us how surely the observed values can be accepted as governed by the theory in question.

c) **UTF-8** (8-bit Unicode Transformation Format): is a type of variable-length Unicode encoding created by Ken Thompson and Rob Pike. It can represent any standard Unicode wildcard and is also compatible with ASCII.

CORPUS FORMATTING <BASIC FORMAT>

Texts are introduced by four asterisks (****) followed by a series of (illustrative variables) introduced with an * (asterisk) separated by a space.

Separation by participants

The text can be written according to the syntax below:

*autor_01

Objective to share experiences, simulated scenarios and clarification sessions on the application of the technique of analyzing and interrogating on real pre-hospital challenges, allowing the student to apply and improve their specific skills in simulation-based learning, in an air ambulance in the City of London. Through lectures given by doctors or paramedics on pre-hospital challenges, providing opportunities for reflection and simulation-based learning, based on the simulated scenarios encountered during the course.

And so on, successively with the whole text.

Separation by issues

**** *suj_001 *sex_1 *ida_21 *escol_2

Where

suj_001: subject 001 sex_1: sex as per the following table: 1 (male) and 2 (female)

ida_21: age 21 (age is placed after underscore)

escol_2: schooling according to the following table: 1 (elementary); 2 (medium); 3 (top)

ADJUSTING THE *TEXTUAL* CORPUS

a. Grammatical revision of Portuguese, correcting spelling and agreement.
b. Elimination of expressions unnecessarily, such as: Ahh, Uhmm, right, okay.
c. Elimination of sentences that are not consistent with the subject matter.

SAVING THE FILE TO THE CORRECT FORMAT (.TXT) – UTF-8 FORMATTING

Access Archive

-> Save As -> location -> Type: -> Plain Text (*.txt)

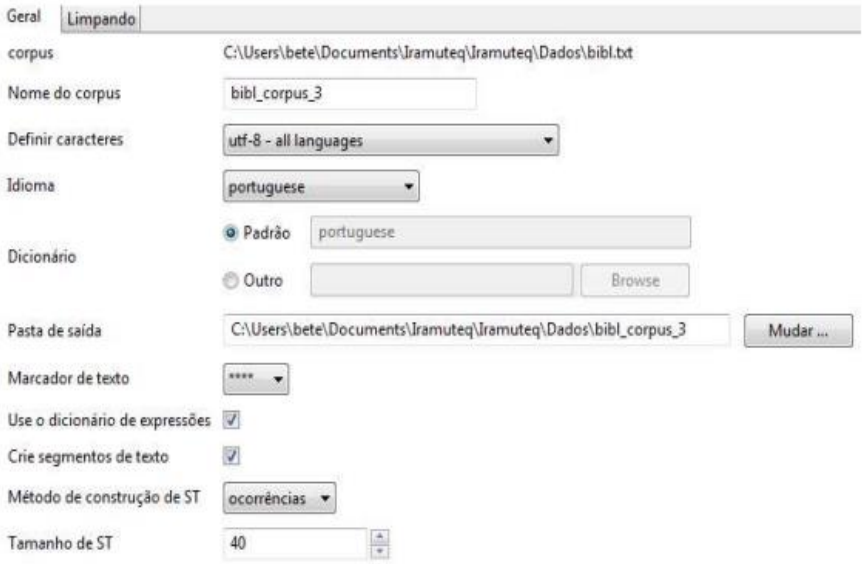
-> Save -> Other encoding: -Unicode (UTF-8)

-> **OK**

IMPORTATION OF THE *CORPUS*

To import text already structured in txt format, start IRaMuTeQ, and choose File / Open a textual *corpus* from the horizontal menu. Then choose the file and click Open. The following import parameters window will appear, as shown in Figure 5.

Figure 5 – Importing the *Corpus*



Source: Own, 2024

AFTER IMPORTING, DEFINE THE FIELDS:

Under "Corpus Name," type the name of the *analysis corpus* . Under "Define characters", choose the UTF-8 format (all languages);

In "Language" it is necessary to select the language of the text to be analyzed (Portuguese);

In "Dictionary", leave the Standard option (the system selects the dictionary that has the same language as the text);

Under "Output folder", choose the directory you want to save the folder with the scans done. The name of this folder that will be created is arquivo_corpus_X name, but it can be changed along with the save location;

In "Highlighter" leave the four asterisks, which delimit the corpus, by default;

Under "Use expression dictionaries", leave it selected to use the expression dictionary. Dictionaries of expressions allow you to treat compound words as a whole, thus avoiding division in analysis;

In "Create text segments", leave it selected for the software to separate the text into text segments (process in which the software separates the textual corpus into text segments for fractional analysis and identification of lexical environments);

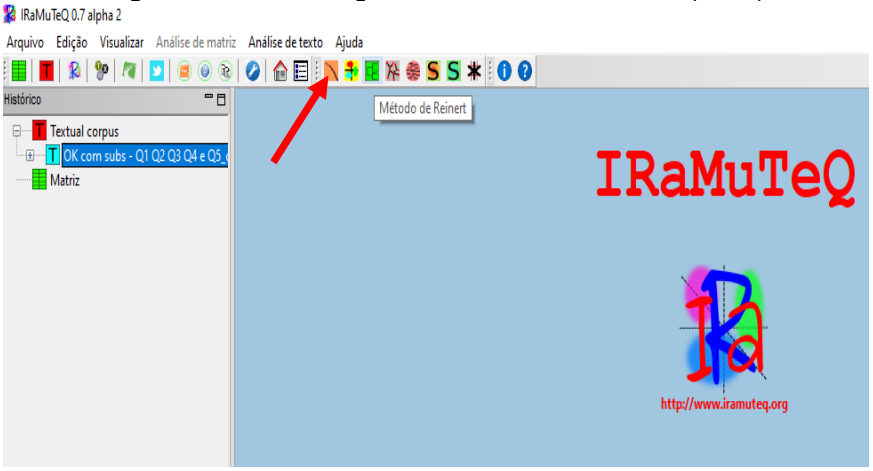
Under "Text Segment Construction Method," select "occurrences" to segment all text *corpus* by word frequency, "characters" to segment from characters, and "paragraphs" to segment by paragraphs. Use the standard (by occurrences) except if there is a requirement due to the corpus to choose the other methods;

Under "Text segment sizes," select the number that will define the character size of the text segments. By default, leave 40 (average 6-7 words). However, if you want the pieces of analysis text to be smaller or larger, increase or decrease the number respectively. The size of the text segments must be in accordance with the chosen segment type.

DESCENDING HIERARCHICAL CLASSIFICATION (CHD) – REINERT'S METHOD

CHD divides text segments into content classes by generating percentage graphs, as shown in Figure 6.

Figure 6 - Descending Hierarchical Classification (DHC)



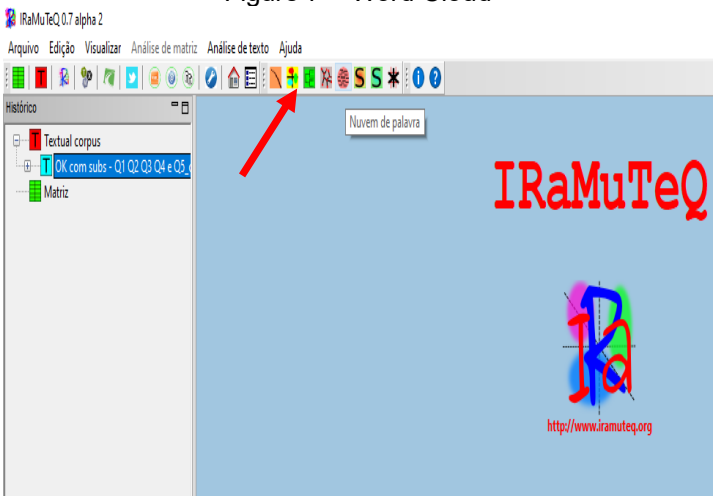
Source: Own, 2024

The DHC method proposed by Reinert (1990) classifies text segments according to their respective vocabularies, and the set of them is distributed based on the frequency of reduced forms (words already stemmed). This analysis aims to obtain classes that, at the same time, have similar vocabulary to each other, and different vocabulary from the other classes. The IRaMuTeQ also provides another way of presenting the results, through a correspondence factor analysis made from the DHC (Post-Factor Analysis) that represents in a Cartesian plane the different words and variables associated with each of the DHC classes. The interface allows the retrieval, in the original corpus, the text segments associated with each class, at which time the context of the statistically significant words is obtained, allowing a more qualitative analysis of the data.

WORD CLOUD

Excellent for studies of social representations, it allows quick identification of keywords in a *corpus*. It shows a set of words grouped, organized, and structured in the shape of a cloud, as shown in Figure 7.

Figure 7 – Word Cloud



Source: Own, 2024

INTRODUCTION TO ANALYTICS

Once the corpus *is indexed* in the left tab of the IRaMuTeQ window, the Name arquivo_corpus _X is added. The available analyses can be viewed by clicking on the Text Analysis option. Examples of the text analysis can be seen in this tutorial, starting from item 7 (Synthesis of Results).

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TEACHING PRACTICE AND PLAYFULNESS: PEDAGOGICAL REFLECTIONS IN EARLY CHILDHOOD EDUCATION

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ABSTRACT

This article reflects on **teaching practice and playfulness focusing on the pedagogical actions used for the socialization and learning of children in an early childhood education center.** The theme under study aims to highlight the importance of play in an early childhood education center, specifically in the first and second periods of this level of education. Our interest in the theme consists of questioning how the pedagogical practices developed by teachers in this phase of education have contributed to the significant learning of children. Thus, our objective was to analyze how teachers use playfulness in their teaching practices as pedagogical tools. The pedagogical practice through playfulness is a dynamic action in constant movement, requiring planning to ensure the realization of the proposed intentionalities. This study is qualitative in nature, and the subjects of the research were 10 teachers from an Early Childhood Education Center in Lagoa Grande do Maranhão. Open questionnaires were applied and the results revealed that the pedagogical practice through playfulness is indispensable to enhance the teaching work and allow the integral development of the child in a pleasurable way.

Keywords: Early Childhood Education. Playfulness. Teaching practice.

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INTRODUCTION

Reflecting on Early Childhood Education in the institutional space is very important, because at this stage of basic education, children are having their first contacts with school, where they will have the opportunity to interact with other people outside their family cycle, as well as explore, discover and experiment, which allows the little students to have an expanded development in physical aspects, motor, cognitive, social and emotional through various activities that involve playfulness. Playfulness in early childhood education involves games in general, games, stories and activities that pass through the children's ludic universe. They contribute to the child's development occurring in a pleasurable way, it should be considered of paramount importance for the child's development to express their feelings, fear, problems, anguish and happiness. Everyone who is part of the educational process must also be involved in the ludic world.

The games can be both collective and individual. Therefore, the teacher can and should diversify his way of working with playfulness. At the time of fun, the child spares no effort to participate physically or mentally in the game, thus strengthening learning within the children's educational field. From his imagination, the child builds his process of commitment to the other, trusting in his abilities.

The children's universe is full of playful activities, playing in early childhood education is fundamental for their development. The child is always creating fantasies, playing make-believe, thus awakening his creativity, making the learning process easier and more pleasurable.

In the educational environment at all levels of education, pedagogical practices are present. It is necessary to clarify that this practice is comprehensive and complex, as it extrapolates the daily routine of the teacher in practice, but there is a whole theoretical intentionality that needs to be analyzed according to the conception that will be developed in the classroom

The classroom is a space permeated by diverse practices which refer to the work of the teacher who foresees different possibilities of guiding learning tasks in a creative way, having as a starting point knowledge, experiences, contextual experiences, thus putting into practice the conduction of the teaching process. extrapolating from simple practice and assuming teaching as a reflective and critical pedagogical practice.

The theme in focus is the result of a monographic work by one of the authors, an early childhood education teacher, who experiences child development in the classroom based on playfulness in pedagogical practice. The following objectives were outlined: to reflect on the teaching practice involving playfulness in early childhood education in the I

and II period in a Municipal School of Lagoa Grande do Maranhão; to identify the contributions of playfulness in early childhood education; to analyze the teaching practices involving playfulness for the teaching of children.

Teaching practices involving playfulness in child development were analyzed, with reference to the authors: Paulo Freire (1996), Maria Amélia do Rosário Santoro (2016), Paloma de Andrade Alves (2015); Eliete Lemos Cardoso (2010); Alexandre Sant'Anna and Paulo Roberto do Nascimento (2011); Gisele Mariotti Putton and Pollyanna Santos da Cruz (2021) among others.

The field research was developed in a municipal school in the urban area of Lagoa Grande do Maranhão, through the application of a questionnaire with open questions, where data were collected from the teachers of the referenced school. Next, the results will be presented through tables and supported by the authors who deal with the theme. Here we will focus on the most significant answers presented by the teachers.

TEACHING PRACTICES INVOLVING PLAYFULNESS FOR TEACHING CHILDREN

The education of young children is a complex process made up of evolutionary phases, whose development should be accompanied by parents and teachers who have the knowledge and technical competence to educate, socialize, and insert them into the world of knowledge in an appropriate way to the different stages of development, privileging interests, curiosities, imagination, indispensable characteristics for their integral development, so we will reflect on what the authors say about teaching practice and playfulness.

The teacher's work consists of a set of activities that materialize in the classroom in the form of orientations, experiences and practical examples, always directed to the students, with a view to learning in a meaningful way, in this perspective, Cruz (2007) states, teaching practice is

> An experience that takes into account the fact that teachers produce in their practices a wealth of knowledge that needs to be, together with their experiences, assumed as the starting point of any process of improvement of their work and curricular change. (Cruz, 2007, p. 195)

The author highlights the importance of recognizing and valuing the wealth of knowledge produced by teachers in their practices, along with their experiences. This appreciation is fundamental for the improvement of teaching work and for the promotion of significant curricular changes. By considering the experiences and knowledge of teachers as a starting point, it is possible to develop educational practices that are more aligned with

the needs and realities of students, as well as to enhance the work of educators and contribute to the quality of the educational process.

The educational practice at all levels of education continuously needs critical reflection on the daily work that occurs within the school institution, where diverse practices are present, but the practices performed by the teacher are planned, have as their objective the learning of the students, therefore pedagogical practices, specific to the teaching field, that is, tools of the teaching practice, in this understanding, Franco (2016) states that:

> [...] a class or an educational meeting will become a pedagogical practice when it is organized around intentionalities, as well as in the construction of practices that give meaning to intentionalities. It will be pedagogical practice when it incorporates continuous and collective reflection, in order to ensure that the proposed intentionality is made available to all; will be pedagogical as it seeks the construction of practices that ensure that the referrals proposed by the intentionalities can be carried out. Franco (2016, sp).

Franco's approach emphasizes the importance of intentionality, planning, and continuous and collective reflection for pedagogical practices to be effective. This view places the student as the protagonist of learning, which is fundamental to form critical and emancipated subjects.

It is known that the concept of pedagogical practice may vary depending on the approach with which we share, and it is notorious that non-critical approaches, of pedagogical practice that only reproduce knowledge in a mechanical way centered on repetition do not meet the demands of training a critical subject. Critical and emancipatory pedagogical approaches seek to use active and contextualized methodologies to place the student as the protagonist of the learning process, the practice of teachers is also innovative, reflective and critical, which will allow the constant improvement of the teaching process.

It is essential to understand that education goes beyond a simple act of transmitting knowledge, it influences the lives of human beings in a broad way, while the process of knowledge production allows man to be inserted through social and educational processes to seek his own autonomy. The local school institution for the production of knowledge must offer conditions so that the student can develop his or her potential in a welcoming, pleasurable and rich environment of possibilities to experience and apprehend socialization and education situations that are basic to awaken imagination, creativity, curiosity, autonomy that must be worked on dynamically, Especially in the first years of Early Childhood Education, thus playfulness becomes a basic tool to boost the pedagogical practice of teachers at this level of education

The insertion of playfulness in education from childhood to higher education is, without a doubt, a practice that can make teaching lighter and more dynamic, contributing to the integral development of students. I believe that it is important to promote an educational environment that involves pleasure, joy, and happiness, as this will certainly positively impact the development of skills and the formation of more critical and conscious citizens.

We can see that the pedagogical practice through playfulness is something that is in constant movement, so it can be said that there is no ready-made formula or recipe, but a practice that involves a lot of planning, creativity and boldness on the part of the teacher. When planning his teaching activities, the teacher does so based on theoretical and methodological knowledge to ensure the efficiency of the teaching-learning process in a qualified way. Dallabona, Mendes (2004) state:

> Educating playfully is not throwing packaged lessons for the learner to consume passively. Educating is a conscious and planned act, it is to make the individual conscious, engaged and happy in the world. It is to seduce human beings into the pleasure of knowing. And to rescue the true meaning of the word "school", a place of joy, intellectual pleasure, satisfaction and development. (DALLABONA, MENDES, 2004, p. 110).

The authors above reinforce the idea that educating playfully goes beyond simply offering playful activities, but rather involving students in a conscious, planned and pleasurable way in the learning process.

The teacher in early childhood education must create an environment conducive to the development of children, where playfulness is an important tool to stimulate curiosity, creativity and pleasure for knowledge. The conscious and planned approach to playfulness contributes to rescuing the true meaning of school as a place of joy, learning built in an interactive way where the child feels pleasure in attending it.

In this way, the teacher needs to carefully plan his playful activities, as well as any other activity, so that he does not only insert games, toys and games in his pedagogical practice, but also inserts intentional practices, with objectives to be achieved, making the students develop and learn, *playing*.

Playfulness and pedagogical practice are fundamental aspects in the educational context. From a critical perspective, playfulness is used as a tool to promote reflection and social transformation. We will explore how playfulness can be used critically in pedagogical practice, encouraging students' autonomy, critical thinking, and social awareness.

Through playfulness, the student has the opportunity to develop skills and competencies that make him a critical and free citizen. Play, play, and playful expression

allow students to learn actively, experiment with different roles, make decisions, solve problems, and collaborate with peers. These experiences contribute to the formation of an individual capable of thinking critically, questioning reality and actively participating in society.

There are numerous ways to integrate playfulness in a critical way into the school environment. One of them is through simulation games that address social and ethical issues. For example, simulation games to challenge children to make immediate decisions about life in society. In addition, the dramatization of real situations are effective ways to promote reflection through playfulness.

Educators play a key role in promoting critical reflection through playfulness. They can do this by creating a learning environment that encourages curiosity and exploration. By introducing playful activities that involve cognitive and ethical challenges, educators encourage students to develop thinking, language and socialization. Oliveira (2022): corroborates by stating

> Playfulness is essential for the child, as it helps in the child's formation, in social and physical aspects, enabling development in coordination. In this way, with games and play, the student develops socialization, self-esteem and thinking, among other factors. (COSTA, OLIVEIRA. 2022 sp.)

In addition, by using games, simulations, and role-plays to address relevant and current topics, educators provide students with the opportunity to apply their critical thinking in practice. This helps develop problem-solving, decision-making, and empathy skills.

Playfulness promotes active student engagement, making learning more engaging and memorable. In addition, critical reflection strengthens students' ability to analyze information, understand complex contexts, and make informed decisions. These skills are essential for academic success and for preparing students to face real-world challenges.

This practice also fosters a collaborative learning environment, in which students learn from each other, share ideas, and develop important soft skills.

The toy, or playful activity, allows the child to transcend their usual limits and explore new possibilities. When playing, the child is engaged in meaningful work, in which he develops cognitive, social, and emotional skills in an active and engaged way. "In the toy, the child behaves above his age, above his usual behavior; In toys, the child is always more than himself. The toy is the child's work." Vygotsky (2007).

Considering the above, it is reaffirmed that playfulness is not only a form of entertainment, but a serious and essential work for the integral development of the child. These are just a few of the many benefits of integrating critical playfulness into the school

environment. There are many other ways educators can promote teaching tasks through playfulness.

The teaching practice involving playfulness serves as a mediator for the best development of the teacher's work, considering that it will help the student in the acquisition of knowledge, provides interaction, and stimulates cognitive creativity, through playful practice it is also possible to create bonds between student and student and student and teacher. Thus leading the teacher to perform a satisfactory job for both the teacher and the student.

In this sense, Putton, Cruz (2021. sp) states that, "playfulness is very important for children's development, especially when it comes to interactivity, whether between children and adults or with other children." In other words, playful practices must be worked on in an interdisciplinary way, without leaving out any field of education, we can highlight both collective and individual games, as well as those that require physical effort such as dances, such as those that require mental effort such as puzzles and memory games.

Playful practices can be carried out both in the classroom and outdoors with physical activities, running, soccer, in addition to other practices that can be developed according to the activity worked.

Also according to Putton, Cruz (2021)

> The teaching-learning process with play offers a healthy and harmonious development. When they play, children become more independent, their visual and auditory sensitivity becomes sharper, they learn to value popular culture, the occurrences of aggressiveness decrease, the imagination improves and with that creativity flows, they balance their emotional intelligence and increase the capacity for mental growth and social adaptation. (PUTTON, CRUZ, 2021. Sp).

It is perceived that playful practices promote several contributions to the development of young children's teaching-learning, thus providing a development not only within the educational scope but as a social being, considering that from playfulness the child will develop rules for social, cultural and religious habits.

When playing, the child engages in an extremely complex psychomotor activity, not only enriching his sensory organization but also structuring his perceptive, cognitive and neuronal organization, jointly elaborating his adaptive motor organization. Thus, it is possible to affirm that through playful practices the child develops several activities, whether they are simple such as participation and interaction or complex such as the acceptance of rules and imposition of limits.

It is important that the teacher as a mediator plans and elaborates effective playful practices according to the reality of his class, thus seeking to obtain a good development

through playfulness and not just play for the sake of playing. It is up to the teacher to analyze each student in his class and develop activities that can be carried out by everyone according to their difficulties and needs.

In this way, it is possible to say that playful practices are indispensable for the teaching of young children, it provides children with a state of satisfaction, well-being, a greater facility to learn what is desired, in short, through teaching practices through playfulness it is possible to achieve a faster and more satisfactory result in relation to the development of children, both psychic, social, cognitive, cultural and motor, among others.

The well-being and development of the child should be the main objective of teaching practices, so it is essential that these practices are well developed respecting the individuality of each one, thus leading the student to a significant and satisfactory level of development for all.

Pedagogical practice requires attention and planning, especially when we talk about teaching practices involving playfulness so that this playfulness as a methodological tool can be inserted in classes in a conscious and responsible way, contributing to children's learning. This is how Nascimento states

> The teacher who works with Early Childhood Education needs to develop his work focused on play, be aware of the children's age group, so that each activity worked on enables the teacher to achieve the proposed objectives, in addition to coherent and necessary materials. (LIMA, LIMA AND NASCIMENTO 2015, p,11).

For the author, the relationship between teacher and student can be facilitated by the playful activity, deepening better learning conditions. Because playfulness, in addition to contributing to the child's development, also helps with the creation of bonds between students and teachers.

It is evident that playful activities must be incorporated into pedagogical practices. Through play, the child reinvents himself, giving wings to his imagination, sharpening the curiosity between what he already knows and what is new. The teacher, as a mediator, needs to be attentive to all situations, thus favoring meaningful learning, taking care that the act of playing is not just a pastime. In this sense, it is important and necessary to build strategies that contemplate the integral development of children.

According to Leal (2011):

> It is possible to say that playfulness is a pedagogical tool that teachers can use in the classroom as methodological techniques in learning, since through playfulness students will be able to learn in a more pleasurable, concrete and consequently more meaningful way, culminating in a quality education. (LEAL, 2011, p.08).

Playful practices provide better development for children. Therefore, from teaching practices using playfulness, it is possible to develop interaction, socialization, improve the acquisition of knowledge, thus generating a more effective and dynamic development for the teaching and learning of children.

WHAT TEACHERS THINK ABOUT THE USE OF PLAY IN THEIR TEACHING PRACTICE

Next, we will present what teachers think about playfulness in their teaching practice, here we will focus on more significant responses revealed by the analyzed data provided by teachers.

Relationship between playfulness and children's learning

Subject	Answers
Professor A	Playfulness is a powerful instrument for the teaching-learning process, because in childhood the way the child interprets, knows and operates naturally is playful.
Professor B	It is a pleasurable relationship that contributes to the development of children in the personal, cultural, social aspects, which facilitates the process of building the child's knowledge, with regard to creativity, orality, interaction, logical reasoning, socialization, as well as cognitive, motor, psychomotor development, in addition to stimulating fantasies, imagination, thinking and clarity of ideas.
Professor C	Playfulness facilitates the child's learning and development.

Source: Field research

All teachers who responded to the questionnaire have the same opinion about the importance of playfulness for children's learning. The teachers' opinion was unanimous in affirming the importance of playfulness directly linked to the child's learning, so that it facilitates the process of knowledge construction, awakening the pleasure of learning, interaction and socialization.

Following this thought, we can cite Cardoso (2010, p. 30) who states, "games and games should not serve as simple entertainment, but as activities that develop their learning."

To this end, it is necessary that these games and games are according to the age group or needs of each group of students, with clear objectives and not just playing for the sake of playing. In this way, the teacher can add the pleasure of the students playing or playing to develop their classroom activities in a more pleasurable way, and without their class becoming tiring and boring.

The relationship between playfulness and the emotional development of its students

Subject	Answers
Professor A	There are several benefits, they improve the relationship with each other, concentration, joy during activities and greater interest in learning.

Professor B	Playful activities are essential for the development of children's learning, through these activities it is preserved that children are more motivated to learn. They contribute a lot to the improvement of learning and consequently to their emotional development. Emotions are part of children's daily lives, when playing, children get emotional. The key is that this has a positive impact on the child's learning process.
Professor C	Playfulness promotes in early childhood education a practice of knowledge of the world, thought and meaning, so it is a fundamental tool for the emotional development of children.
Professor C	Playfulness facilitates the child's learning and development.

Source: Field research

Regarding the benefits of playful practices for the emotional development of students, the research points out that playfulness is directly related to the child's development in all aspects, psychic, emotional and sociocultural.

And in this regard, Cardoso (2010) indicates that:

> Through play, I believe that it is possible [...] to develop in the child motor coordination, cooperation among their peers, expressive and understanding language, socialization and especially cultural values. (CARDOSO, 2010. n.p.).

Thus, it is possible to affirm the importance of playful practices in early childhood education, relating them to the emotional, psychic and sociocultural development of children. Thus, playful practices cannot be left out of the school planning of early childhood education teachers.

It is from well-developed practices with defined objectives, in different environments, that it is possible to stimulate students, which will lead to better development and self-knowledge, enabling a total development of the child so that he becomes autonomous from childhood.

Teaching intervention in the case of students who refuse to participate in playful activities

Subject	Answers
Professor A	It is necessary to investigate the reasons that lead the student to cross his arms in front of a certain activity, maintain dialogue, promoting interest in the importance of the activity for his learning, always looking for the best way to help.
Professor B	Talk to the child, find out why he does not want to participate**;** respect the child's decision at that moment; promote actions with classmates to integrate him in the activity; and if he is still reluctant in the other activities, try to talk to the child's parents, to ask for help from the parents, explain the importance of playful activities in early childhood education.
Professor C	Investigate the reasons why you don't want to participate

Source: Field research

The research points to the interventions that should be carried out in order to investigate the reasons for non-participation in classroom activities. Where at first a

dialogue with the student is suggested, seeking to understand their reasons for rejecting the activities and, if necessary, talking to the family.

However, it is important to emphasize that the student will hardly deprive himself of playful activities, playfulness is part of the child's daily life and when proposed by the teacher in the school environment, it becomes even more important and conducive to his development.

In this sense, Carvalho (2021) states that:

> Playing has always been present in children's lives, even if in different forms and expressions. This and all the linked elements, such as play, toy and game, are directly related to the child and the individual as a whole. (CARVALHO, 2021, p. 16).

In this way, it is unlikely that the student will fail to participate in playful activities, because play is part of being a child, at the time of play the child develops even more in all senses, emotional, social, cultural, among others.

Therefore, playful practice is indispensable when it comes to young children, because from it the student will expose his fears and desires, with playful practices in the classroom the student will express himself better without fear of making mistakes, because with playfulness it is like this, the student develops his activity many times without even realizing how pleasurable it is. And this is one of the reasons why Students do not stop doing this type of activity.

Frequency with which they carry out playful activities in the classroom

Subject	Answers
Professor A	3 times a week
Professor B	Every day.
Professor C	3 times

Source: Field research

According to the research, playfulness is present in the daily school routine and this shows that the pedagogical practices of the teachers are being consistent with the needs of the students.

Playfulness brings moments that will never be forgotten, with satisfactory results. Playful activities during the school period make students better develop their skills.

According to Lima, Nascimento (2020)

> For many psychologists, pedagogues and psychopedagogues, the work carried out with play in the classroom allows the development of relevant aspects in each student that are important for personal and intellectual life, such as, for example, allowing the development of sociability, multiple intelligences and creativity. (LIMA, NASCIMENTO, 2020. p, 7).

Therefore, playfulness becomes of fundamental importance in the school routine, as it transmits satisfactory experiences for the interaction and development of students. It enables moments of interaction and satisfaction in which students feel full, fulfilled, with the desire to return to school the next day, that is, early childhood education and playfulness need to be together so that a positive result can be obtained in relation to the development of students' teaching and learning.

Materials available for carrying out playful activities

Subject	Answers
Professor A	Yes. games available at school and material made by teachers.
Professor B	There are some materials, but most of the time the teacher needs to make or buy these materials.
Professor C	Yes, we make

Source: Field research

According to the research, there are several materials in the school, but teachers sometimes also produce complementary materials, which meet the needs of teachers and students. Making materials together with the students is very important because it will stimulate the creativity of the students.

For Silva (2017. p, 10) the construction of toys allows the child to experience the experience of producing, feeling useful, capable of imagining and recreating through play, alone or with colleagues.

For the students, these are unforgettable moments in their school life, considering that they will be their first experiences of making toys in the classroom, being a satisfactory experience, which everyone feels at the time of making these materials.

In this sense, nothing better than the teacher bringing these materials to be made together with the students, this will even serve as an incentive for the students to carry out the activities.

Difficulties encountered to develop the activities

Subject	Answers
Professor A	No, they are activities designed according to the needs of the students.
Professor B	Not presenting. What is often difficult is the material that is not available and the inadequate space in the room, which are too small to develop such activities.
Professor C	No

Source: Field research

The research points out that teachers do not find it difficult to carry out playful activities, as they draw the attention of students who automatically want to participate.

In this sense, Dantas, Costa, Silva, Caraúbas (2019) states that:

> Playing is an important construction tool, it is through this act that the child reproduces his daily life. Playing promotes the child's learning process, in addition to contributing to the construction of reflection on autonomy and creativity by establishing a close relationship with learning. (DANTAS, COSTA, SILVA, CARAÚBAS, 2019, p.4).

Therefore, it is possible to reaffirm the importance of working with playful activities in early childhood education, they enable students to build their own identity with learning through games that draw their attention, that give them a sense of well-being, and pleasure to learn.

By using playful practices, the teacher will possibly not find difficulties in developing them, because when playful activities are brought to the classroom, the child's learning process becomes more pleasurable and everyone wants to participate. After all, what does the child like most if not playing, and nothing better than learning by playing.

FINAL CONSIDERATIONS

Playfulness provides a more pleasurable learning approach, essential for the educational process of children. When considering the relevance of playfulness in the development of students, we can say that it plays a significant role in the teaching and learning process.

The results revealed the importance of playfulness in the school routine, through the teaching practice of teachers for the educational development of children, favoring both the teaching process and the learning by children, through playful approaches.

Pedagogical practices and playfulness, when incorporated into early childhood education, play a fundamental role in the integral development of children. The teachers researched in this study affirm the importance of pedagogical practices based on playfulness, however, there are still professionals who do not adopt such practices and even disregard them in their teaching action.

It is also important to emphasize that pedagogical practices based on playfulness require a commitment on the part of educators to stay up-to-date on best practices and pedagogical approaches, as well as to reflect on their own practice and adapt it to the needs and interests of children.

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POLITICAL AND CONSTITUTIONAL INSTABILITY IN BOLIVIA: HISTORY AND IMPACTS ON MERCOSUR MEMBERSHIP

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ABSTRACT

This article correlates the political and constitutional instability of Bolivia and its distant process of accession to MERCOSUR, highlighting the difficulties faced due to internal crises and constitutional reforms. The analysis includes the relationship between political transformations and regional integration, as well as exploring how government challenges have affected the negotiations and ratifications necessary for membership. The methodology adopted is logical-legal, with bibliographic and documentary analysis, addressing the main theoretical landmarks on the Bolivian political history and the process of joining MERCOSUR. The article concludes that Bolivia's accession to MERCOSUR reflects the country's effort to overcome its historical political and constitutional instability, being an opportunity to consolidate democratic institutes and strengthen regional integration and development.

Keywords: Bolivia. MERCOSUR. Regional Integration. Political and Constitutional Instability.

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INTRODUCTION

Bolivia, throughout its recent political history, has faced periods of intense political and constitutional instability, which directly reflected on its process of joining MERCOSUR. The relationship between internal political transformations and regional integration is complex, especially considering that Bolivia has undergone significant constitutional changes and faced governmental challenges that have made it difficult to implement consistent policies. This context of political and constitutional instability was one of the main factors that shaped Bolivia's long and challenging trajectory towards its accession to the MERCOSUR economic bloc.

The main objective of this work is to understand how Bolivia's political and constitutional history has impacted its accession to MERCOSUR, highlighting the elements that made this process prolonged and complex. To this end, the article proposes to analyze how the country's internal crises, combined with frequent constitutional reforms, have affected its ability to establish a stable compromise with the other members of MERCOSUR and have hindered the negotiations and ratifications necessary for full membership. The analysis of the effects of these instabilities offers a crucial perspective to understand the obstacles faced by Bolivia and the mechanisms that, over time, needed to be adjusted to enable its integration into the bloc.

This study adopts a logical-legal methodology, using the collection of bibliographic and documentary data, both primary and secondary, to explore the Bolivian historical analysis and its process of adhesion to the South American economic bloc. In addition, the work is structured in two axes: the first will deal with the troubled political history of Bolivia, highlighting the main moments of instability and their political and institutional implications. The second chapter will be dedicated to joining MERCOSUR, addressing the challenges, negotiations and the impacts of Bolivian instability on the integration process.

The main theoretical frameworks of this study include sources on Bolivia's recent history, such as the G1 and Deutsche Welle (DW) reports on the 2019 crisis, which address political tensions and the coup attempt. Also relevant are the analyses of Agence France-Presse (AFP) on the post-Evo Morales transition period. Authors such as Jorge Ocsa Laime, Magdalena Cajías and Gladstone Leonel da Silva Júnior discuss the constitutional challenges and the evolution of the Bolivian State before and after the promulgation of the 2009 Constitution, which created the Plurinational State, as well as legal sources (such as the publication of constitutions by the Constitutional Court of Bolivia) that analyze the consolidated legal mechanisms of stabilization of the country.

Through a detailed analysis of these two aspects, the article seeks to offer a deeper understanding of the difficulties faced by Bolivia in the search for its integration into MERCOSUR, highlighting how the country's internal context, marked by political and constitutional instability, had a direct impact on its accession process to the regional bloc.

HISTORY OF POLITICAL AND CONSTITUTIONAL INSTABILITY OF THE REPUBLIC OF BOLIVIA

XIX CENTURY

The book "*Las Constituiciones Políticas de Bolivia*", by the Constitutional Court of Bolivia (2018), teaches that, from the Decree of February 9, 1825 by Antonio José de Sucre (p.10), to the Constitution of 2009 (p.413), Bolivia has experienced a trajectory marked by political instability and constitutional changes. Bolívar, in proposing the first constitution for Bolivia, designed a model based on a strong, centralized government with a lifetime presidency, aimed at avoiding political disputes and maintaining order in a newly independent nation. This model, however, was not implemented according to Bolívar's ideal, and Bolivia soon experienced the difficulties of building a stable democratic order.

As we can see from the analysis of Bolivian constitutions published by the Plurinational Court of Bolivia (2018), over the years, Bolivia has had a total of 20 constitutions (ps. 9, 23, 39, 55, 75, 93, 105, 117, 131, 141, 155, 175, 197, 219, 243, 271, 299, 337, 377, 413), each trying to respond to the challenges of its time. These constitutional changes reflect both the attempt to adapt to economic and social needs and the political instability marked by coups and regional and ethnic tensions. The need to integrate different groups and ensure broader representation, including indigenous populations, was a central issue, especially from the twentieth century onwards.

The 2009 constitution, pushed by the government of Evo Morales, brought a significant break by establishing Bolivia as a Plurinational State, formally recognizing the country's ethnic and cultural diversity. This new constitutional text seeks to overcome the limitations of previous constitutions, promoting the inclusion of indigenous peoples, environmental protection, and gender equality. In addition, it brought innovations in social and political rights, finally seeking to consolidate a more democratic and representative model.

These 20 constitutions reveal Bolivia's long quest for a stable and representative system of government, in a history marked by constant attempts to reconcile cultural diversity, regional autonomy, and national unity. The history of Bolivia's constitutions reflects

a trajectory marked by frequent political changes and the search for stability in a scenario of social and economic tensions.

During the nineteenth century, Bolivia underwent a series of constitutional changes that reflected the political contexts and needs of each historical moment. As pointed out in the work prepared by the Bolivian Plurinational Constitutional Court, constitutions were promulgated in 1831 (p. 39), 1834 (p. 55), 1839 (p. 75), 1843 (p. 93), 1851 (p. 105), 1861 (p. 117), 1868 (p. 131), 1871 (p. 141), 1878 (p. 155) and 1880 (p. 175). Each of them highlighted the constant political transformations of the Andean country.

Shortly after independence, Bolivia adopted its first constitution, inspired by the idealism of Simón Bolívar. This text was based on a centralized and strong government, with a robust executive power, aimed at ensuring national unity. Based on the Political Constitution of the State of 1826, Bolivia's international relations were shaped by principles of sovereignty and independence, enshrined in fundamental provisions. Article 2 (p. 25) reflects an intrinsic commitment to the maintenance of national autonomy and the repudiation of any form of subordination. This provision establishes a legal and political framework that guides the country's actions in the international sphere, supporting its negotiations and external relations.

Between 1836 and 1839, Bolivia faced a period of intense instability due to the War of the Peru-Bolivian Confederation, as Jorge Basadre (1977) explains. Subsequently, the government of José Ballivián Segurola (1841-1847) was marked by significant civil conflicts. According to Víctor Cortés (2022), between 1848 and 1864, Bolivia had six different presidents, in addition to a governing junta in 1861, which reflects the scenario of political instability.

The government of Manuel Mariano Melgarejo Valencia (1864-1871) was a period of extreme controversy. According to the text by Marta Victoriano (2023), Melgarejo was the protagonist of coups d'état and insurgencies, implementing an authoritarian regime that sought to legitimize power and defend the Constitution of 1868 in a revolutionary context. However, as Gladys Murillo points out, his agrarian reforms have negatively affected indigenous communities, generating intense land conflicts with large landowners. Deposed in 1871, Melgarejo was assassinated shortly after, while his successor, Agustín Morales Hernández, also did not remain in power for long, being assassinated in 1872.

In the government of Hilarión Daza Groselle (1876-1879), another constitution was promulgated. During this period, Bolivia went to war against Chile, a conflict that resulted in the loss of its outlet to the sea, as detailed by Patrício Cifuentes (2018). This event

profoundly marked Bolivian history and its territorial disputes, the consequences of which resonate to the present day.

As can be seen from the work of the Plurinational Court, the Constitution of 1880 marked a period of stability in the political history of Bolivia, being the longest lasting in the country, in force until 1938. Elaborated in the context of the War of the Pacific (1879-1874), it sought to consolidate internal order after the territorial loss to Chile. The Constitution of 1880 consolidated a framework of stability in Bolivia, reflecting the challenges of the post-Pacific War period and promoting a balance between institutional order and individual rights.

This balance is visible in legal provisions such as Article 4 (Bolivia, 2018, p. 178), which ensured freedom of movement, work, and expression. By reinforcing the inviolability of the home, Article 12 (Bolivia, 2018, p.179), property, Article 13 (Bolivia, 2018, p.179), and the prohibition of confiscation of property as a political penalty, Article 11 (Bolivia, 2018, p.197), the constitutional text guaranteed protection of civil rights. These legal principles, aligned with a representative democratic model, strengthened governability and increased the social legitimacy of the State, contributing to the durability of the Constitution.

In addition, legal predictability and constitutional reform mechanisms, Articles 132-134 (Bolivia, 2018, p.192), were fundamental for the acceptance of the text over time. The exclusion of the death penalty for political crimes, Article 21 (Bolivia, 2018, p. 179), and the recognition of equal taxation, Article 16 (Bolivia, 2018, p.179), highlight progressive advances that reconciled conservative traits, such as the recognition of the Catholic religion, with modern principles of protection of fundamental rights.

The robustness of the legislative, executive and judicial structure, organized by the Constitution, reinforced political and institutional stability. Thus, the Constitution of 1880 provided a model that not only met the demands of the time, but also offered flexibility to face the challenges of the future, consolidating itself as one of the most resilient texts in Bolivian history. Thus, the Constitution of 1880 represented a milestone in the consolidation of the Bolivian State, providing solid foundations for governability and the construction of republican institutions in the country.

TWENTIETH CENTURY

After more than half a century under the Constitution of 1880, Bolivia once again faced several periods of legal instability throughout the twentieth century, reflecting the intense social conflicts that marked that era. According to Bolivia (2018), Bolivia's 1938

Constitution consolidated important guidelines for the conduct of its international relations, aligning them with the principles of sovereignty, equality, and modernization of the State.

In Article 1 (Bolivia, 2018, p. 200), the text reaffirms Bolivia as a unitarian, free and independent republic, while Article 3 (Bolivia, 2018, p. 200) declares that sovereignty resides in the people, exercised through the constituted powers. This centralized structure allowed the legitimately elected government to conduct foreign policy, reinforcing Bolivia's position as a sovereign actor on the international stage. At the same time, Article 18 (Bolivia, 2018, p. 200) establishes equality between Bolivian citizens and foreigners in access to property, but Article 19 (Bolivia, 2018, p. 200) imposes strategic restrictions on the possession of land by foreigners in border areas, a measure clearly linked to the protection of territorial integrity, especially in the context of the vulnerability exposed during the Chaco War (1932–1935).

These provisions reflect a concern to ensure that foreign policy is conducted on the basis of legality, transparency, and the protection of national interests. At the same time, they show an attempt to balance the need for international cooperation with the preservation of autonomy and internal security. In this way, the 1938 Constitution sought to project a more respectable and modern Bolivia on the international stage, while establishing barriers against external influences that could compromise its sovereignty and territorial integrity, in addition to the fact that, according to Soliz (2014), the so-called "peasant régimen" was recognized for the first time, which had recognized the legal existence of the "Bolivian indigenous communities".

Soliz (2014) explains that in the 1940s left-wing political parties began to organize in Bolivia (Partido de la Izquierda Revolucionaria-PIR, Partido Obrero Revolucionario-POR, and Movimiento Nacionalista Revolucionario-MNR). Thus, in the 40s of the twentieth century, the idea of modifying the country's agrarian structure began to be debated more vehemently. Gualberto Villarroel López had approved the 1945 constitution with the support of the MNR and had a government marked by authoritarianism and summary execution of opponents, however, explains Fernandez et al (2004), the party's coreligionists abandoned him and the country's macroeconomic conditions deteriorated, in 1946 people invaded the government palace and assassinated the president, defenestrating him dead on a pole in Murillo Square in La Paz.

From 1964 onwards, Bolivia began to be governed by military dictatorial regimes, coincidentally in the same year that Brazil also began to experience the same political situation, it was in this context that, in 1967, Bolivia proclaimed a constitution that would last until the end of the 1990s, being the second longest lasting constitution in the country.

Cajías (2014, p.157-158) explains that the democratization of Bolivia was structured after the 1978 national elections, together with the pressure exerted by the population, especially the strength of the mining workers' union movements (which had their union rights restricted between 1975 and 1978). According to Cajías (2014, p.166), the Bolivian people showed their ability to rearticulate their organizations, from the underground and articulate with the opposition political parties, and managed to reestablish democracy in October 1982.

Bolivia's 1995 Constitution reflected the context of neoliberal structural reforms proposed during the 1990s, marked by an attempt to modernize the state. This modernization sought to strengthen democratic bases, ensure greater administrative decentralization, and promote citizen participation, in line with international recommendations such as those of the IDB. Ocsa (2014, p. 204) explains that the introduction of mechanisms such as the Popular Participation Law and the reforms to the Code of Criminal Procedure aimed to consolidate the rule of law, promoting greater efficiency in public management and transparency in institutions. The creation of the Defensor del Pueblo and the strengthening of instances such as the National Electoral Court are examples of institutional advances that sought to respond to the demands for a more robust and accessible public administration. In this scenario, the municipal elections of 1995 and 1999 stood out as spaces of resistance and political reappropriation, led by social and union organizations, signaling a new dynamic of local governability that tensioned the limits of the political model then in force.

The constituent process that culminated in the 2009 Constitution in Bolivia had its roots in an intense context of social conflicts and popular mobilizations that characterized the previous decades. The water (2000) and gas (2003) "wars", followed by the presidential resignations of Sánchez de Lozada and Carlos Mesa, highlighted a crisis of legitimacy of the current political and economic model. These events strengthened the demands for a Constituent Assembly, originally articulated by social, indigenous and peasant organizations, which became the core of the transformation of the Bolivian state.

The election of Evo Morales, an indigenous union leader, in 2005, was a milestone in this process, allowing the advancement of repressed historical agendas and the convocation of the Constituent Assembly in 2006, supported by Special Convocatory Law No. 3,364 The new Constitution faced significant political resistance, especially from the traditional elite, concentrated in the departments of the "media luna". These groups opposed the plurinationality project and agrarian and economic reforms, adopting sabotage and boycott tactics. Despite the tensions, explains Silva Júnior (2015, p. 174-176), the MAS-IPSP obtained a parliamentary majority in the Assembly, which allowed for substantial

advances, such as the recognition of the rights of indigenous peoples and the redefinition of the State as plurinational.

However, negotiations with the opposition resulted in concessions, such as the limitation of indigenous community justice and adjustments to agrarian reform, evidencing the hybrid nature of the final text. In February 2009, it began to have its current Constitution with popular support, consolidating the Plurinational State of Bolivia as a milestone in the "new Latin American constitutionalism", although permeated by challenges and compromises.

Let us look at the speech of Evo Morales Ayma (2009, p.1) in the preamble of the Constitution:

> In time immemorial, mountains were erected, rivers were moved, lakes were formed. Our Amazon, our Chaco, our altiplano and our plains and valleys were covered with greenery and flowers. We populated this sacred Mother Earth with different faces, and since then we have understood the current plurality of all things and our diversity as beings and cultures. This is how we formed our peoples, and we never understood racism until we suffered it from the disastrous times of the colony. The Bolivian people, of plural composition, from the depths of history, inspired by the struggles of the past, by the indigenous anti-colonial uprising, by independence, by the popular liberation struggles, by the indigenous, social and trade union marches, by the water and October wars, by the struggles for land and territory, and by the memory of our martyrs, we built a new State. A State based on respect and equality among all, with principles of sovereignty, dignity, complementarity, solidarity, harmony and equity in the distribution and redistribution of the social product, where the search for living well predominates; with respect for the economic, social, legal, political and cultural plurality of the inhabitants of this land; in collective coexistence with access to water, work, education, health and housing for all. We leave the colonial, republican and neoliberal state in the past. We take on the historic challenge of collectively building the Unitary Social State of Plurinational Community Law, which integrates and articulates the purposes of advancing towards a democratic, productive, peace-inspiring Bolivia, committed to integral development and the self-determination of peoples. We, women and men, through the Constituent Assembly and with the original power of the people, express our commitment to the unity and integrity of the country. Fulfilling the mandate of our peoples, with the strength of our Pachamama and thanks to God, we refounded Bolivia. Honor and glory to the martyrs of the constituent and liberating feat, who have made this new history possible.

CONTEXT AFTER THE 2009 CONSTITUTION AND POLITICAL CRISES IN THE FIRST HALF OF THE 20S OF THE 21ST CENTURY

Promoted by the government of Evo Morales, the 2009 constitution is the most recent and represents a break with the previous model, establishing Bolivia as a "Plurinational State". This Bolivian constitutional history shows a country in search of a political system that caters to ethnic and cultural diversity, while stabilizing democratic institutions. The 2009 constitution remains in force, but political and social challenges keep the country in constant debate about the need for adjustments and reforms.

In 2019, according to an article published in G1 (2019), then-President Evo Morales sought a controversial fourth term. Accusations of electoral fraud sparked massive protests, leading to his resignation and the installation of an interim government, under the presidency of Jeanine Añez. Morales' party, the Movement Toward Socialism (MAS), had maintained that the event was a coup d'état. Currently, Añez is in prison accused of terrorism and criminal association, according to a report by Santiago (2024).

A report by Deutsche Welle (2024) explains that in the 2020 elections, Luís Arce, former Minister of Economy and ally of Morales, was elected president, returning the MAS party to power. On June 26, 2024, General Juan José Zúñiga led an attempted military coup, mobilizing troops and armored vehicles in La Paz, he had attempted to take the Quemado Palace in Murillom Square, a place that witnessed other coup attempts, as evidenced in this article. The action was quickly contained, and Zúñiga was arrested. This event highlighted the deep political divisions in the country.

As reported by Mayara Paixão (2024), Bolivia faces significant challenges, including a declining economy, low international reserves, and internal political tensions. The split within the MAS between factions loyal to Arce and Morales further complicates the political landscape, with the 2025 presidential elections approaching. Bolivia faces protests led by Morales supporters, who accused Arce's government of corruption and economic mismanagement. Agence France-Presse (2024) reported that in November 2024, protesters occupied military barracks and held soldiers hostage, intensifying political instability.

BOLIVIA'S ACCESSION TO MERCOSUR IN THE FACE OF POLITICAL-CONSTITUTIONAL INSTABILITY

Bolivia's long and complex process of joining MERCOSUR represents a significant milestone for Latin American integration. This decision reflects the country's quest to strengthen its relations with its neighbors and expand its growth opportunities through greater regional cooperation and coordination. In addition, joining the bloc represents an attempt to overcome the internal crises that have marked Bolivia's political and economic trajectory, while aiming to restore international confidence in the country.

The history of the Republic of Bolivia's accession to MERCOSUR dates back to December 21, 2006, when, through its representative, Evo Morales Ayma, Bolivia formalized its application to join the economic bloc during the MERCOSUR Presidents Summit, held in Córdoba, Argentina (SEGGATO, 2024). This event initiated the procedures provided for in Decision No. 28/05 of the Common Market Council (CMC).

As stipulated in Decision No. 28/05, which regulates the procedures for the accession of new members, once the request to the CMC has been formalized, through the *acting Pro Tempore* Presidency , it is up to the CMC to determine the creation of an *ad hoc group*. This group, as established by the decision, would have an initial period of 180 days, extendable for an equal period, to analyze the conditions of the application for adhesion.

After the formalization of the application for accession to the bloc by Bolivia, through the *Pro Tempore* Presidency of the Oriental Republic of Uruguay, on January 18, 2007, during the 32nd Ordinary Meeting of the CMC, the creation of an *ad hoc group* for the analysis of the incorporation of Bolivia as a State Party to MERCOSUR was approved. The first meeting of this group took place between March 26 and 27, 2007, initiating a series of discussions and analyses on the terms and conditions of Bolivia's accession.

From this phase, the *ad hoc* group began to evaluate the impact of Bolivia's accession in various aspects, such as trade, economic policies and social policies of MERCOSUR. During this period, the study and preparation of the Accession Protocol began, a legal document that formalizes the conditions for the integration of a State into MERCOSUR. The protocol aims to establish a series of provisions, ranging from the obligations of the requesting State in relation to the bloc's trade and political rules, to responsibilities in intra-bloc trade and issues of political and social cooperation.

Bolivia's accession process advanced in a more concrete way from that moment on, with the start of negotiations and the preparation for the country's full integration into MERCOSUR. During 2010 and 2011, the *ad hoc group* drafted the Protocol of Accession, detailing the specific conditions for Bolivia's integration into MERCOSUR, including the adoption of the bloc's trade and political norms, such as the Common External Tariff (CET), the MERCOSUR Common Nomenclature (NCM) and the MERCOSUR foreign policy.

However, as detailed in the previous chapter, Bolivia's political instability directly impacted this process. The constant changes of government, internal crises and popular protests have slowed down the continuity of the integration process. These crises have affected the Bolivian government's ability to engage in dialogue effectively and have generated uncertainty about the country's commitment to the other MERCOSUR members.

Another factor that hindered the process was the constant alteration of the Bolivian Constitution, which delayed the creation of a stable political environment, essential for the celebration and ratification of international agreements, and sometimes paralyzed the dialogue in search of an internal political consensus, necessary for the ratification of the agreements. This scenario resulted in legal uncertainty and institutional weakness, reflecting negatively on the country's accession process to the economic bloc.

Bolivia's accession process gained new momentum in 2012 with the political approval of accession during the Mendoza Summit in Argentina, where Decision No. 28/12 was adopted, formalizing the political will of the member countries to accept Bolivia as a full member. However, although there was a symbolic advance with Decision No. 28/12, the formal ratification of Bolivia as a member of MERCOSUR would require a series of additional steps, such as the signing of the Protocol of Accession and the conclusion of negotiations with the bloc's member countries.

It was only on July 7, 2015, during the MERCOSUR Summit in Brasilia, Brazil, that Bolivia's Accession Protocol was finally signed. This framework detailed the country's obligations in relation to the internalization and compliance with the MERCOSUR normative acquis, including commercial, political, economic and social integration standards, as well as commitments aimed at regional cooperation. This step, however, did not represent the end of the accession process. After the signing of the protocol in 2015, the MERCOSUR States Parties, as well as Bolivia, must complete the legislative ratification of the Accession Protocol.

After signing the Accession Protocol, the National Congress of Brazil, following the due constitutional rite, according to the Federal Constitution of 1988, ratified the Protocol through Legislative Decree No. 127, of 2022. Argentina, in turn, also ratified Bolivia's Accession Protocol in 2022, through a national law approved by the Argentine National Congress. Paraguay ratified the Protocol quickly, in 2022, through a resolution of the Paraguayan National Congress. Finally, Uruguay ratified the Protocol in 2021 through a Resolution of the Uruguayan Senate.

Venezuela, suspended from MERCOSUR in 2016 after a series of internal political and institutional issues, as well as after going through a period of growing political instability and tensions with the other members of the bloc, along the lines of the Ushuaia Protocol, which governs the democratic clause of MERCOSUR, had its vote withdrawn during Bolivia's accession negotiations. being prohibited from exercising any influence on the decisions of the bloc while the suspension lasts.

Currently, Bolivia has managed to become a full member of MERCOSUR, after a long and challenging process that lasted more than 15 years, with formal membership completed in 2015 and final ratification of the protocols by the bloc's members taking place in 2024. From its accession, Bolivia has a period of up to 10 years to adapt its regulatory framework to MERCOSUR norms and treaties, including the implementation of commercial, economic and social policies compatible with the bloc's objectives.

According to the Brazilian Ministry of Foreign Affairs (BRASIL, 2024):

> The Brazilian government has learned, with satisfaction, of the approval, today, by the Bolivian Senate, unanimously, of the Protocol of Accession of Bolivia to MERCOSUR. With the conclusion of the process within the Legislature, the regulation, which had been approved by the country's Chamber of Deputies on June 14, will proceed to presidential sanction. Bolivia's accession had already been ratified by Argentina, Uruguay, Paraguay and Brazil. Once ratified by Bolivia, the instrument will enter into force in 30 days, and the country will have a period of up to four years to incorporate the MERCOSUR normative acquis.
> The full incorporation of Bolivia into the bloc will open new opportunities for increased trade and investment, as well as possibilities for deepening cooperation on social issues for the five countries involved, contributing to the economic growth and prosperity of MERCOSUR members.

However, despite this achievement, Bolivia's internal challenges, such as political instability, frequent constitutional reforms, and social crises, remain present (G1, *on-line*, 2019). These factors still raise doubts about the country's ability to consolidate itself as a strategic and effective member of MERCOSUR. The complexity of Bolivia's internal scenario raises questions about the sustainability of its commitment to the bloc and the effectiveness of integration policies in the future.

In the words of Seggano (*online*):

> Political instability is another challenge to be overcome. Bolivia has a history of coups d'état and political turmoil. The country has already had a president lynched in the street and the presidential palace itself set on fire. For this reason, the building where Luis Arce dispatches is called Palácio Queimado. This history of instability scares away investors and hinders negotiations and works. In this regard, it is up to the Bolivian governments to respect democratic rules and to the neighbors to ensure their compliance in an incisive way, without depending on the ideology of the government of the day.

However, the same author reinforces that, if the challenges are overcome, Bolivia's entry into MERCOSUR can mean the strengthening of the country's democratic institutions, being an important source of support for MERCOSUR to overcome its own internal crises and prosper. In the words of Seggano (2024, *online*): "[...] The potentialities exist and are many. However, for them to materialize, it will depend a lot on the political will of the States that are part of the Southern Common Market. South American integration would have much to celebrate if these challenges are overcome."

Thus, although the accession process has been long and challenging, Bolivia now finds itself in a strategic position to take advantage of closer integration with its neighbors, contributing to a more promising future, both for the country and for the entire region.

CONCLUSION

Bolivia's accession to MERCOSUR, although historic and significant for regional integration, was marked by a long and troubled process, a reflection of the country's internal political and constitutional crises. Since the formal application for membership in 2006,

Bolivia has faced government instability, frequent changes of presidents, and popular protests, factors that have slowed negotiations and made it difficult to build a stable political environment, essential for the formalization of membership.

Despite these difficulties, the country finally managed to complete the process of joining MERCOSU in 2024, with the completion of internal ratifications of the Protocol of Accession. However, political instability has persisted, with constant constitutional reforms and internal crises that continue to challenge Bolivia's ability to consolidate a lasting commitment to MERCOSUR. This unpredictable political scenario raises doubts about the effectiveness of integration and the sustainability of future agreements within the bloc.

If Bolivia succeeds in overcoming these internal challenges, MERCOSUR membership could represent a crucial opportunity to strengthen its democratic institutions and promote more robust economic growth. Integration with its neighbors can be the key to political stability and the creation of an environment more conducive to regional development, benefiting not only Bolivia, but the entire MERCOSUR bloc.

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CONSTITUTIONAL AMENDMENT NO. 45/04 AND THE INNOVATIONS INTRODUCED IN THE THEME OF THE PROTECTION AND PROMOTION OF HUMAN RIGHTS: REPERCUSSIONS AND ADHESION OF NEW ACTORS

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ABSTRACT

INTRODUCTION: We currently have an extensive number of international standards for the protection of human rights and we find a large number of treaties of this nature. Hence, it is enough to be a human person to be able to apply for protection, whether in the domestic or international context. Fundamental rights are those related to constitutional protection (Domestic Law), while human rights are assigned to any person, without any discrimination and are collated in international instruments. What matters, according to Mazzuoli (2021, p. 762), is to admit the interaction of these same rights so that all people (whether or not they belong to the State where they are) are effectively protected.

Keywords: Human Rights, Convention Control.

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INTRODUCTION

We currently have an extensive number of international standards for the protection of human rights and we find a large number of treaties of this nature. Hence, it is enough to be a human person to be able to apply for protection, whether in the domestic or international context. Fundamental rights are those related to constitutional protection (Domestic Law), while human rights are assigned to any person, without any discrimination and are collated in international instruments. What matters, according to Mazzuoli (2021, p. 762), is to admit the interaction of these same rights so that all people (whether or not they belong to the State where they are) are effectively protected.

Contemporary human rights are not divided, because their content is indivisible, they are interconnected. In turn, the rights of freedom (civil and political) cannot survive without those of equality (economic, social and cultural). The dimensions of human rights were based on the motto of the French Revolution: liberty, equality and fraternity.

The characteristics that are imposed on Human Rights are universality (ownership belongs to all people), non-renounceability; inalienability; inexhaustibility (expansion is allowed, being able to add new ones); the imprescriptibility (they can be requested at any time); the prohibition of retrogression (there can be no retrogression in the protection of human rights), among others.

Constitutional Amendment (EC) No. 45, of December 30, 2004 (EC) played an important role in the protection and promotion of human rights, bringing relevant adjustments to the Brazilian legal system.

Considering the purpose of immersion of this research, the referred EC will be analyzed in the context of article 5, §§2 and 3, of the Federal Constitution (FC) of 1988, under the aspect of the scope/projection of the innovations that stood out in relation to the theme of Human Rights, with special emphasis on the control and measurement of conventionality. Likewise, an approach to the Inter-American Human Rights System, whose American Convention on Human Rights (ACHR) is the main instrument and which, together with its jurisprudence, consolidates rights in the Brazilian State.

The institutionalization of human rights took place with the constitutional opening allowed by the system of article 5, §§2 and 3, of the FC, the object of this study. Hence, a multilevel tutelage, that is, the domestic legal system counts, in complementarity, with the international system for the protection of human rights which, in the case of Brazil, is due to article 5, paragraph 2, allowing the maintenance of the social contemporaneity of the FC.

This constitutional opening allowed important treaties to enter Brazil and the adoption of conventional control, in cases where a domestic rule contradicts international

provisions, was present. It is in this alignment that we emphasize the importance of carrying out conventionality checks, so that the diffuse control and measurement of domestic and international conventionality have been recognized in the States. And from there, new interpreters emerge in the implementation of fundamental rights internally, due to the doctrinal and jurisprudential evolution of the System, including the adhesion of new actors.

As a bibliographic support, the research will be carried out in a doctrinal context and on official websites, given the great relevance of the theme for Brazilian law regarding the protection and promotion of human rights.

THE INTER-AMERICAN SYSTEM ON HUMAN RIGHTS AND THE GOVERNING BODIES

And with the greater purpose of protecting human rights, those States that adhere to the American Convention on Human Rights (ACHR) must observe its guidelines and comply with them, in accordance with the principles of good faith and *pacta sunt servanda*, which are the basis of the Vienna Convention (VCLT) and the source of conventional law and, equally, cannot invoke provisions of their domestic law as a justification for non-compliance with the treaty. by virtue of having assumed legal obligations at the international level.

This idea of protection was not reduced to the reserved domain of the State, nor was it restricted to domestic jurisdiction, exclusively. With the facts that devastated humanity, originating from wars, the protection of human rights reached the international domain, at the global level and took place more diligently in the post-World War II period. With legal globalization, domestic law, from being sovereign, has become relativized.

The expansion of the protection and promotion of fundamental rights has a history in the Inter-American Human Rights System (IAHRS), whose main instruments were the Universal Declaration (1948) and the Charter of San Francisco (1945). The purpose of the ISHR is to curb human rights violations by the states parties (VARELLA. 2016, p. 20), and the Pact of San José definitively created another door of access to justice to claim rights in the regional international context. The dignity of the human person and the benefit of institutionalized international guarantees are ensured. The mechanisms for the protection of human rights in the ISHR have undergone a progressive process of implementation, and the Inter-American Commission (IACHR) has an important role.

Access to the ISHR is granted by petition to the IACHR, a diplomatic or political body, which issues Advisory Opinions (OC); precautionary measures; it assesses human rights violations, in a judgment of admissibility, and conventional control can be carried out by the IACHR itself.

In view of the fundamental point of the research, in domestic law the measurement and control of conventionality of the primary normative species can be carried out, that is, in two stages. In the assessment, the MP, for example, makes a request for appreciation without invalidating the norm, a check of the internal norm in relation to human rights treaties. In the control of conventionality, the internal norm is invalidated if it is in dissonance with the treaty.

The IACHR strengthened its *legal status* by putting an end to any objections and began to be endowed with a conventional basis: not only with a mandate to promote, but also to control and supervise the protection of human rights. (CANÇADO TRINDADE. 2003, v. III, p. 36-37).

For Mazzuoli (2009, p. 253) there is a genre called conventionality examination, which is divided into conventionality control and measurement, and in the first there is the invalidation of the Brazilian norm for violation of a human rights treaty, while in the measurement it brings only an indication that the internal norm is unconventional. The checks take into account the term plan.

The IACHR precedes the Pact of San José, as it is based on Article 106 of the Charter of Bogotá and carries out the assessment. The basis of control is the ACHR. (MAZZUOLI. 2009, p.252). Petitions or communications are sent to the Commission, which makes a judgment of admissibility, which Cançado Trindade (1997, p. 23) explains has a residual character and the principle of exhaustion.

The performance of internal judges in exhaustion is a requirement, and only acting in the omission, inefficiency, failure or deficiency of the State. The exhaustion of domestic remedies in Brazil occurs with a final and unappealable judgment, as the State will have priority in the investigations, but with the exceptions of article 46, paragraph 2 of the Pact.

In the IAHRS, we also have the Inter-American Court of Human Rights, which performs advisory and litigation functions and dictates provisional measures, in cases of urgency and gravity. In its advisory role, the ACHR vests the Inter-American Court with the task of interpreting the American Convention on certain human rights treaties in proceedings that do not involve specific judgments. The Inter-American Court of Human Rights issues the CO and all member states of the Organization of American States (OAS) can consult regardless of whether they are parties to the ACHR.

The contentious jurisdiction of the Inter-American Court of Human Rights is inherent to the role of an international Court of Justice in taking upon itself the task of resolving controversies of a legal nature permeated by violations of rights protected by the American Convention on Human Rights. This contentious jurisdiction does not operate automatically

because a State has signed the American Convention, it must be expressly declared, which does not occur in the advisory jurisdiction. This recognition is optional and may take place *a posteriori*.

The Brazilian State adhered to the contentious jurisdiction of the Inter-American Court of Human Rights in 1998, through Legislative Decree 89 (BRAZIL) and, in 2002, through Decree 4463 (PLANALTO), promulgated the Declaration of Recognition of the Contentious Jurisdiction of the Inter-American Court of Human Rights, subject to reciprocity, in accordance with Article 62 of the ACHR, with the note that it would be *for events after December 10, 1998*. The Advisory Opinions issued by the Inter-American Court of Human Rights are not binding, but they are relevant, however, their effectiveness has been increasing.

RELEVANT ASPECTS OF THE PROTECTION OF HUMAN RIGHTS IN THE CONTENT OF ARTICLE 5 OF THE FEDERAL CHARTER OF BRAZIL

The Federal Charter of 1988 has a relevant role in the process of redemocratization of the Brazilian State because it is the one that regulated and granted an opening for the reception of several international treaties that entered our legal system.

Brazil's ratification of the treaties culminated in expanding the protection and promotion of human rights internally, at the global level/United Nations system, as well as in the Regional of the Americas.

Within the protective aspect, we can mention important articles that were constitutionally enshrined as fundamental principles of the Federative Republic of Brazil, being Article 1, III (the dignity of the human person); Article 4, II (prevalence of human rights) and, a significant step was with Article 5, paragraph 2 when it established that *the rights and guarantees expressed in this Constitution do not exclude others arising from the regime and principles adopted by it, or from international treaties to which the Federative Republic of Brazil is a party.*

From the reading of this paragraph 2, of article 5, it is observed that the reception of other treaties expands the block of constitutionality and, in turn, doubly protects (internally and internationally) human rights in the national system, with multilevel protection. This multilevel evolution provides greater effectiveness of human rights, serving as an appreciation of the democratic character of the State in international commitments.

In search of the optimization of such systems, the *pro homine principle in* the protection of rights is vindicated, so that the most favorable norm is the one adopted in case of any conflict of norms in the domestic and international system. This principle is already

enshrined in the Brazilian constitutional text, in Article 4, II, according to which the Brazilian State must be governed in its international relations by the principle of *the prevalence of human rights*.

Due to the evolution of doctrine and jurisprudence based on the *pro-homine principle*, mentioned above, in addition to the provisions of the Pact of San José de Costa Rica and the United Nations Convention on the Law of Treaties, as well as the jurisprudence of the Inter-American Court, new interpreters emerge in the implementation of fundamental rights.

Mazzuoli (2021, p. 777) teaches that the opening clause of the aforementioned paragraph 2, of article 5, of the FC/88, has always admitted the entry of international treaties for the protection of human rights at the same hierarchical level and not in another scope of normative hierarchy. Therefore, he argues that the fact that these rights are found in international treaties has never prevented their characterization as rights of *constitutional status*.

Commenting on paragraph 2 of article 5, Piovesan (2015, p. 52) points out that this implies that the international rights and guarantees contained in the human rights treaties ratified by Brazil are included in our domestic legal system, as if they were written in the Constitution.

Mazzuoli (2021, p. 776) concludes, adopting a syllogism for the understanding of this paragraph 2, if the rights and guarantees expressed in the FC do not exclude others arising from international treaties to which Brazil is a party, it means that to the extent that such instruments ensure other rights and guarantees, the FC, in turn, includes them in the list of protected rights.

However, this theme was not unanimous in the doctrine, given the understandings of the supra-constitutional status of the treaties dealing with human rights (Mello. 2001, p. 25), and the Supreme Court of Brazil never reached a uniform position, despite the clarity of this paragraph 2, of article 5, Constitutional.

Thus, Constitutional Amendment No. 45/2004 added paragraph 3 to article 5, to state that *international treaties on human rights that are approved in each House of the National Congress, in two rounds, by three-fifths of the votes of the respective members, will be equivalent to constitutional amendments*.

By this provision, international treaties and conventions on human rights, as long as they are subject to the aforementioned special conditions of approval for internalization in national law, will undoubtedly acquire the hierarchical status of constitutional amendments.

The wording of this article, according to Valério de Oliveira Mazzuoli (2021, p. 778), is materially similar to that of article 60, paragraph 2 of the FC, whose similarity is linked to the fact that, before the entry into force of EC 45/2004, international human rights treaties, in order to be ratified later, were exclusively approved (by means of a Legislative Decree) by a simple majority in Congress, under the terms of Article 49, I, of the Federal Constitution, which generated jurisprudential controversies about the apparent infra-constitutional hierarchy (level of ordinary norms) of these international instruments in our domestic law.

CONCERNS ABOUT THE CONTENT OF PARAGRAPH 3, ARTICLE 5, OF CF/88

Despite the fact that paragraph 3 of article 5 of the Constitution provides that international treaties and conventions on human rights approved by a qualified majority are equivalent to constitutional amendments, concerns have arisen on the subject.

For example, what status would they have in those international treaties prior to EC 45/2004? Valerio de Oliveira Mazzuoli (2021, p.781) asks, and could it also be interpreted as meaning that, despite a human rights treaty having been ratified several years ago, can the National Congress approve it again, however, now, by the quorum of paragraph 3, for there to be a change of *status*? What *status* would it be? Ordinary law (according to the old jurisprudence) or supra-legal law (as of December 3, 2008, in view of the judgment of RE 466.343-1/SP) to hold the *status* of a constitutional norm?

Mazzuoli (2021, p. 781) certifies that even though the STF has started to attribute to human rights treaties (when not approved by the special quorum of paragraph 3, article 5, of the FC) the level of supra-legal norm, the doctrine has correctly understood that such treaties have the *status* of constitutional norm. This would ensure the internal effectiveness of international human rights protection standards.

In this regard, José Roberto Anselmo (2023, p. 126) asserts that,

> however, in relation to treaties that were already in force on the date of the enactment of the Amendment and that were not subject to differentiated approval, the understanding of equivalence to ordinary laws still prevailed. This position lasted until the judgment of RE 466.343/SP, where the civil imprisonment of the unfaithful trustee was discussed (art. 5, LXVII) in comparison with the prohibition of civil imprisonment established in the American Convention on Human Rights – Pact of San José de Costa Rica (art. 7, 7), the Supreme Court changed its understanding. The interpretation of the Federal Supreme Court in the aforementioned judgment is that these treaties have supra-legal hierarchy, and should prevail in relation to infra-constitutional norms. Thus, human rights treaties prior to Amendment 45/04 have a special character, being below the Constitution, but above domestic legislation.

The judgment of this RE 466.343-1/SP, by the STF, involving the aforementioned issue of the civil imprisonment of the unfaithful trustee in the emblematic vote of Justice Gilmar Mendes who, taking up the view of Justice Sepúlveda Belongs on the occasion of the judgment of Habeas Corpus n. 79.785/RJ, highlighted that the constitutional reform demonstrated a clear special character of human rights treaties and conventions in relation to the others, and that such a change pointed to the insufficiency of the thesis of hierarchical parity to the ordinary laws whose Court had upheld since the judgment of RE 80.004/SE, in 1977. Defending the need for an urgent review of the position to provide better protective effectiveness of these human rights, it was concluded, in the end, that there is an intermediate thesis of infra-constitutionality, but with supra-legal status of these international instruments.

On the occasion, the exquisite vote of Justice Celso de Mello should be highlighted, reviewing his own position issued on March 12, 2008, in the judgment of Habeas Corpus No. 87.585-8. This time, deciding in the light of the principle of maximum constitutional effectiveness, based on the axiological premises of the Constitution, emphasizing the ethical-legal value of the prevalence of human rights, based on the influence and effectiveness of treaties and conventions on the matter under consideration, as well as on the reflections brought about by the reform that introduced paragraph 3 to article 5 of the Federal Charter of 1988, and with the exception of the previous hypotheses, it defended the need to attribute to them, formally and materially, *the status* of constitutional norms. Finally, it noted that with regard to the treaties and conventions prior to the advent of paragraph 3, the provisions of paragraph 2, both of article 5, of the Federal Constitution, should be applied to them to give them a materially constitutional nature, thus providing their subsumption to the block of constitutionality.

On December 3, 2008, the Supreme Court unanimously dismissed Appeal 466.343, giving precedence to the *libertatis status* of the individual over the equally constitutional right to property, emphasizing respect for human rights. It also converged with regard to the hierarchical specialty of international treaties and conventions that deal with human rights, remaining divided, however, in relation to the level of this hierarchy: between constitutionality and supra-legality. In this last question, in a close vote, the (mistaken) understanding of the thesis of supra-legality (and infra-constitutionality) finally prevailed, with Justices Celso de Mello, Cesar Peluso, Ellen Gracie and Eros Grau being defeated, who in turn followed the thesis of constitutionality.

Despite the interpretative evolution of the Supreme Court, there is no way to forget the thesis of the substantive constitutionality of international treaties and conventions in the

field of human rights, as defended by the internationalists and the minority of the Justices of the STF. After all, the matter of human rights coincides exactly with the fundamental rights established in our Federal Constitution, which are even insusceptible to any measures aimed at abolition (article 60, paragraph 4, of the FC).

In any case, the STF definitively broke with the paradigm of the thesis of parity between international treaties and conventions and ordinary infra-constitutional legislation, which had remained alive for more than three decades, providing a catalytic effect so that the other organs of the Judiciary could also promote the essential control of conventionality, as directed by the IACHR, in its OC 22, of 2/26/2016, requested by the Republic of Panama.

Thus, currently, the colenda Court remains faithful to the understanding it adopted from the judgment of RE 466.343, whose jurisprudence denotes a consolidation of the special character of international human rights treaties and their supra-legality if not submitted to the special procedure equivalent to that of constitutional amendments, as provided for in paragraph 3, article 5, of the FC/88.

Notwithstanding the divergences, the text of paragraph 3 of article 5 of the CF/88 came with the intention of clarifying the position in which international treaties and conventions specifically in the field of human rights occupy the pyramid of norms in the Brazilian legal system. This is a special quorum for voting on international human rights treaties and conventions.

Valerio de Oliveira Mazzuoli (2021, p. 784) also clarifies that the Constitution does not say that an amendment will be approved, but an act (in this case, a legislative decree) that will allow the treaty to have (after ratified) equivalence of a constitutional amendment. Even with EC 45/2004, the treaty will follow the normal procedural course, that is, it must be approved by Congress by legislative decree, and Parliament may decide with the quorum (and only the quorum) of a constitutional amendment or without it. Therefore, the National Congress does not use the process of proposing constitutional amendments, but only has to issue a legislative decree by qualified majority.

OBLIGATED TO CASES INVOLVING HUMAN RIGHTS IN THE COURTS

It is important to highlight that regardless of the *constitutional status* of human rights treaties in Brazilian law, their application is immediate due to the fact that the norms related to fundamental rights and guarantees have immediate application in accordance with the provisions of paragraph 1 of article 5, which reads as follows: *the norms defining fundamental rights and guarantees have immediate application*, which does not depend on

the form of approval, whether by qualified majority or not. Thus, treaties of this nature must be applied immediately by the Judiciary.

A relevant issue that needs to be brought to light was that, in addition to EC 45/2004 adding paragraph 3 to article 5 of the CF/88, it also changed the wording of article 109 of the Federal Constitution of 1988, adding item V-A and paragraph 5, so that the Federal Court could raise before the Supreme Court, the invocation of any cause, regardless of whether an investigation or a lawsuit, related to human rights.

The purpose of changing this prerogative of original action is to safeguard compliance with international treaties and conventions whose subject matter affects human rights, with the Brazilian State as a signatory. Let's see:

> Article 109. Federal judges are responsible for prosecuting and judging:
> V-A the cases related to human rights referred to in paragraph 5 of this article;
> Paragraph 5 - In the event of a serious violation of human rights, the Attorney General of the Republic, in order to ensure compliance with obligations arising from international human rights treaties to which Brazil is a party, may raise, before the Superior Court of Justice, at any stage of the investigation or proceeding, an incident of transfer of jurisdiction to the Federal Courts.

It is observed that there was a shift of competences from the State Courts to the Federal Courts, with a view to effectively complying with the provisions of international treaties and conventions on human rights.

The study of EC 45/2004 ensured in its content innovations and expansion of the protection of human rights. However, it could be in line with other constitutions around the world, in the sense that all human rights treaties ratified by Brazil had constitutional hierarchy and, therefore, immediate applicability. This understanding would void any doubt in the jurisprudential or doctrinal context that might eventually arise.

THE CONVENTIONALITY CONTROL

Arising from contentious jurisdiction is the control of conventionality, which corresponds to a normative control carried out by the Inter-American Court of Human Rights when the cause of the violation of a human right is a provision of domestic law, by virtue of which there is a confrontation between the American Convention on Human Rights and a provision of domestic law. such as the Political Charter, a legislative act, a law, a decree, a sentence or an administrative act, among others.

The Control of Conventionality defines the obligation of every public authority not to apply a domestic rule if it is contrary to the American Convention on Human Rights or to the interpretation made by the Inter-American Court of Human Rights.

According to Constança Nuñez Donald (2015, p. 159),

> This – which is the current conceptualization of conventionality control – has its origin in the jurisprudence of the Inter-American Court. At the current stage of the evolution of the concept in the jurisprudence of the Inter-American Court, it has four constituent elements: a) it consists of verifying the compatibility of the norms and other practices with the ACHR, the jurisprudence of the Inter-American Court of Human Rights, and the other inter-American treaties to which the State is a party; b) it is an obligation that corresponds to every public authority within the scope of its competences; c) it is a control that must be carried out *ex officio* by any public authority, and d) its execution may imply the suppression of norms contrary to the DAC or their interpretation in accordance with the ACHR, depending on the powers of each public authority.

The control of conventionality is not opposed in cases where the rule is incompatible with the Political Charter, which means, in this case, unconstitutionality. Unconventionality, in turn, is when the law, although valid in comparison with the constitutional text, suffers from the vice of invalidity because it is incompatible with the international instruments to which the country is a signatory, dealing with the protection of human rights.

In the context of conventionality control, internal rules must be in accordance with international treaties and conventions, otherwise they will reach unconventionality.

The prevailing understanding is that the validity and effectiveness of ordinary rules must be subject to double checking, as to control. In other words, both in the control of constitutionality to verify its harmony with the Constitution of the States, and in the control of conventionality, in order to conform its adequacy with international human rights treaties and conventions, a double filtering of the domestic norm is carried out, in order to confer the best protection of human rights to the jurisdictional.

Of paramount importance is this internal control of the norms – laws, regulations, etc., which must be in harmony with the conventional provisions and from the elaboration of the norm, under penalty of its incompatibility implying unconstitutionality or unconventionality and consequent distancing from the legal world.

The control of conventionality within the scope of the Inter-American Court of Human Rights has evolved:

In the case of Almonacid Arellano et al. v. Chile, the Inter-American Court refers to the "Judiciary"; in the case of the Dismissed Workers of Congress v. Peru, the Inter-American Court of Human Rights is positioned by the "organs of the Judiciary"; in the case of Cabrera Garcia and Montiel Flores v. Mexico, the Inter-American Court deliberates on the "Judges and bodies linked to the administration of justice at all levels"; in the case of Gelman v. Uruguay, the Inter-American Court of Human Rights took the position that the control of conventionality would be the responsibility of 'any public authority', at all levels, *ex officio*, within the scope of their respective competences and the applicable procedural rules. With this decision, there was a significant expansion of the range of scope of those

required to control conventionality. There was the addition of new actors in the panorama of conventional control.

Hence, it is also allowed the extension of control and the measurement of conventionality and the defense of the filing of constitutional actions by the Attorney General of the Republic (PGR) to invalidate a rule that violates the Convention that deals with human rights.

INNOVATIONS INTRODUCED IN THE THEME OF THE PROTECTION AND PROMOTION OF HUMAN RIGHTS IN THE DOMESTIC SYSTEM: REPERCUSSIONS AND PERMISSION OF NEW ACTORS

It can be seen from what is provided in paragraph 3 of article 5 of the CF/88 that it is not a determining constitutional norm, but a mere faculty made available to the National Congress to, if it so wishes, approve international treaties and conventions through a special procedure to confer them formally *constitutional status*.

Thus, in harmony with the current constitutional text and in line with the special quorum, some treaties have already been approved in the Brazilian State with the equivalence of constitutional amendment, as stated on the official website of the Planalto:

Acts	Syllabus
Decree No. 10,932, of 01.10.2022 Published in the Official Gazette of 01.11.2022	Promulgates the Inter-American Convention against Racism, Racial Discrimination and Related Forms of Intolerance, signed by the Federative Republic of Brazil, in Guatemala, on June 5, 2013.
Legislative Decree No. 01 of 18.02.2021 Published in the Official Gazette of 02.19.2021	Approves the text of the Inter-American Convention against Racism, Racial Discrimination, and Related Forms of Intolerance, adopted in Guatemala at the 43rd Regular Session of the General Assembly of the Organization of American States, on June 5, 2013.
Decree No. 9,522, of 10.08.2018 Published in the Official Gazette of 10.09.2018	Promulgates the Marrakech Treaty to Facilitate Access to Published Works for Persons Who Are Blind, Visually Impaired, or Otherwise Print-Impaired, signed in Marrakech on June 27, 2013.
Legislative Decree No. 261 of 25.11.2015 Published in the Official Gazette of 11.26.2015	Approves the text of the Marrakesh Treaty to Facilitate Access to Published Works for Persons Who Are Blind, Visually Impaired or Otherwise Print-Impaired, concluded within the framework of the World Intellectual Property Organization (WIPO), signed in Marrakech on June 28, 2013.
Decree No. 6,949, dated 08.25.2009 Published in the Official Gazette of 08.25.2009	Promulgates the International Convention on the Rights of Persons with Disabilities and its Optional Protocol, signed in New York, on March 30, 2007.
Legislative Decree No. 186 of 09.07.2008 Published in the Official Gazette of 07.10.2008	Approves the text of the Convention on the Rights of Persons with Disabilities and its Optional Protocol, signed in New York on March 30, 2007.

Source: *Official website* of the Planalto da República.

The aforementioned treaties were approved with a qualified quorum, however, the Supreme Court of Brazil did not express itself on the hierarchy. As it turned out, it manifested for supra-legality, equivalent to the block of constitutionality.

As exposed, paragraph 3 of article 5 does not oblige the Legislature to approve a human rights treaty by the qualified quorum it establishes. What it does is only authorize the National Congress to give, when it suits it, at its discretion the "equivalence of amendment" to the human rights treaties ratified by Brazil. This means that such international instruments may continue to be approved by a simple majority of the National Congress (article 49, I, of the Federal Constitution), leaving for a future moment the attribution of equivalence to a constitutional amendment.

To say that a treaty is equivalent to a constitutional amendment is to say that it formally and materially integrates the block of constitutionality. From a systematic interpretation, the reformed constitutional text intended to say that these human rights treaties ratified by Brazil, which already have *the status* of constitutional norm, under the terms of paragraph 2 of article 5, may be formally constitutional (that is, be equivalent to constitutional amendments), provided that, at any time, after their entry into force, are approved by the quorum of paragraph 3 of article 5 of the FC. (Mazzuoli. 2021, p. 786 and 790). However, these cannot be reported.

From this conclusion, it can be observed that international human rights treaties have been passed in two moments, the first being under the dictates of paragraph 2 of article 5 and a second moment under the auspices of paragraph 3, article 5 of the FC.

And in a better explanation, it is clear that the human rights treaties in force in the country, regardless of having been ratified before or after EC 45/2004, have *the status* of (materially) constitutional norm (subject to the diffuse control of conventionality), but only those approved by the qualified quorum of article 5, paragraph 3, will have *the status* of material and formally constitutional (they will be subject to concentrated control or abstract control of conventionality). This has important implications regarding the subject of denunciation.

Nothing would technically prevent the denunciation of a human rights treaty that has only the *status* of a constitutional norm, because internally it would not modify anything, since they are already petrified in our system of rights and guarantees, importing such denunciation only in freeing the Brazilian State from being responsible for the fulfillment of the treaty in the international sphere. But if the human rights treaty has been approved under the terms of paragraph 3 of article 5, Brazil can no longer disengage from the treaty, either internationally or internally (which does not occur when the treaty has only *the status*

of a constitutional norm), and the President of the Republic may be held responsible if he denounces it (and such denunciation must be declared ineffective). Concluding the reasoning, Valerio de Oliveira Mazzuoli (2021, p. 798 and 800) states that either under the terms of paragraph 2 or paragraph 3 of article 5, human rights treaties are not susceptible to denunciation because they are stony constitutional clauses; what differs is that, once the treaty is approved by the quorum of paragraph 3, its denunciation entails the responsibility of the President of the Republic, which does not occur in the system of paragraph 2 of article 5.

VERIFICATION BY MEASUREMENT BY THE PUBLIC PROSECUTOR'S OFFICE OF BRAZIL

The jurisprudence of the Inter-American Court of Human Rights says that other actors must enforce the rights provided for in the treaties, and the doctrinal advances point to the legitimacy for the measurement and control of conventionality by the MP.

This is justified by the difficulties encountered within the scope of the IAHRS, such as the delay in the trials of cases in the Inter-American Court, as well as the large number of cases that are not accepted by it.

There are possibilities for growth in the exercise of checking in internal control, with the presence of the Public Prosecutor's Office and the Ombudsman's Office, including the Inter-American Court of Human Rights.

The judgments of the Inter-American Court of Human Rights are always the *initial legislative steps, taken by a few States Parties to the Convention, in order to ensure their faithful compliance at the level of domestic law* (CANÇADO TRINDADE. 1998, p. 29), that is, the protection of fundamental rights is being expanded.

For Lazcano (2013, p. 79) this expansion is supported by the Court of the Americas and inter-American law becomes a direct formal source of national law and, in turn, all those cited must follow conventional law.

The assessment takes place without invalidation within the verification work, similar to the work done internationally in the OCs of the Inter-American Court of Human Rights and by the IACHR, without removing its legal effects, while, in the control, the norm will be invalidated

The basis of the ministerial activity comes from the judgment of Gelman v. Uruguay, which refers to the violations of the fundamental rights of Maria Claudia García Iruretagoyena Gelman as a result of her forced disappearance in 1976 and the suppression of the identity of her daughter María Macarena Gelman Garcia Iruretagoyena, within the

framework of *Operation Condor.* Maria was kidnapped and raised as the daughter of one of her mother's executioners, who died in the hospital.

The sentence brings the legal figure of *the custus juris,* which has to manifest itself in the actions, giving an opinion, that is, it can assess the conventionality. Thus, the sentence brings the duty of the Public Prosecutor's Office (MP) to carry out this function of measurement, one of the types of checking.

Article 127 of the CF/88 states: *The Public Prosecutor's Office is a permanent institution, essential to the jurisdictional function of the State, and is responsible for defending the legal order, the democratic regime and the inalienable social and individual interests* and, provoked within its typical functions in the defense of the legal order, it assesses the norm under discussion in the specific case if it is in harmony with treaties and jurisprudence of the Inter-American Court.

The Public Civil Action Law No. 7.347, of 1985 (LACP), is based on liability for damages caused to the environment, to the consumer, to goods and rights of artistic, aesthetic, historical, touristic and landscape value.

And the defense of transindividual rights, with legitimacy for the ministerial body to promote Public Civil Action, and the thesis for the defense of these assets may be a human rights treaty, which includes the measurement.

It should be noted that the main action and the injunction may be filed by the MP, the Union, the States and Municipalities, as well as they may also be filed by an autarchy, public company, foundation, mixed capital company or association.

The *Parquet* also defends the democratic regime and if it is not a proponent, in defense of the legal order, it must act as an intervening party in the process, including being able to request the production of evidence. Within the due process, he will have a view of the records, after the parties, and at this time the MP must check the compatibility with treaties ratified by Brazil. Therefore, prosecutors and prosecutors must assess whether the law is in accordance with treaties and jurisprudence and even Advisory Opinions.

This doctrinal construction is also present in Mexico. Lazcano (2014, p.77) cites a Mexican contribution from *La SCJN* of 07/14/2011, of the so-called *Expediente varios 912/2010*, which brings the ex *officio* control of conventionality as a model of diffuse control according to the Constitution of Mexico, by which all the country's authorities, within the scope of competences, are obliged to ensure the human rights that are in international instruments, adopting the most favorable interpretation of the law, by the *pro persona* principle, given the superiority of human rights norms and the reflex protection of fundamental rights.

PUBLIC PROSECUTOR'S OFFICE: POPULAR ACTION AND IN SIMILAR SITUATIONS

The popular action is defined as the procedural means to which any citizen who wishes to judicially question the validity of acts that he considers harmful to public property, administrative morality, the environment and historical and cultural heritage is entitled, and the MP will carry out the measurement of conventionality, through the phenomenon of checking, protecting human/fundamental rights.

The action consists of expressing whether or not there is compatibility of domestic law with treaties, such as cases involving native peoples (quilombolas and indigenous peoples), under the terms of article 232 of the CF/88, in the case of the Federal Public Prosecutor's Office (MPF).

The constitutionally protected fundamental right is that of the Indians, their communities and organizations, and it is up to the MPF, consequently, to comply with the jurisprudence of the Inter-American Court of Human Rights regarding collective territory and ancestral lands. In case of injury, the concentrated control of constitutionality (abstract control of the rule, whose treaties were approved by four votes of 3/5 and are equivalent to amendments) and, by extension, the conventionality, will be proposed in the Supreme Court of the Brazilian State, as it corresponds to a functional duty of the Attorney General of the Republic (PGR).

The PGR acts by expressing on the possible injury, or not, of a domestic law in relation to these treaties, carrying out the verification by measurement, however, it will not be the author of the concentrated control actions.

ROLE OF THE PUBLIC PROSECUTOR'S OFFICE AND ATTORNEYS GENERAL

The legitimacy of the ministerial body to carry out the control of conventionality arises in the Gelman v. Uruguay, already mentioned, with the expansion of the list of legitimates, whose performance ranges from the filing of lawsuits to the archiving of Civil Inquiry; in addition to those activities that are discriminated in rules by the exclusive action of the PGR and the State Attorney General (PGE). Therefore, this position has the predictable duty to file a lawsuit both domestically and internationally.

It is understood that ministerial participation in the invalidation of a domestic norm that violates human rights treaties is possible because, above all, Brazil has ratified the ACHR and has the duty to comply with the jurisprudence derived from the Inter-American Court, including the hypotheses of investigative procedures in the Civil Inquiry and in the Public Civil Action, when defending or protecting individual interests and in criminal prosecution.

Heemann (2018, p.8) says that it is important for any and all public authorities to exercise control of conventionality, as it ends up maximizing the principle of maximum effectiveness of human rights, after all, the greater the number of those legitimized to exercise control, the greater the international protection of rights.

And the performance of the *Parquet*, incident of unconventionality of an internal normative act, will be supported by the decisions rendered by the Inter-American Court of Human Rights, where a rule will be valid in the Brazilian legal system if it passes through the sieve of the control of constitutionality and conventionality (RAMOS, 2016, p. 60).

The initial hypotheses are those of the Civil Inquiry, although Valério de Oliveira Mazzuoli (2009, p. 267) assures that there is also conventional control in the filing of the Public Civil Action, but it is necessary to analyze whether there is even an effective control of ministerial conventionality.

There is control when the Public Prosecutor's Office requests the archiving alleging contravention of a treaty within its institutional functions in the defense of the legal order (Article 129 of the FC, III): *to promote the civil inquiry and the public civil action, for the protection of public and social property, the environment and other diffuse and collective interests*, protecting the said individual meta assets.

The protection of diffuse and collective assets implies the protection of the environment and public property, via Public Civil Action that proposed, must demonstrate the violation of an international treaty by an internal rule. The petition does not imply the withdrawal of the internal rule, being an assessment, since the Judiciary will invalidate it by sentence. It is a fundamental provocation that points to control, but which does not constitute an effective invalidation of a norm, although it defines the molds. There is an investigation, with ministerial action in the protection of human rights.

When the Public Prosecutor's Office adjusts a Term of Conduct with a view to preserving human rights protected in International Treaties, there is a control of conventionality, ending with the obligations collated in the Instrument.

The conventional control by *the Parquet* in criminal prosecution will occur when the Police Inquiry (IP) or criminal investigation procedure (PIC) is archived, when it does not promote the Public Criminal Action and the Public Prosecutor's Office alleges as a motivation a treaty to which Brazil is a party. In the IP and PIC, there is no referral to the Judiciary, since it is only communicated to the investigated, victim or police authority, which corresponds to the effectiveness of control within the ministerial body itself.

The Criminal Action constitutes a control, as it is not limited to the proposal, but to all the measures of ministerial action with the purpose of its regular processing, for example, in

the protection of the rights of the victims, whose function is to ensure human/fundamental rights. Thus, the Attorney General of the Republic may propose constitutional actions with the purpose of invalidating an internal rule that violates conventional law.

CONCLUSION

Complaints of human rights violations are sometimes impacted by the delay in the process and the high number of lawsuits, added to structural precariousness, in addition to the fact that the State is sometimes responsible for the facts. Justice is slow, not effective for access and sentences are subject to mistakes. Hence, the citizen can exercise his right by resorting to an International Court, if the case involves an injury to human rights and, through Conventional Law, rights are protected in the legal systems of States. Therefore, internal control and measurement are pointed out as important possibilities to ensure rights and the performance of the Parquet in the filing of constitutional actions in cases of treaties approved with a qualified quorum by the PGR. The ministerial action in the check when proposing the Criminal, Popular and Public Civil actions and, when they are intervening, there will be no departure from the rule.

This ministerial action has as its aspect a human rights treaty, as in the case of archiving the IC and a Criminal Procedure, which will result in conventional control, without forgetting to mention, also, the elaboration of Conduct Adjustment based on a Convention. With a view to the protection of human and fundamental rights, it is noted the possibility that the PGR, the only one constitutionally legitimate, may propose actions with the purpose of informing norms that diverge from the conventional context, within the scope of Brazilian law.

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MOLECULAR MODELING AND IN SILICO HUMAN AND ENVIRONMENTAL TOXICOLOGICAL STUDY FOR THE ANTIBIOTICS TRIMETHOPRIM AND SULFADOXINE

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ABSTRACT

Sulfadoxine in combination with trimethoprim are commonly used for broad-spectrum antimicrobial therapy in veterinary medicine. Although widespread resistance limits use in ruminants, the combination is still useful in the treatment of gastrointestinal and respiratory infections in calves, including neonatal colibacillosis. The pharmacokinetic profile of sulfadoxine and trimethoprim differs from each other due to their chemical properties: sulfadoxine acts as a weak acid while trimethoprim is a weak base, thus concentrating at different sites in the body. Sulfadoxine and trimethoprim are two antimicrobial agents that are often used in combination due to their different mechanisms of action, acting synergistically against bacterial infections. The package inserts, both from national and international companies, state that the pharmaceutical product containing the two antibiotics has as its target the treatment of respiratory and gastrointestinal diseases in cattle and horses. One of the major challenges is related to the fact that antibiotics produced by the pharmaceutical industry result in antibiotic residues in the environment, both in water bodies and in the soil. These residues contaminate the food chain, affecting fish, crustaceans and even organisms such as Tetrahymena pyriformis, a protozoan widely distributed in freshwater environments. This contamination mechanism is very worrying because it not only compromises the health of ecosystems, but will also affect the humans who consume the contaminated food. The in silico toxicological study revealed that the compounds did not present toxicity in the AMES test, did not present carcinogenicity and did not have Acute Oral Toxicity.

Keywords: Antibiotic. Sulfadoxine. Trimethoprim. Environmental Contamination. Human *and Environmental* in silico toxicology.

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INTRODUCTION

Antibiotics are drugs that can be natural or synthetic, and are responsible for inhibiting the growth of bacteria, or causing their death. Thus, they are called bactericidal when they cause the death of the bacterium, or bacteriostatic when they inhibit microbial growth (Guimarães, Momesso & Pupo, 2010). It is known that animal production in Brazil has gradually increased in recent years, consequently the use of antibiotics has also grown.

In Brazil, animal production is one of the most expressive activities. To ensure productivity and maintain the competitiveness of the sector, it is common to use drugs for both treatment and disease prevention. Among the most commonly used drugs, antibiotics are one of the most frequently prescribed classes (Regitano and Leal, 2010). Since humans consume products of animal origin, humans are exposed to the antibiotic residues contained in these foods, so regulatory and research agencies have been paying special attention to this study (Capleton *et al*, 2006). Thus, the subject deserves to be highlighted in the present study, as it will evaluate the pharmacokinetic and toxicological impacts of the antibiotics Sulfadoxine and Trimethoprim on humans and the environment.

Most antibiotics given to animals are not completely metabolized, being excreted in urine and feces, both in the original form and partially metabolized. The application of manure and sewage sludge as fertilizers is one of the main ways to spread these compounds into the environment. In the environment, antibiotic residues can accumulate in the soil, leach or be transported to water bodies by surface runoff. Some waste can be absorbed by plants, accumulating in their tissues and posing a risk to human health through the consumption of contaminated plant foods (Regitano & Leal, 2010). Sulfonamides have a low sorption potential at soil organic and mineral exchange sites, which facilitates their transport to watercourses (Sarmah et al., 2006).

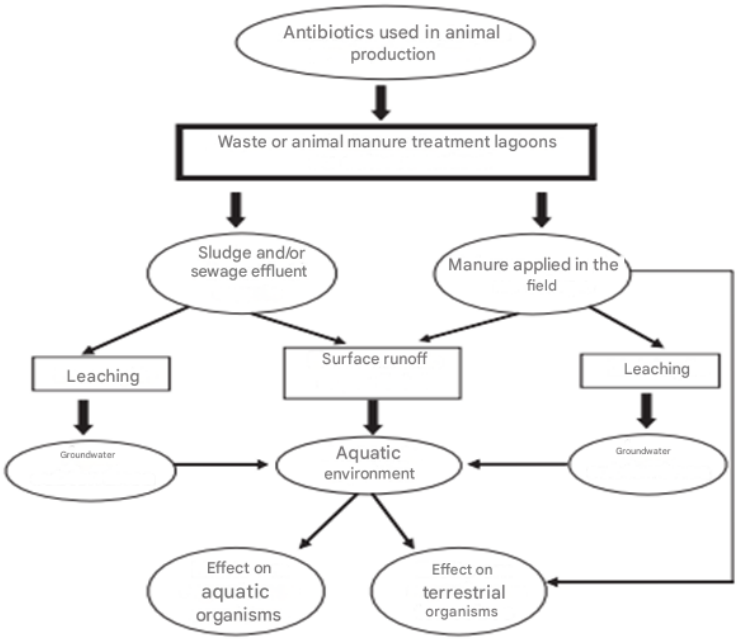
Sulfadoxine is a type of sulfa characterized by its rapid absorption by the body, followed by a very slow excretion. Due to these pharmacokinetic properties, it provides a prolonged action, which makes it effective in treatments that require a sustained release of the drug in the body. Trimethoprim, a diaminopyrimidine, is structurally similar to dihydrofolic acid and works by blocking the enzyme dihydrofolate reductase, which is responsible for converting dihydrofolic acid to tetrahydrofolic acid. Although this enzyme is present in mammals and bacteria, trimethoprim has an affinity 20 to 60 thousand times greater for the bacterial enzyme than for that of mammals. This makes trimethoprim a very safe chemotherapy drug (Spinosa, 2006).

Although trimethoprim can be used alone, its combination with sulfa offers significant advantages, as it broadens the spectrum of action, being effective against Gram-positive

and Gram-negative bacteria. In addition, this combination reduces the incidence of bacterial resistance. Unlike the isolated use of each of these chemotherapy drugs, the association of sulfa and trimethoprim has a bactericidal effect (Cordeiro et al., 2008).

Figure 1 shows the main forms of environmental exposure to drugs used in veterinary medicine.

Figure 1: Main forms of environmental exposure to drugs used in veterinary medicine.



Source: Regitano & Leal, 2010.

When this waste is in the soil, processes such as leaching, surface runoff, and erosion can transport it to water bodies. In addition, it is common to find small amounts of antibiotics, both for human and animal use, in samples of sludge or effluents from urban sewage treatment plants. The disposal of these effluents in water bodies or the use of sludge and effluents as organic fertilizers are significant sources of environmental contamination by a variety of drugs (Regitano & Leal, 2010). Once the soil and animals are contaminated, humans can be exposed to the waste through the consumption of meat and products derived from these animals, resulting in human contamination.

LITERATURE REVIEW

This chapter addresses the theoretical definitions essential to understand the work in question. In addition, the factors that motivated this proposal will be highlighted, especially in the context of technological innovation. The literature review concludes with statistical data provided by regulatory agencies, such as MAPA and ANVISA, emphasizing the

relevance of the sectors involved in our country and the rational use of the antibiotics Trimethoprim and Sulfadoxine.

REGULATORY AGENCIES AND MEAT CONSUMPTION IN BRAZIL

As the two active ingredients act both in antibiotics for veterinary use, in the treatment of respiratory and gastrointestinal diseases, and in antibiotics for human use for the treatment of malaria, it is necessary to mention both regulatory bodies.

The Ministry of Agriculture, Livestock and Supply (MAPA) is the government agency responsible for regulating and inspecting various sectors of agriculture in Brazil, including the control of veterinary drugs. One of MAPA's attributions is to ensure the quality, safety and efficacy of veterinary products marketed in the country, in order to protect animal health and, indirectly, public health. To this end, MAPA conducts inspections, grants registrations for veterinary products, and monitors the production chain, from manufacturing to commercialization (BRASIL, 2024).

The National Health Surveillance Agency (ANVISA), on the other hand, is the regulatory body responsible for inspecting and regulating products intended for human use, including medicines, food, cosmetics, and health products (Brasil, 2024).

According to Conab, in 2023, the production of the three main types of meat in Brazil is estimated at approximately 29.6 million tons, as indicated in the updated product supply table, including poultry, cattle and pork. These data show a significant increase when compared to previous years. As we are dealing with drugs for veterinary use, this brings some concern, because increasing meat production, consequently increasing the use of antibiotics for the treatment of animal diseases.

When it comes to drug misuse, the inappropriate use of antibiotics and other drugs in the production of meat and milk can result in the presence of residues of these products in food consumed by humans. In addition, the improper disposal of medicines and excessive use in agricultural practices can also lead to soil contamination and, consequently, the water table, affecting water quality.

The contamination of water bodies due to improper disposal of pharmaceuticals can also negatively impact aquatic ecosystems and fauna. Finally, environmental and food contamination can affect the entire food chain, including humans, who can also be contaminated by ingesting contaminated food or water.

GASTROINTESTINAL AND RESPIRATORY DISEASES

Digestive system disorders in horses and cattle are a major concern for producers and veterinarians due to their significant economic impact and the complexity involved in controlling, treating, and preventing these conditions. The incidence of these diseases has increased with the intensification of production, as many foods have been incorporated into the animals' diets with the aim of increasing production rates, often without taking into account the welfare of the animals, nor their metabolism and physiology (Brandolt, 2016).

In the case of the respiratory tract of horses, it presents peculiar characteristics in relation to other species of domestic animals, being adapted to meet metabolic needs whose spectrum of variation ranges from low levels of basal requirements in relation to body volume, to high demands for gas exchange during intense long-term efforts. Some of these characteristics, combined with environmental conditions and individual predispositions, facilitate the installation of infectious processes (Brandolt, 2016).

The complex of respiratory diseases in cattle, on the other hand, results from an imbalance between the animal's natural defenses and the external factors that promote the disease. This imbalance is more common in animals that cannot adapt to changes in the environment or overcome these modifications. Stress affects the cleaning and defense mechanisms of the respiratory system, facilitating the proliferation of microorganisms and the production of toxins (Laval; Carraud; Filleton, 1994).

Gastrointestinal diseases affect cattle and horses with great frequency and have a direct impact on the economy, demonstrating the need to modernize veterinary medicine with concepts of population medicine based on epidemiology that allows the establishment of preventive and disease control strategies.

SULFADOXINE

Sulfadoxine is a sulfonamide, which works by inhibiting the enzyme *dihydropteroate* synthetase. This enzyme is essential for the synthesis of folic acid in bacteria, which in turn is necessary for the production of nucleotides and, consequently, for the synthesis of bacterial DNA. By inhibiting *dihydropteroate* synthetase, sulfadoxine interferes with folic acid synthesis, leading to the interruption of bacterial growth and proliferation (Aucamp, 2016).

New antimicrobials, such as sulfadoxine, are available in the Brazilian market and are widely used in the treatment of bacterial infections, especially in combination with other drugs, such as trimethoprim. Sulfadoxine is a long-acting sulfonamide, acting as a competitive inhibitor of *dihydropteroate* synthase, essential in the synthesis of bacterial folic

acid. Its use is prevalent in veterinary medicine, although it also has applications in some human infections, such as malaria, in combination with other medications. Sulfonamides are categorized based on their chemical structure and mechanisms of action, with sulfadoxine being one of the best known for its efficacy and long-term use (Aucamp, 2016).

As for pharmacokinetic and pharmacodynamic properties, sulfadoxine is often administered orally as part of a combination with other drugs, showing relatively slow but effective absorption in the gastrointestinal tract. Sulfonamides are rapidly absorbed in the gastrointestinal tract and reach peak concentrations within 4 to 6 hours. The drugs penetrate the blood-brain barrier and cross the placental barrier in varying concentrations according to the type of sulfa. They have good permeation in inflammatory exudates. They are metabolized mainly in the liver and excreted in the urine (Dereti, 2003).

TRIMETHOPRIM

Trimethoprim is a folic acid antagonist that works by inhibiting the enzyme *dihydrofolate* reductase, which is responsible for converting *dihydrofolate* to *tetrahydrofolate*, an active form of folic acid. By blocking this conversion, trimethoprim disrupts nucleotide synthesis and, consequently, bacterial DNA synthesis. Like sulfadoxine, trimethoprim interferes with the production of bacterial DNA, but acts at a different stage of the folic acid synthesis process (Kaartinent, 2000).

Trimethoprim is widely used in the treatment of bacterial infections, often in combination with sulfonamides such as sulfadoxine. Trimethoprim is an antibiotic that inhibits the enzyme dihydrofolate reductase, which is essential for the synthesis of folic acid in bacteria, and has a spectrum of action that makes it effective against a wide range of pathogens. Its use is common in both human and veterinary medicine, especially in the treatment of urinary, respiratory, and gastrointestinal tract infections (Kaartinent, 2000).

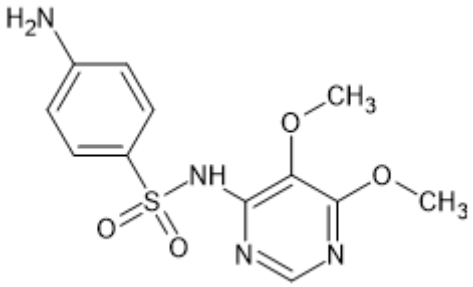
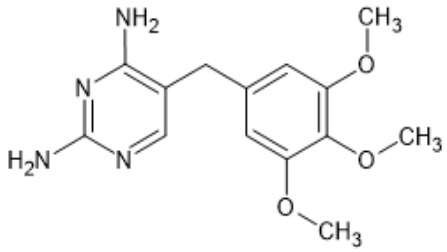
Regarding pharmacokinetic and pharmacodynamic properties, trimethoprim is usually administered orally, with good absorption in the gastrointestinal tract, which allows its rapid availability in the body. The distribution of trimethoprim in tissues is wide, reaching therapeutic concentrations in different organs, including the lungs, kidneys, and prostate. Trimethoprim can be administered both orally and parenterally, being completely absorbed in the gastrointestinal tract and distributed widely to all tissues of the body. It reaches high concentrations in the lungs and kidneys, and reaches high levels in the cerebrospinal fluid. Its excretion occurs mainly by the kidneys and, as it is a weak base, its elimination is intensified with the decrease in urinary pH (Rang, 2001).

SULFADOXINE-TRIMETHOPRIM COMBINATION

Sulfadoxine in combination with trimethoprim are commonly used for broad-spectrum antimicrobial therapy in veterinary medicine. Although widespread resistance limits use in ruminants, the combination is still useful in the treatment of gastrointestinal and respiratory infections in calves, including neonatal colibacillosis. The pharmacokinetic profile of sulfadoxine and trimethoprim differs from each other due to their chemical properties: sulfadoxine acts as a weak acid while trimethoprim is a weak base, thus concentrating at different sites in the body. (Kaartinen, 2000; Golan, 2009).

Sulfadoxine is a sulfonamide consisting of pyrimidine with methoxy substituents at positions 5 and 6 and a 4-aminobenzene sulfonamide group at position 4. Trimethoprim is an aminopyrimidine antibiotic whose structure consists of pyrimidine 2,4-diamine and 1,2,3-trimethoxybenzene linked by a methylene bridge. It functions as an EC 1.5.1.3 (dihydrofolate reductase) inhibitor, a xenobiotic, an environmental contaminant, a drug allergen, an antibacterial drug, and a diuretic. It is a member of methoxybenzenes and an aminopyrimidine. Figure 1 shows the two-dimensional (2D) chemical structure of Sulfadoxine and Trimethoprim.

Figure 2 - Two-dimensional (2D) chemical structure of the active ingredients.

Active ingredient	Two-dimensional (2D) drawing
Sulfadoxine	
Trimethoprim	

Source: ChemSketch® Freeware version 2021.

ENVIRONMENTAL IMPACTS OF ANTIBIOTIC CONTAMINATION

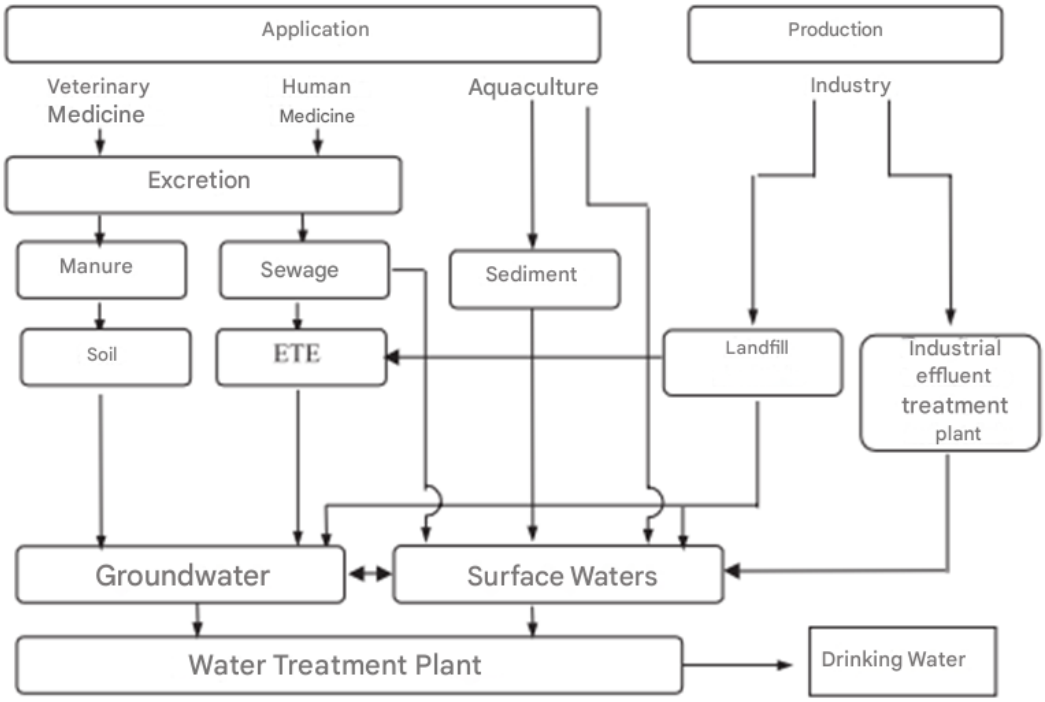
The disposal of expired drugs is a significant public health issue, as these drugs can be considered toxic waste based on their chemical composition. Due to their potential for environmental contamination, which varies according to the level of toxicity, they should not be treated in the same way as common waste (Tannus, 2017).

Studies have revealed the presence of medicines, cosmetics and personal hygiene products in surface and groundwater, as well as in drinking water and even in soils that receive the application of sewage sludge. These compounds, when present in soil and water, can cause contamination, which even in a sewage treatment network is not completely removed (Tannus, 2017).

The main forms of environmental contamination by drugs occur through their intentional use, when they are eliminated by the body after oral consumption, injection or infusion; by the removal of topical medications during bathing, and by the improper disposal of expired or no longer unwanted medications, either in the sewer or in the garbage (Carvalho et al., 2009).

Although the high consumption of antibiotics and their presence in surface waters are evident, it is not yet clear whether the contamination originates from effluents or from animal production residues. The current legislation does not include pharmaceutical products in lists of priority compounds. However, as knowledge about the occurrence, toxicity, and efficacy of antibiotic elimination methods increases, it is expected that it will be possible to establish legal limits for these compounds. As for the routes of contamination of antibiotics in the aquatic environment, there are several ways, the main ones being through excreta and effluents resulting from industrial processes. In addition, in rural areas, where there is often no adequate sanitation system and excreta is disposed of in septic tanks, cross-contamination of soils also occurs, which in turn affects surface waters (Homem, 2011).

Figure 3: Routes of contamination of veterinary and human drug residues.



Source: Bila & Dezotti, 2003.

CHEMOINFORMATICS

Chemoinformatics is a multidisciplinary area capable of providing relevant advances, especially in Medicinal Chemistry, through the use of computer science resources to predict various molecular descriptors (Araújo; Dick; Motta, 2022). The term chemoinformatics was coined by Frank Brown in 1998, defining it as "a mixture of information resources to transform data into information and information into knowledge, in order to make better and faster decisions in the area of identification and optimization of leading compounds".

The field of chemoinformatics has developed significantly, moving from practical and technical approaches to the representation, manipulation and processing of individual chemical structures to its central function today: the exploration of chemical databases and the discovery of new compounds with desired activities or properties. Through the exploration of these databases, it is possible to obtain various information that helps to understand the behavior of certain groups of compounds and create computational models. These models are used to predict the activity of molecules that do not yet have experimental data, such as results from *in vitro* and *in vivo assays* (Alves *et al.,* 2018).

It is crucial to note that chemoinformatics is deeply interconnected and often overlaps with other areas of chemistry that use computational technology. This includes computational chemistry, which employs theoretical methods to calculate molecular properties; molecular modeling, which uses three-dimensional graphs and optimization techniques to analyze the nature and action of chemical compounds and proteins; and

computer-aided drug planning, which focuses on the application of computational techniques to assist in the discovery and development of new bioactive molecules (Alves *et al.*, 2018).

Although a variety of high-throughput *in vitro* screening methods are widely used, it is still challenging to obtain data on ADMETOX from the compounds (HOU & WANG, 2008). Deficiencies in pharmacokinetic studies and drug metabolization are the main causes of failures in the clinical phase of drug development. Studies conducted by *in silico methods* show that the prediction of absorption, distribution, metabolization, excretion and toxicity (ADMETOX) profiles plays a crucial role in the discovery of new drugs (Yang et al., 2018).

The purpose of this research is to use chemoinformatics methods in order to investigate the *in silico* human and environmental toxicological profile of the antibiotics Trimethoprim and Sulfadoxine.

MATERIALS AND METHODS

The calculations, simulations, computational modeling and prediction of molecular descriptors will be carried out at the Laboratory of Medicinal Chemistry and Advanced Computational Technologies at the Montes Claros campus of the Federal Institute of Northern Minas Gerais (IFNMG).

COMPUTATIONAL MOLECULAR MODELING

Initially, the chemical structure of the antibiotics Sulfadoxine and Trimethoprim were drawn two-dimensionally (2D) and visualized three-dimensionally (3D) using the ACD/ChemSketch® Freeware computer program version 2021 (Advanced Chemistry Development, Inc., 2021). All chemical structures were saved in a file of the type MDL molfiles (.mol).

IN SILICO ENVIRONMENTAL TOXICOLOGICAL PREDICTION FOR THE ANTIBIOTICS SULFADOXINE AND TRIMETHOPRIM

The present study was carried out with the help of the Chinese international platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/) coordinated by Professor Yun Tang, Leader of the Molecular Modeling and Design Laboratory (LMMD), School of Pharmacy of the East China University of Science and Technology (YANG, et al., 2018).

IN SILICO HUMAN TOXICOLOGICAL PREDICTION FOR THE ANTIBIOTICS SULFADOXINE AND TRIMETHOPRIM

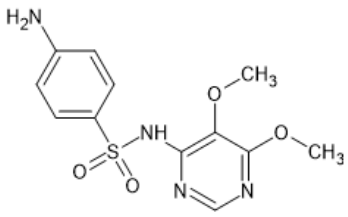
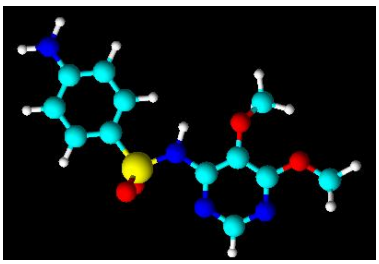
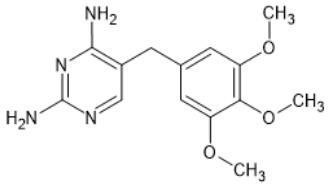
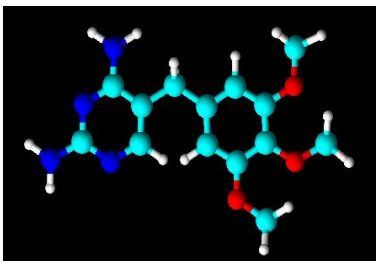
The study was carried out with the help of the Chinese international online platform admetSAR® version 2.0 (http://lmmd.ecust.edu.cn/admetsar2/), coordinated by Professor Yun Tang, Leader of the Molecular Modeling and Design Laboratory (LMMD), School of Pharmacy of the East China University of Science and Technology (YANG, et al., 2018).

RESULTS AND DISCUSSIONS

COMPUTATIONAL MOLECULAR MODELING

In medicinal chemistry, complete knowledge of molecular structure is essential. Therefore, computational modeling allows the visualization of the chemical structures of the molecules under study from a set of tools for the construction, editing and visualization, analysis and storage of complex molecular systems (Barreiro; Rodrigues, 1996). After performing the molecular modeling step (2D Drawing and 3D Drawing) for the chemical structure of Sulfadoxine and Trimethoprim, all structures were saved in a molfiles (.mol) type file. Table 1 shows the 2D and 3D drawings for the antibiotics Sulfadoxine and Trimethoprim.

Table 1: Drawings of the two-dimensional (2D) and three-dimensional (3D) structure of sulfadoxine and trimethoprim.

Compound	Two-Dimensional Design (2D)	Three-dimensional drawing (3D)
Sulfadoxine		
Trimethoprim		

Source: ChemSketch® Freeware version 2021.

IN *SILICO* ENVIRONMENTAL TOXICOLOGICAL STUDY

The evaluation of the environmental toxicity of antibiotics using *in silico* methods is of great importance for the rational planning of new drugs, as it allows predicting the impact

of antibiotics on ecosystems. In this study, parameters such as environmental biodegradation capacity, toxicity in fish, toxicity in *Tetrahymena Pyriformis* and toxicity in bees were analyzed. The preliminary results of these evaluations for the active ingredients Sulfadoxine and Trimethoprim are presented in Table 2.

Table 2: Evaluation of the in *silico* environmental toxicological profile.

Antibiotic	Environmental Biodegradation		Toxicity in Fish		Toxicity in *Tetrahymena Pyriformis*		Toxicity in Bees	
	Q	P	Q	P	Q	P	Q	P
Sulfadoxine	N	99,6%	N	82,3%	N	64,0%	N	83,31%
Trimethoprim	N	99,49%	N	94,48%	P	89,18%	N	66,16%

Source: admetSAR® version 2.0
Q: Qualitative - N: Negative; Q: Positive.
Q: Probability

The results obtained for the evaluation of the *in silico* environmental toxicological profile of sulfadoxine shown in table 2 reveal that Sulfadoxine is not toxic to fish, *Tetrahymena Pyriformis* and bees, but it is not biodegradable in the environment, which indicates that it contaminates the food chain, and also humans, since they consume contaminated food. By analyzing the results obtained for Trimetoprima, it can be analyzed that it has toxicity in *Tetrahymena Pyriformis*, in addition to not being biodegradable in the environment. It has no toxicity for bees or fish.

IN SILICO HUMAN TOXICOLOGICAL STUDY

The in silico *toxicology study* in humans for Sulfadoxine and Trimethoprim was conducted with the objective of predicting the toxicity of the compounds, according to the AMES test (T: toxic; NT: non-toxic), carcinogenicity (C: carcinogenic; CN: non-carcinogenic) and acute oral toxicity, which was classified into categories I, II, III and IV.

To evaluate Acute Oral Toxicity, the derivatives were classified into four categories. Category I (high toxicity) includes compounds with LD50 (Lethal Dose in mg of derivative per kg of body weight) values less than or equal to 50 mg/kg. Category II (moderate toxicity) covers compounds with an LD50 between 50 mg/kg and 500 mg/kg. Category III (low toxicity) refers to compounds with LD50 between 500 mg/kg and 5,000 mg/kg, while category IV (non-toxic) encompasses compounds with LD50 greater than 5,000 mg/kg. Table 3 presents important information on the evaluation of the human toxicological profile *in silico.*

Table 3: Evaluation of the human in *silico* toxicological profile.

Antibiotic	AMES Testing		Acute Oral Toxicity		Carcinogenic	
	Q	P	C	P	Q	P
Sulfadoxine	NT	64,56%	III	57,64%	NC	54,73%
Trimethoprim	NT	82,27%	IV	62,35%	NC	93,69%

Source: admetSAR®. Version 2.0

The analysis of Table 3 indicates that both Sulfadoxine and Trimethoprim do not demonstrate toxicity in relation to the human toxicity profile, as assessed by the AMES test. In addition, these compounds are not carcinogenic, and as far as Acute Oral Toxicity is concerned, they are classified in categories III and IV, which means they have no toxicity.

CONCLUSION

Sulfadoxine and Trimethoprim were chosen for evaluation because they are antibiotics that are known about their pharmacokinetics and toxicity. In the present study, *in silico* methodologies were used in order to predict molecular properties for the molecules of the antibiotics Sulfadoxine and Trimethoprim.

The in silico environmental *toxicological study* indicates that Sulfadoxine has no toxicity for bees, fish and *Tetrahymena Pyriformis*, but its chemical structure is not biodegradable in the environment, that is, in addition to contaminating the aquatic environment and fish, the chemical structure of the antibiotic remains unchanged in the environment because it does not suffer environmental biodegradation, contaminating the food chain and the human being through food. For Trimethoprima, the environmental in *silico* toxicological study indicates that the antibiotic is not toxic to bees or fish, but it is toxic to *Tetrahymena Pyriformis,* in addition to not being biodegradable in the environment, contaminating the food chain and humans through food.

The human in silico *toxicological study* showed promising data for Sulfadoxine, since the antibiotic is non-toxic (non-mutagenic) as far as the AMES test is concerned, it does not present carcinogenicity and as for acute oral toxicity it falls into category III, that is, it has low toxicity. Promising results were also obtained for Trimethoprim, since the antibiotic is non-toxic as far as the AMES test is concerned, it does not present carcinogenicity and for acute oral toxicity it falls into category IV, that is, it is considered non-toxic.

Finally, it is worth mentioning that the studies carried out so far reveal that the antibiotics Sulfadoxine and Trimethoprim promote environmental and human contamination, so it is essential to continue the studies for antibiotics, to evaluate the other impacts on humans and the environment.

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THE VOICE OF AN EDUCATOR FROM AN EARLY CHILDHOOD EDUCATION SCHOOL IN LATIN AMERICA, INSPIRED BY THE PHILOSOPHY OF LORIS MALAGUZZI

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ABSTRACT

This work presents an analysis of educational practices inspired by the philosophy of Loris Malaguzzi, developed by a pedagogist and atelierist who works at the Casa da Infância School in the city of Salvador, Bahia in Latin America The results of the educator's educational practice show how the approximation with the educational principles of Loris Malaguzzi's philosophy are translated into learning strategies, Through the hundred languages of the child, listening, investigation, documentation and participation, they made an approximation with the approach used in early childhood education schools in Reggio Emilia/Italy, demonstrating how this educational practice enhances and favors the learning of children in Latin America, developing creativity, autonomy, entrepreneurial behavior and child protagonism.

Keywords: Educational approach Reggio Emilia/Italy. Early Childhood Education. Enterprise. Role.

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INTRODUCTION

The voice of a Brazilian teacher

> *"[...] It's that protagonism of thinking that it's a collective idea for the community, for the whole world."*

Educator Márcia Santos[4] is a pedagogue, atelier and works in a private institution called Escola Casa da Infância[5] in the city of Salvador, Bahia. His class is made up of 19 children in the age group of four and five years. She has been working in Early Childhood Education for 15 years, five of which were at the Childhood Home. During her career as an Early Childhood Education educator, she has always sought a transformative approach, and when she started her work at that institution, she found her professional fulfillment in the school's identity. Inspired by the educational approach of Reggio Emilia/Italy, she began to develop her educational practices following the principles of this approach and the principle of "Listening"[6] is one of those used by her to favor the development of child protagonism and the enhancement of entrepreneurial behavior in children.

In this sense, Filippini (2014) corroborates the educator's thinking by saying that the nature of the organization of the municipal schools of Early Childhood Education in Reggio Emilia/Italy, thought by the community, by Loris Malaguzzi and all the other educators who were part of the approach, are structured in the sense of giving identity to the school, aiming at the values and choices of what the educational project proposes. Thus, the organizational choices that characterize the educational project are centered on understanding the broader and cultural daily contexts that aim at the quality of children's learning.

In view of the above, the educational practices observed in the documentation (planning of the educator together with the children, records of projects developed, school documents published in https://www.casadainfancia.org/) and in the interview conducted with teacher Márcia Santos demonstrate proximity to the educational practices of the Reggio Emilia/Italy approach, since they favor the development of the same educational principles: that of child protagonism, that of the hundred languages of children, that of listening, that of investigation, that of participation, that of planning, that of learning as a process of subjective and group construction, that of design, that of the environment, that of space and relationships, that of documentation, that of the organization of spaces, that of

[4]Professor Márcia Santos signed the Informed Consent Form (ICF) authorizing her name to appear in the text of this thesis.
[5]Casa da Infância School, Salvador – Bahia. Link: https://youtu.be/3iI5BXYHlek.
[6]"Listening, understood as a metaphor of availability, of sensitivity to listen and to be listened to; listens not only with hearing, but with all the senses: sight, touch, smell, taste, orientation" (Strozzi, 2014, p.82).

evaluation and that of professional training that collaborate to favor another educational principle that I defend is the of entrepreneurial behavior.

According to studies carried out on the philosophy of Loris Malaguzzi, applied in the educational approach of the municipal schools of Reggio Emilia/Italy, I evidenced aspects that lead me to defend that there are, in this philosophy, characteristics that enhance the entrepreneurial behavior of children. According to Dolabela (2003), an entrepreneur is an individual "[...] whose dream is to promote the well-being of the community, the improvement of the living conditions of all" (p. 47). In this sense, I argue, as I have said elsewhere, that entrepreneurship can become another principle of the educational approach of Reggian municipal schools, collaborating with the other principles that impact the lives of children. I describe, below, the methodology and data analysis according to the report of the Brazilian educator who deals with the educational practice inspired by the Reggian approach.

METHODOLOGY

The methodological paths I followed were in order to answer the central problem of this research: How has Loris Malaguzzi's educational approach been developed in the educational practice of four teachers, who work in Early Childhood Education schools in Latin America, in order to develop child protagonism and enhance children's entrepreneurial behavior? To this end, I sought techniques that ensure the credibility of the research, since, according to Bogdan and Biklen (1994), the main objective assumed by a researcher is to build knowledge and not merely offer opinions in relation to the context investigated.

In view of the chosen field of investigation, I opted for a research with a qualitative approach that, according to Bogdan and Biklen (1994, p. 13), "involves the detection of descriptive data, obtained in the researcher's direct contact with the situation studied, emphasizes the process more than the product and is concerned with portraying the perspective of the participants". Therefore, I made use of this research approach because it allows the description of events as they present themselves in their natural context.

The qualitative approach, according to Bogdan and Biklen (1994), is not represented by means of numbers, but in a descriptive form. Godoy (1995, p. 65-71) contributes by presenting three fundamental characteristics of this research approach: a) the natural environment is a direct source of data - for him, the researcher needs to be inserted in the environment he investigates in order to produce reliable and real material; b) descriptive research - observation is comprehensive, making use of varied materials to describe reality in a "holistic" way; and, finally, item c) the researcher's main concern is to capture the

meaning that the participants attribute to the object of the research, the researcher investigates the perception of the research participants in order to understand the reality that surrounds them, checking or confirming with them the interpretations they have reached.

Considering how much teachers can contribute with an innovative educational approach, with a practice that enables an entrepreneurial and protagonist pedagogy, I decided to research and produce data from four teachers, who work in Early Childhood Education in four Latin American countries that are inspired by the educational approach of Loris Malaguzzi. Below I make an excerpt of the research and describe the voice of the Brazilian teacher through an interview, documents and photos analyzed.

RESULTS

At the beginning of the interview, educator Márcia Santos mentioned the research work carried out in the Eucalyptus Square[7] and stressed that it is not only in Reggio Emilia/Italy, but also in Brazil, that ecological aspects, the environment and the spaces of the school and its surroundings are valued as environments of learning possibilities. Most of the planning of learning possibilities involves, according to the educator, exploration and investigation projects in tune with nature. Among the projects, those that take place in Praça dos Eucaliptos and in other important places in the city of Salvador/BA, such as the beaches and streets in which projects are developed related to reflections on care and preservation of the environment and actions that can improve and give more quality of life to the people who are part of these places. Places that serve to give meaning to the child and to the families of their own existence and of their own performance in the various social spheres. In Figure 7 I present the Eucalyptus Square:

[7] The Eucalyptus Square is located at Alameda das Algarobas, n. 569. Pitubas, Salvador- BA, Brazil.

Figure 7 - Eucalyptus Square



Source: material collected by Gabriel (2022).

Márcia Santos referred to an explanation she gave to an Uber driver when asked about the importance of educators, children and families investigating in the Eucalyptus Square and discussing issues related to ecology, the environment and the city. The following is an excerpt from the aforementioned report:

> *So, today I came in the uber, talking to the driver and he asked what space was there, at school. Because now I'm working at the school in front of Praça dos Eucalyptus. So, people pass by trying to understand what it is there, they see the children investigating individually and in groups, they see the educators observing the children and the learning groups in the square. So, we spend hours listening to the children and for us who are part of this educational process, of this day to day, where the child is inserted in everything, it makes a lot of sense to be there, to problematize and reflect on nature* [...] (Brazilian Educator).

When the educator says "we", she refers to the educators, the children, the families and a large part of the local community of Salvador/BA. To elucidate the participatory organization of the school, the Brazilian educator presented examples of how the process of participation of families happens during the moments in which she and the children are protagonists in the construction of their learning through the project methodology. Always focused on reflections on the elements of the environment, its care and preservation:

> *So, I bring some recent examples from the Children's House. It was the arrival of Dobby, a cockatiel, in which the children wanted to have a pet as a pet, a mascot, and then they organized a study group on what care they should have with Dobby. And also to decide how the care of the mascot would be, how they would do it during school recess periods. So, we see the children as protagonists, making important decisions such as: how long Dobby was going to spend at each one's house, what type and amount of food he needs to eat* [...] (Brazilian Teacher).

All decisions made in assemblies[8] by the group of children, mediated by the educator, were shared with the families. Validating, in this way, the process of subjective construction and in the group, of the project of having a mascot at the Casa da Infância school. This whole idea, built with the participation of families, with agreements and disagreements at times, are important for a participatory educational practice. In this sense, Carvalho and Silva (2016) collaborates with this thought by saying that the participation of children takes on a special importance, because, according to her: "Participation has to be something that is at the service of the subject, that gives him tools, that allows him to build his identity, as a citizen and that is useful" (p. 188).

Aware of the importance and value of participating and listening to the protagonist and entrepreneurial children in their work, the Brazilian educator went on to say that for the community this novelty of having a mascot was a process of building responsibilities, which were assumed not only by the group of children who started the project, but by all those who are part of the school. And it worked so well that Dobby got a companion. Another cockatiel named Milke.

When asked about her educational practice, educator Márcia Santos told how permanent research takes place during the projects and the learning possibilities that are offered to children. In addition, how imagination and creativity are part of the cognitive process during the construction of learning. They are not adventures lived by children, but personal and group investigative processes that create creative knowledge capable of interacting with different problems and languages (Vecchi, 2014).

The proportion of investigative processes became even more visible when the Brazilian educator reported on another permanent project of the school: the arrival of three bee hives:

> *The project started first out of fear. "Oh, because the bee is going to sting me!". Then, we started researching about bee species, we made incredible discoveries about the characteristics of each species, how to take care of them and also how this process of setting bees at school would be. Reflect and build awareness of the importance of bees, there, living together with us in harmony and, especially, their importance for the balance of nature* (Brazilian Teacher).

In this way, the project, the educational practices and the various learning possibilities, through the principle of investigation, are carried out by the children and the educator. In view of this, the evidence of protagonism is recorded and documented by educator Márcia Santos during the presentations and discussions held by and with the

[8]The educator uses the strategy of the assembly with the children to enhance the participation of children in decisions involving educational projects, the daily problems of the classroom and the school, under the pillars that support democratic management (Brazilian Educator).

children, with or without the participation of the families. These records, according to the educator, are important moments for the evaluation of children, as they help to understand the level of learning in the group. They provide clues for the interpretation of documentation and raise awareness in the daily work with children (Vecchi, 2017). In addition to being, in my understanding, a strategy for reflection on the educational practice itself, in which the actions of children can be interpreted in their protagonisms.

The Brazilian educator understands that the observations, reflections and documentation of the projects and learning possibilities, built by the children and mediated by the educator, are only fully understood if they are analyzed from a pedagogical perspective. A perspective that is related to the artistic processes communicated through metaphorical and poetic languages. In the words of the educator:

> [...] *to see the children bringing their questions, their discussions, solutions, ideas, building materials such as drawings, clay and wire sculptures and poetry, you know, not only to share with those who are inside the Children's House, but also expanding it to families, to society, to the community there in Praça dos Eucalyptos through the production of newspapers* (Brazilian Teacher).

As in the experiences of the Reggio Emilia/Italy approach, Márcia Santos carries out experiments with children in organized environments inside the school or in the Eucalyptus Square, which is in front of the school. For her, the school and its mediations constitute a living organism, ideal for children to develop children's protagonism and their entrepreneurial potential, which Gandini (2016, p. 57) defines as "a place of lives and relationships between adults and children". Thus, the educational practices carried out by the children and the educator are always under construction, in movement, in continuous adjustment, expanded towards the Eucalyptus Square and the families with responsibility and ethics.

It is possible to observe in her speech how strong the development of child protagonism is in her educational practice and how entrepreneurial behavior is enhanced. In the reports of the Brazilian educator, she demonstrates actions of autonomy (children's protagonism) that are reflected in thoughts, generating attitudes with a view to understanding and solving problems that involve the collective and the common good of the community (children's entrepreneurial behavior). The Brazilian educator reinforces her conception of everyday actions and relationships that favor protagonism and entrepreneurial behavior by saying that:

> [...] *So, that's right, this protagonism is very strong. Many times when we think about doing it, they are already there, everything is ready. So think of these children like that in the future, with the attitude of thinking about the world. But it's not that thinking that "my idea is worth it!", it's that protagonism of thinking that it's a*

collective idea for the community, for the whole world (Brazilian Teacher).

The report of educator Márcia Santos about her educational practice with children and the didactic material structured, organized and made available by her, demonstrates how the principle of protagonism and the principle of entrepreneurship are present in her practice. Continuing the analysis, I seek, from this moment on, to show how the educational practices of the Brazilian educator favor protagonism and enhance entrepreneurial behavior during the planning and execution of projects. I demonstrate that, although there is an approximation with the educational approach of Reggio Emilia/Italy, there is also innovation and creation, coming from the Brazilian culture.

Each year, according to the Brazilian educator, the knowledge constructions proposed, shared and planned with the children at the Casa da Infância school take different forms, which demonstrates a continuous process of innovation and entrepreneurship. The analysis of the documentation of the educational projects developed in the school, present on the walls and on the institution's website, demonstrate how the school was built considering the model of the municipal schools of Reggio Emilia/Italy. Each environment has been carefully prepared for children and families. Environments that start from the experience and personal experience of each one to build a collective environment that proposes to show innovation in its educational approach, which values the social commitment of quality education. We find in Dolabela (2003), when describing the strategies of how the entrepreneur develops his work, that the context, energy, leadership and relationships are what support creative and innovative practices.

During the interview, the Brazilian educator commented on the ongoing projects that end up transforming the spaces of the classrooms and the schoolyard. Figure 8 shows how the projects take root and are part of the school space.

Figure 8 - Project "Learn to raise bees"



Source: Material collected by Gabriel (2022).

These projects are part of educational practices that seek to innovate the teaching and learning processes, and are provided to children on a daily basis, through active participation in the planning of learning possibilities, led by everyone in the school community. Entrepreneurial behavior is enhanced by the educator during educational practices, allowing children to build their own doing and their own knowledge. We can take as an example the drawings of the investigations carried out with children on the beaches during the development of the "Golden Waves Project". Project in which children recorded the garbage that is deposited on the beaches, such as pet bottles, bags and other polluting objects. In this same project, the children reflected on the importance of clean water for the preservation of marine life and human life.

In the records of the project planning, placed on the murals of the Casa da Infância school, I observed a special concern in the way in which the self-knowledge and development of children's autonomy are built, undertaking and respecting the preservation of the environment, as a good of humanity. The plans are on a panel accessible to the child and, according to the Brazilian educator, right at the beginning of the class she asks one of the children to remove the register from the wall and take it to the planning wheel.

The educator asks if they remember what part of the project they are in and what should be sent that day. Among the actions reported in the educator's documentation is the questioning of how garbage at home should be separated and the procedures on how to wash the glass to deliver it to the collection points.

In the "Golden Waves Project" the ideas and research have already gone beyond the walls of the school and went to the city, reaching the seaside communities with a joint work of cleaning the beaches. Actions that, according to Dolabela (2003), constitute

entrepreneurship, as it supposes a set of external and internal actions, organized and planned based on the needs of the community.

These are educational practices that demonstrate how the principle of entrepreneurship empowers children in the sense of being and having. To be better people and to have a better world. To this end, the questions and problems raised by the children: "[...] *fresh water comes from salt water, it is salty because it is polluted*"; " [...] *seawater comes from another planet and we must take good care of it*"; " [...] *How should we help people take care of seawater?*", are valued from the beginning of the project's investigation to its developments and completion. The image presented in Figure 9, of the "Ocean waves" panel, illustrates, through drawings, the problem of water pollution on planet Earth.

Figure 9 - Documentation of the Golden Waves Project



Source: Material collected by Gabriel (2022).

When drawing, the children suggest investigative possibilities, they think about the way they intend to carry out the research and how they will structure and shape the project.

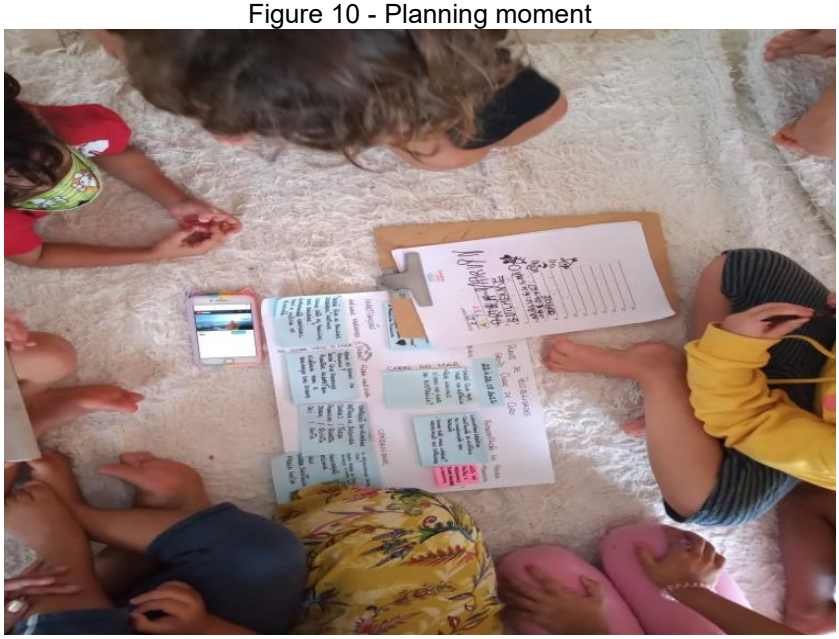
> [...] *The children think about it, and from the drawings the actions begin, such as collecting water from many places to observe, bringing empty bottles... So, we see how they develop this thinking and grow and how this shapes the project* (Brazilian Teacher).

The planning of the learning situations suggested by the group of children are examples of living experiments, generating confidence, existential opportunities and with entrepreneurial characteristics. The protagonism with actions that enhance entrepreneurial behavior in children was evident when they designed the various stages of the "Golden Waves Project". Steps that, as previously stated, were directed at thinking about how to

improve and change the course of seawater pollution.

To do so, they used investigative strategies, observations, information from written notes and poetic language[9]. In short, everything that enables multiple choices, problem solving, the educator's interference in the moments of exchange of experiences through the principle of listening, as exemplified in Figure 10.

Figure 10 - Planning moment



Source: Material collected by Gabriel (2022).

The moment, illustrated in Figure 10, presents the teacher and the children gathered in a conversation circle in order to remember where they were in the "Golden Waves Project". To this end, the Brazilian educator questioned: "[...] *Do you remember what we did yesterday*? *And what was it*? and the children answer, "*We have seen what animals live in the sea of Australia*." The educator continues, "*And today what are we going to do?*" and the children reply: "*Let's watch the movie about humpback whales*".

The identity of the educator, protagonist and entrepreneur is passed on to the child when she participates in the constructions carried out by the children, when she instigates the children with the questions during the planning of the "Golden Waves Project*".* And also, during the artistic works, the investigations in the Eucalyptus Square and even during the drawing of observations of fruits and vegetables, as shown in Figure 11.

[9]The poetic language in Reggio Emilia's educational approach values the text, exploring the combination of words and figures of speech giving meanings and feelings to the expressions used by the children (Vecchi, 2017).

Figure 11 - Fruit and Vegetable Observation Drawing



Source: Material collected by Gabriel (2022).

For the Brazilian educator, it is not the final product that makes children protagonists, but their attitudes during the process, as they act in a protagonist way, building their identities through the development of perseverance, initiative, creativity, energy, leadership and imagination. Hoyuelos (2020) reinforces this thought by saying that: "We must always think – comments Loris – that children have the need to find meaning in what they do. This meaning is linked to the meaning that adults give to their profession" (Hoyuelos, 2020, p. 258). In this sense, the Brazilian educator reported the search for meaning in what she does and her dream. She said:

> [...] *since I was studying for a Pedagogy degree, I was looking for an organized and structured school with political and ethical projects to form a citizen, aware and active in the world around him, and now I see my dream come true, when I come to work at the Casa da Infância School* (Brazilian Educator).

A life determined by a professional dream qualified the educator Márcia Santos with characteristics of an enterprising person that, according to Dolabela (2002), are present in people who:

> [...] By learning to dream and to seek the realization of the dream, the individual triggers processes that involve critical factors, such as learning to learn, learning to be, learning to do, learning to live together, learning to know. That is: it activates and develops the characteristics of the entrepreneur (Dolabela, 2002, p. 13).

The process of drawing the sea waves, carried out by the children during the structuring of the "Golden Waves Project" (Figure 3), exemplifies the protagonism and entrepreneurship present in the group of children while they draw, elaborate their interpretative theories of how the waves are formed. While drawing, someone says: "[...] *it's*

when a ship passes at sea," another child says "[...] *That's when it rains a lot in the sea*" and the other complements by saying "[...] *that's when a storm happens*." And so, with their speeches, they get a sense of and give meaning to what is being done through verbal interaction at the time of recording on paper. According to Dolabela's (2003) conception, it is possible to infer that this moment experienced by children is entrepreneurial, because, according to the author, knowing how to undertake is to have "the ability to represent reality in a differentiated way and to the degree of congruence between one's own self and the individually constructed reality" (p. 28).

Being a protagonist and an entrepreneur do not only mean planning new projects, creating new sculptures and drawings, producing new concepts, getting involved with technologies, but, above all, "it means modifying reality in order to obtain self-realization from it and offer positive values to the collectivity" (Dolabela, 2003, p. 29). In this sense, the Brazilian educator has mediated the construction of intellectual wealth in children through poetry, art, philosophy and games that impact the daily life, daily life and future of children as entrepreneurs.

The principle of protagonism and entrepreneurship are present in childhood policies[10], however, in my understanding, childhood is still considered an investment that will guarantee a financial return for world economic development. However, in the educational approach of Reggio Emilia/Italy, in which the educator of the Casa da Infância school makes approximations, children are seen as powerful, competent, autonomous subjects and protagonists in the construction of their identity and citizenship. This way of thinking requires visibility by all the protagonists of the school, because only when children become visible in the school context, they come to be understood as competent and powerful and even regulators of a future economic market, but in an intelligent, sustainable and ethically conscious way.

DISCUSSION

From this perspective, it is necessary to build participatory teaching contexts, involving the family and everyone in the school, in offering support so that children's skills can be built for their lives. In this sense, the Brazilian educator, the school and the families recognize children as protagonists of their learning. This recognition ends up guaranteeing an educational practice that provides resources and opportunities in the school and family contexts in which the relationships between children and adults take place. This allows the

[10] Policies such as: United Nations Convention on the Rights of the Child and the National Common Curriculum Bases for Early Childhood Education.

emergence of valuable experiences in the construction of their self-knowledge and autonomy, privileging self-learning.

To highlight the network of protagonist and entrepreneurial relationship that is established between the educator, the families and the children, I describe an excerpt from the interview in which the strategies and methods used during the educational practice for conflict resolution illustrate the moments in which the children's self-learning occurs. These moments are mediated by the Brazilian educator so that the relationships of daily coexistence enhance the children in relation to confidence, opportunity and time to develop their ideas, their experiences and build concepts of values. In this sense, educator Márcia Santos reported:

> [...] *So, thinking about this conflict resolution that happens during everyday life, in which ideas and values are different among children. It's just that we start to think together with them about strategies so that they can resolve their conflicts in the best possible way.* [...] *How did they* [...] *that we started to think of strategies in a way that they could listen to each other, could have time to talk, you know, could come to a conclusion on how to relate, not only with the other, but with the world, with the family, with the parents, with the siblings* (Brazilian Teacher).

With the report of the Brazilian educator, I observe how important she considers conflict mediation in the construction of emotional learning.

The participation of families in the search for teaching strategies is not, according to Fortunati (2021), understood as a complement, but a fundamental element for educational practice during the development of work projects. To this end, the Brazilian educator, the children and the families thought of the strategy called 'conflict resolution table'. In her report, the educator explains how this strategy works:

> *So, something that happens between us is the conflict resolution table. It's even funny to see very young children in this situation of sitting down to talk even "me, I don't agree with what you said", "oh, I didn't like how you did it. How can we solve this?", "why are you like this with me?", "How can I help you?", [...] before all this, there is that process of them sitting down, of taking time to reflect on their idea and behavior, moments of pause, time to look at the other, even if they say nothing, but it is a time to be there thinking about* it (Brazilian Educator).

In this case, relationships, confrontations, and agreements lead children to elaborate ideas in which the strategies used by each one can find space for expression, and personal growth when it occurs in the individual achievement of new levels of awareness and confidence in their own potentialities (Fortunati, 2021). Educator Márcia Santos continued the report by validating the importance of the resource used by children for their personal growth. She said that she always mediates between the children using the words "[...] *you can also convey this in a drawing, on paper, put your anger out, your emotions*" (Brazilian

Educator).

According to Dolabela (2003, p. 59) "it is emotion that brings out the entrepreneurial characteristics inherent to the human species, because how can we assume characteristics without being possessed by the emotion that triggers them?". Thus, the educator considers that many behaviors such as initiative, rebellion against imposed standards, leadership, imagination, energy are present in young children and are behaviors inherent to human beings and that are present in a positive way in the entrepreneur. For this reason, she always thinks about possibilities for emotional learning. According to her, it is necessary to:

> [...] *to put in the plan of possibilities, learning situations to be carried out together with other educators such as English, possibilities of working with emotions, fantasies and dreams, both individually and in the group. Because children are very young and are beginning to understand how they communicate, how they relate and interact with the group. [...]Thus, the strategy of the conflict resolution table favors democracy, cooperation and for me it is a moment in which it is possible to perceive how wise children are, how they interpret the world* (Brazilian Educator).

CONCLUSION

In view of all that has been explained so far, I understand that the educational practices of Educator Márcia Santos are close to the philosophy of Loris Malaguzzi, at the same time that they build her repertoire of knowledge and experiences about childhood, making use of different strategies to favor children's learning. The development of protagonism and the enhancement of children's entrepreneurial behavior is permeated by the protagonist and entrepreneurial profile of the Brazilian educator.

Dolabela (2003) contributes to this thought when he says that: "[...] the entrepreneurial spirit is a potential of any human being and needs some indispensable conditions to materialize and produce effects" (p. 24). In this way, experiences with the environment, in a sustainable way; permanent research; The favoring of participation and conflict resolution, exemplified by the use of the conflict resolution table, are configured, in this context, as conditions for the materialization of the expansion of children's protagonism and entrepreneurship.

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CREATIVE ECONOMY: INTERTWINING KNOWLEDGE, ART AND FASHION

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ABSTRACT

The text explores the relationship between Creative Economy, art and fashion as potential catalysts for economic, social and cultural development. The Creative Economy, which emerged in Australia and spread in Brazil, values "know-how", uniting creativity, culture and sustainability. In Brazil, this economy represents 2.84% of GDP, with annual growth of 6.13%, and has great potential to expand creative exports. Handicrafts and fashion design, core subsectors of the Creative Economy, stand out for adding cultural and social values to products, promoting inclusion and sustainability. Authorial fashion and handicrafts rescue traditional techniques, integrating cultural identity and technological innovation. The Creative Economy faces the challenges imposed by globalization, offering market alternatives that prioritize intangible values, such as creativity and cultural heritage. It is concluded that the strengthening of the interaction between art and fashion, with the support of the government, can generate employment and income, consolidating the Creative Economy as a model of resistance and inclusion in a market dominated by consumerism.

Keywords: Creative Economy. Solidarity Economy. Fashion Design.

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INTRODUCTION

Since the Industrial Revolution and the emergence of the capitalist mode of production, the productive processes have come to evidence of machinism. This fact was mainly due to the need, typical of the capital cycle, to produce more and more and with notorious quality, different from what happened in the previous time, when manual production and quality were limited, common to handicraft work.

Throughout the development of this system of production, societies began to link their levels of development with the productive sphere associated with social data. In addition, with the advent of globalization, the world has become submissive to the production model of transnational corporations. As a result, nations have devoted salutary attention so that the industrial economies of their countries improve more and more, seeking to raise their level of development and, at the same time, ensuring conditions of vitality of their companies in the face of global competition. However, this process sometimes fails to value other types of economies, especially those linked to "know-how", overvaluing the economy submissive to the capitalist aegis and, sometimes, ignoring or failing to prioritize other values.

In this sense, countries have paid special attention to economic sectors that link "know-how" with the capitalist economy. Thus, Australia was the first country where the concept of "Creative Economy" emerged, linking social, cultural and artistic factors to the market economy. In addition to the Creative Economy, other economic models have also emerged as ways to increase the development of societies, especially local ones.

In the Brazilian case, since the beginning of the last decade, the government has started to encourage this type of Economy, and between 2019 and 2022 it suffered a relative "inattention" and, now, since 2023, it is expected to reactivate the incentives through public policies of a government more concerned with social inclusion. After all, a country like Brazil, characterized by social and cultural diversity, needs to find in the diversity of its knowledge, potentialities to develop niches in the national economy and face social inequality.

It is common for capitalist societies to value current aspects of the consumer society, prioritizing brands and fads in their consumer products. However, it is necessary to have resilience in order to seek an appreciation of subjectivity in goods through cultural, artistic and sustainable meanings that are present in the know-how of communities.

In this way, the present work intends to address, even if briefly, the Creative Economy (CE) as a means of production that values know-how, more specifically art as a

raw material that adds economic, social and cultural value in products in the clothing segment.

Unfortunately, sociocultural diversity has been losing space of significance for postmodern society, marked by the consumption of products that explore appearance and look and not its social and cultural values. In addition, in Brazil there is little identification with the valorization of products created by the bias of social, cultural and sustainable responsibility, privileging consumerism and futility. It is in this sense that the Creative Economy is beyond consumerism.

The technical-methodological procedures chosen to carry out this work was the descriptive bibliographic research. Thus, there was a bibliographic review aimed at understanding the Creative Economy and its subdivision into sectors, in which fashion *design* and handicrafts are found. Thus, the methodology used was exploratory (Gil, 2019). It is, therefore, a theoretical cabinet research, in which a certain theme began to be studied as a possibility of use in the development of raw material for products in the clothing segment.

The results, although theoretical, demonstrated that handicrafts, while belonging to the group of arts and culture, are an important source of inspiration and cultural product for the development of clothing products, meaning a form of resilience that favors know-how, adding cultural and social value to fashion products. After all, fashion and handicrafts are two sub-subjects of the Creative Economy that can be altruistic.

CONSIDERATIONS ABOUT CREATIVE ECONOMY

The relevance of knowing aspects of the Creative Economy is legitimized considering the peculiarities of Brazil, mainly related to ethnic, social and cultural diversity.

These creative subsectors of Brazil are of great economic dynamism, so that in 2010 their participation in the GDP – Gross Domestic Product – was 2.84% with a growth of 6.13% per year. There are also prospects for Brazil to expand its exports of creative goods and services, which in 2010 represented only 0.30% and 3.42%, respectively, of the global value exported (Kubo, 2015).

In general, the Creative Economy is a form of development that relates the market and culture, specifically popular culture based on know-how. As the focus of this work, the popular culture emphasized are the arts, figured in the artisanate which, together with fashion, can mean an opportunity for the development of products and society itself through urban cultural life and social interaction between different classes, inserting minorities and excluded in the market economy in a promotion of income and employment.

At this juncture, the production of clothing and more specifically fashion is one of the areas that the Creative Economy contemplates by inserting the know-how of art and crafts, here understood as cultural knowledge and skills, in the production of clothing. There is no defined and finished concept about Creative Economy, as it is an evolving concept. However, there is consonance in recognizing that this Economy encompasses the relationship between creativity, symbolism and economy (Oliveira, Araújo & Silva, 2013, p. 07).

The Creative Economy emerged in the second half of the last century, concomitant with the emergence of the consumer society. While global capitalism made use of the mass media to encourage consumerism, another economic bias fostered attempts to confront it through alternative production models, such as the Solidarity Economy and the Creative Economy. This, permeated by the cultural, social and economic wealth linked to the productive environment, adds values through know-how and subjective skills, in a tone that emphasizes social, economic and environmental sustainability, in addition to stimulating innovation and cultural diversity.

With its genesis in Australia, when authorities linked to the cultural sector of that country proposed, in 1994, the *Australia: Creative Nation*. Then, in 1997, they published the UK*'s Creative Economy report,* by the British Culture Office with the aim of analyzing the national accounts of the United Kingdom, identifying market trends and the country's comparative advantages. This initiative represented "a practically unique exercise in government – transversal to the traditional Whitehall divisions, uniting government and industry in a partnership and defining an agenda with specific themes" (Reis, 2008, p. 16).

Initially designated as Creative Industries, there was a systematization of the use of the terms in order to avoid confusion of interpretation. Although there is no systematization about this, this model of Economics can be understood as the...

> designation of activities that have creativity as their center of value generation, is part of the knowledge economy and has the same main distinguishing characteristics: the intangible nature of most products, the large participation of the productive factor knowledge in the processes, rapid diffusion of innovations, greater flexibility both in process changes and in the reconfiguration of products (Serra & Fernandez, 2014, p. 362)

In Brazil, the Creative Economy gained notoriety from 1994 onwards, although this type of economy had been treated for a longer time. Thus, from the end of the last century, the Creative Economy has become more expressive, especially in the discussions of sustainability that, year after year, have become more evident. It was thus that, in 2012, when the country was governed by a management of relative commitment to social causes

and the development of alternative economies, the Ministry of Culture embraced the project Creative Economy Plan: Policies, Guidelines and Actions. Such a plan had – and has, the objective of signaling solid paths for the Creative Economy, defining its concept and explaining its structure organized in sectors. According to this plan,

> the Federal Government (assumes) the challenge of building a new development alternative, based on cultural diversity, social inclusion, innovation and sustainability. To this end, it elects the creative economy as an axis of development of the Brazilian State (Ministério da Cultura, 2012, p. 44)

In the same document, the Creative Economy sectors were defined as healthy and understood as healthy

> Those whose productive activities have as their main process a creative act that generates a product, good or service, whose symbolic dimension is determinant of its value, resulting in the production of cultural, economic and social wealth (Ministry of Culture, 2012, p. 22)

For Kubo (2015), the plan defined, in the Brazilian case, the concept of Creative Economy in a synthetic way, emphasizing that this economy is not generated from perishable raw materials, but from intangible values, such as creativity, culture and knowledge.

The Plan of the Ministry of Culture was extremely important for the Brazilian Creative Economy, as it meant an instrument of guarantee, incentive, promotion and guidelines for the portion of society that already developed its activities based on the essence of this economy. After all, the Plan showed that knowledge, know-how, creativity and innovation are elements of great relevance in the social and economic development of the country and its regions and regionalities. As a result, the culture of the places in a society came to be seen as a possibility for local, regional and national development, contributing to the generation of wealth, employment and income.

Acting mostly informally, the Creative Economy, based on know-how, creativity and the culture of places and people, in its most varied sectors, develops as a promising segment of the market economy, combining culture and economy in the generation of added value in productions. Thus, the Creative Economy can, in addition to generating employment, income and development, mitigate social vulnerability and instigate upward social mobility.

> According to data from IBGE and FIRJAN, the creative sectors in Brazil are of great economic dynamism, whose GDP is 2.84% of the country's total, and which has an annual growth of 6.13%. According to UNCTAD, in 2010, there is also great potential for Brazil to expand its

> exports of creative goods and services, which represent only 0.30% and 3.42%, respectively, of the global value exported by the rest of the world, considering these low percentages and the country's explicit potential when compared to other countries (Kubo, 2015, p.19).

In addition to this importance, the author mentions that the Creative Economy contributes greatly to the generation of employment and was responsible for a 90% increase in the number of formal jobs between 2004 and 2013. In addition, it must be considered that the Creative Economy also contributes to the generation of indirect jobs, especially in activities common to other activities in the creative sectors. It is also important to mention that formal employees of the Creative Economy have salaries 44% higher than the average of formal workers in the country.

ON THE STRUCTURE OF THE CREATIVE ECONOMY

UNESCO has proposed a framework that embraces core creative sectors, related creative sectors and the intangible heritage sector. The former are understood as essentially creative sectors in which the cultural and sign value that is added to the product, and is the determinant of its exchange value. The second are sectors that are not essentially creative, but that have a considerable link with the first sector and that end up working as a driving force. Finally, the third refers to traditional sectors of communities and/or societies that have a generational tradition such as prayers, rites, languages and social practices.

It can be seen, therefore, that the Creative Economy is a form of economy that is inserted in the market economy but in an innovative way and in a way that confronts those that the capitalist system institutes in order to undermine the workers. It is a model that, despite commonly having limited financial resources, emphasizes human and intellectual capital, highlighting attention to the cultural sense and know-how of communities, in a way that walks very close to sustainability, including as a potential economy of resistance of minorities in the face of social and economic exclusion caused by globalization.

Thus, it is reiterated that the Creative Economy has links with cultural issues of the communities, praising knowledge in order to develop possibilities of adding values to goods and transforming them into market products, collaborating for environmental, social, and economic sustainability.

With the Creative Economy Plan: Policies, Guidelines and Actions (2012), the Brazilian government, at that time, described the four Guiding Principles of the Creative Economy that would serve as the basis for direction, namely, cultural diversity, sustainability, innovation and social inclusion.

Regarding cultural diversity, it is important to consider that it refers to the different cultures that exist or may exist in a given society. In the case of Brazil, the diversity and ethnic condition of the country favors this principle. After all, creativity and national cultural variability mark this social characteristic. It is also important to emphasize that "cultural homogeneity begins to oppress diversity, making endogenous development impossible", which is why cultural diversity is extremely important, especially for a developing country such as Brazil (Ministério da Cultura, 2011, p. 34).

For UNESCO, as determined in the 2005 convention, the cultural diversity of a country or region generates a wealth that maximizes possibilities, capacities and social values. Thus, it can be postulated that the ethnic and cultural diversity of the country can, through the Creative Economy, become a determining element in economic and social development.

However, as Kubo (2015) states, it must be considered that, normally, cultural diversity is accompanied by social exclusion, minorities and forgotten values, often undermined by ideals and values of hegemonic groups. Therefore, developing and encouraging an economy that nourishes society with hope, social justice, humanism and citizenship is increasingly important.

With regard to sustainability, it is important to mention that it incorporates at least three biases, namely, economic, environmental and social sustainability (Philippe & Pelicione, 2014). Thus, in addition to worrying about environmental issues, those that concern the quality of life of society and organizations must also be considered.

An element or process, to be sustainable, must have autonomy to remain vital for a relative amount of time, obeying these three nuances. Therefore, it is understood that sustainability refers to a symbiosis in the interaction of the individual, the production processes and the world. In other words, the productive system must spend a condition of attention to environmental, economic and social causes in a model of interaction and mutuality.

Within the scope of the Creative Economy, in addition to these mentioned biases, sustainability is structured in two other interrelated biases: the geographical and the cultural.

Regarding environmental (or ecological) sustainability, it can be said that it is the use of natural resources (energy and raw materials) in such a way as not to cause damage to the environment. According to Agenda 21 (*apud* Philippe & Percione, 2014), it is linked to sustainable consumption and production patterns with efficiency in the use of energy and raw materials to reduce environmental damage.element. In the same way as environmental

sustainability, social sustainability concerns the quality of life of society, with decent wages and income and conditions of upward social mobility. In the economic field, it is understood the appropriate use of these resources in order to offer healthy conditions for the economy of organizations, while geographic sustainability concerns the balance of the uses of urban and rural spaces and population distribution, and cultural sustainability, directly linked to the Creative Economy, has the challenge of preserving regional culture, even when it is inserted with the globalized world.

Regarding Innovation as a guiding principle of the Creative Economy, it can be understood as the application of creativity through ideas or methodologies that bring novelties compared to the previous model. Therefore, innovation breaks paradigms and usually incorporates technologies into the production system, adding cultural and economic values to goods and/or products. According to the Solidarity Economy Plan of the Ministries of Culture of Brazil, innovation "requires knowledge, the identification and recognition of opportunities, the choice of better options, the ability to undertake and take risks, a critical eye and strategic thinking that allow the achievement of objectives and purposes (Ministry of Culture, 2012). In general, Innovation is subdivided into product innovation, process innovation, organizational innovation, and marketing innovation. Approaching the theme of this work, innovation is closely related to the Creative Economy and, in a peculiar way, to Fashion, especially with regard to the product and innovation of marketing. After all, it is understood that the insertion of cultural elements in goods ratifies these forms of innovation.

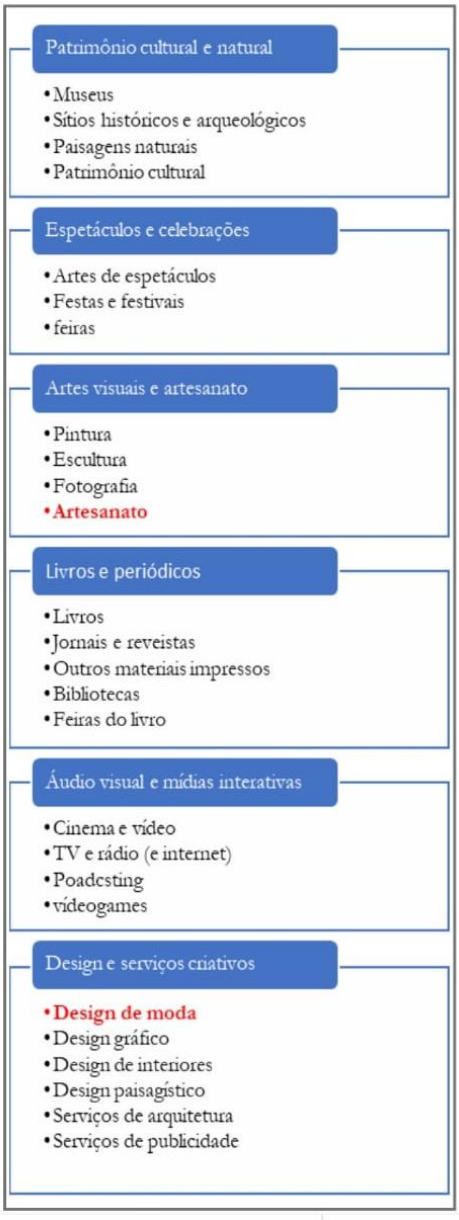
Finally, social inclusion, the fourth guiding principle of the Creative Economy, seeks precisely to insert minorities and excluded people in the productive segment of the national economy. In other words, communities, especially regional ones, that face and suffer the consequences of the globalized economy, can, through this economic model, insert themselves in the productive sphere, generating employment and income through the know-how they have. Typical of the productive system, divergence and consequent social exclusion can find, in the Creative Economy, a form of resistance and confrontation.

CREATIVE DESIGN AND SERVICES AS CORE SUBSECTORS OF THE CREATIVE ECONOMY

As previously expressed, the Creative Economy has, in addition to the noteworthy principles, a subdivision into creative sectors (Core Creative Sectors, Related Creative Sectors and the Intangible Heritage Sector). In these sectors, several areas were inserted because they are understood as promoters of economic development and that have a link with creativity and culture.

The core creative sectors were further subdivided into six subsectors and their activities. Regarding the theme of this work, handicrafts (visual arts and crafts sector), and fashion design (creative design and services sector) deserve to be highlighted. Figure 1 presents the creative subsectors and locates crafts and fashion design.

Figure 1. Core creative subsectors of the Creative Economy and associated activities, with emphasis on handicrafts and fashion design. Source: Ministry of Culture, 2012. Org: The authors.



It is understood that it is in these sectors that, according to the Plan of the Secretariat of the Creative Economy, the cultures of peoples and communities are expressed. In addition, it is perceived that the creative sectors are related to the know-how present in the daily life of society. In order to continue this work, the next and last item will address the relationship of handicraft and fashion design with the Creative Economy which, in the understanding of this work, occurs in a healthy way, legitimizing these fields of knowledge

as an integral part of this form of economy.

CRAFTS AND FASHION DESIGN: CORE SUBSECTORS OF THE CREATIVE ECONOMY

As Lipovetsky states, we are at a time when fashion is increasingly celebrated on an equal footing with art. In parallel, we have as etymological definition handicraft as being the artisan's work method that combines utilitarianism with art. It is in this context that authorial fashion grows, from the combination of experiments and creativity, associated with techniques that rescue the culture and identity of a Brazil so vast and rich in diversity.

Here, art is raw material in fashion production as part of the classifications of the Creative Economy. Neri (2018) clarifies that, with regard to the definitions presented by the Ministry of Culture, fashion currently figures as one of the creative sectors that make up functional cultural creations – along with design and architecture.

As the name suggests, the Creative Economy is a development model based on creativity. It is a new model driven by intellectual capital that generates economic value. Creativity is not something new, nor is economics, but the novelty lies in the nature and extent of the relationship between them and how they combine to create extraordinary value and wealth (Howkins, 2020).

The livelihood of countless families and communities around the country, Brazilian handicrafts are one of the most diverse in the world. Estrada (2004) points out that, with the insertion of handicrafts, Brazilian fashion takes shape in the search for an identity and its commercialization gains space in the international market, a factor that contributes to the country having the fashion industry as the most valuable part of its growing Creative Economy. According to ABIT (2019), Brazil is the largest complete Textile Chain in the West and, in 2019, it was responsible for the production of 8.9 billion textile pieces and 1.2 million tons of textile production.

As Copolla & Santana (2021) point out, fashion has rescued the cultural identity of handicrafts. Crochet stitches, thread, knitting and the wide range of lace, the dialogue between past, present and future, and tradition combined with technology result in products with strong commercial appeal, and generate identification through sociological and ecological biases. In this sense, production is based on the principle that:

> The foundation of the creative economy is the use of intellectual and copyright property as a way to prevent the "commoditization" of goods and services, in addition to enabling the creation of production chains from small and medium-sized entrepreneurs, which causes a positive effect both in the generation of jobs and in the distribution of income. To this end, it is up to the State and the private sector to create an environment (ecosystem) favorable to the development of new products,

> techniques, technologies, and industrial and commercial processes that, in addition to generating new patents, have a uniqueness that cannot be plagiarized (Lelis & Brasil, 2018, p.50).

In fashion, the prevention of the trivialization of the product is based on the valorization of the human factor, of manual labor. From this perspective, handicrafts were viewed for a long period of history with disdain by industry and consumers. Categorized as a by-product, especially when it carried the cultural heritage of a specific region. Thus, we will understand fashion, clothing and dressing as:

> A means that enables the formation of the individual's social identity. To dress is to express oneself, it is a particular form of manifestation that can identify: the probable time, the social group and even the individual's profession. Clothing, therefore, contributes to the construction of people's profiles, and may even reflect their state of mind (Kratz, 2016, p.170).

The subversion of this idea of the Creative Economy and the interaction between fashion and handicrafts results in the overvaluation of the *handmade product*, in which regional factors act as means of differentiation (exclusivity). For example, the case of Martha Medeiros who with her brand rescues the luxury of handmade weaves and embroidery. By the hands of the designer, handmade fashion gained status. His work contributes to the tourist expansion and cultural identity of handicrafts" (Copolla & Santana, 2020, p.49).

Ronaldo Fraga is another Brazilian designer known worldwide, who values the use of handicraft techniques in his products. In his collection "The Apprentice Tourist" (2013), he partnered with a cooperative of embroiderers from Passira (a small town in the agreste region of Pernambuco) translating this initiative into a gesture of inclusion and social dignity (Cidreira, p.103).

In this context, it can be stated that fashion and handicrafts, as core subsectors of the Creative Economy, represent possibilities for adding value to products and for the resilience of local and regional populations that, through know-how, demarcate their respective identities from the market economy.

FINAL CONSIDERATIONS

The present work sought to bring information from art and fashion as a possibility for the development of Creative Economy. After all, it is understood that these subsectors have an appreciation of cultural and social order through know-how.

It is understood that the globalized economy commonly undermines small entrepreneurs, so that big capital, mainly through brands, ends up holding the hegemony of this process.

There is an interesting and important niche for the economy, especially the national one, which can link art and fashion as a way of adding exchange value to the goods produced. These two areas of knowledge have similarities that are expressed in creativity and innovation and can work together in the production process.

However, there is a need for this imbrication to be further explored in order to promote income and work for the groups that may be involved in this production. It is expected that the public authorities will pay attention and promote this productive sector. After all, it is from the interaction of sectors of society that the Creative Economy, and especially the link between art and fashion, can respond with dynamism and increment and respective insertion in the market economy.

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HARM REDUCTION, WEAVING THE THREADS OF THE SKEIN: DRUGS, LEGISLATION AND PUBLIC POLICIES

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ABSTRACT

The consumption of psychoactive substances throughout human history has involved multiple meanings, from therapeutic and ritual uses to social and economic control. In Brazil, drug consumption and legislation have evolved over the centuries, reflecting external influences and social, economic, and political changes.

Keywords: Drug consumption. Drug legislation.

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HISTORICAL ASPECTS OF DRUG CONSUMPTION IN THE WORLD AND IN BRAZIL

Since Antiquity, man has searched in the diversity of flora for plants that were useful to him, discovering in some of them sensations, such as alteration of consciousness, mood, disposition, sleep, among others. This interaction operated multiple meanings in different contexts and civilizations: some plants served as great analgesics, fundamental to combat pain; others as stimulants, allies of energy and productivity; others granted access to the transcendent. All these effects were of great relevance in the history of humanity (CARNEIRO, 2014).

Diehl et al. (2011) point out that the Sumerians, as early as 4000 BC, made use of the opium poppy to obtain contact with the gods. In countries such as China, India and Egypt, around 2000 BC, the use of marijuana for therapeutic purposes was widespread. The use of alcoholic fermented products also represented ancient civilizations. In Egypt, for example, records of paintings are found that denote states of drunkenness with alcohol, in which men appear carrying other men.

In the Middle Ages, opium consumption on the European continent increased, due to the spread of poppy planting among peasants. The expansion of commercial navigation, from the sixteenth and seventeenth centuries, interconnected the continents, allowing the entry and exit of products such as opium, alcohol-based beverages (distilled and fermented), tobacco, marijuana and their derivatives, such as hashish. These products were considered luxury spices and played an important role in trade (AVELAR, 2014).

With the strengthening of the pharmaceutical industry, in the nineteenth century, substances such as cocaine, heroin, morphine and caffeine had their active ingredients synthesized and started to be produced and marketed (CARNEIRO, 2014). Cocaine, for example, around the 1800s, had its use expanded, including in the medical field for its antidepressant, anesthetic, and analgesic properties. Sigmund Freud (1856-1939) himself focused on the study of cocaine, indicating its use for its beneficial functions. Due to its high cost, it was considered a "drug of the elites", becoming an article of desire for all those who wanted to ascend socially. Coutinho (2014, p. 35) says that "a lifestyle was forged that ended up being associated with cocaine", since the consuming population was known for its millionaire jobs, characteristic of the production system of the time. The aforementioned author states that cocaine was considered the ideal substance for those who wanted to have high self-esteem, energy and social ambition, essential attributes for young people who were entering the market, fulfilling a beneficial function even for the American economy in the obstinate conquest of hegemony. Diehl et al. (2011, p. 140) portray the change in this scenario.

> Despite the apparently beneficial effects, its use spread rapidly around the world. At the time, the various harmful consequences resulting from its consumption were already observed, causing behavioral changes, increased aggressiveness and establishing dependence, which led to the subsequent prohibition of its use.

A decisive factor, according to Coutinho (2014), happened in the 70s of the last century, when Colombian traffickers inserted large quantities of cocaine into American territory, increasing availability and reducing prices, which made the substance accessible, especially among the excluded classes.

> [...] the fame of the psychoactive has been turned upside down: it has gone from an elite drug, associated with power and triumph in the capitalist world, to a substance used by excluded populations with great destructive potential (COUTINHO, 2014, p. 35).

The situation was intensified with the rapid popularization of one of its derivatives: crack. The compulsive consumption, the craving, the absence of refining in its production and the affordable price attracted users from the less favored classes. Coutinho (2014) adds that the State's omission in the development of protective social policies intensified its repressive and stigmatizing character to trafficking and especially to the user.

A similar transformation of meanings occurred with the consumption of alcohol. In the period of the Industrial Revolution, the mode of production that exploited the worker made the drink acquire an important role, being used as a relief from subhuman working conditions. When the use of alcohol became a nuisance, precisely because it left the worker unproductive in the eyes of the State, political changes occurred. In the United States, between 1919 and 1933, the so-called "Prohibition" was in force, which prohibited the manufacture and consumption of alcohol (COUTINHO, 2014).

Heroin, another very popular substance, became known as the solution for morphine addicts and also for its therapeutic effects, so much so that it was sold freely in pharmacies. But the solution soon turned out to be a public health problem. Around 1920, the American Medical Association called for a ban on its use, due to its highly addictive nature. However, the fight did not gain as much repercussion, since the substance was not the target of distribution by Colombian mafias. The use of heroin became more popular on the European continent, among the so-called junkies, people who consumed the drug intravenously (COUTINHO, 2014).

Substances such as marijuana and LSD were characterized by the scientific community as the mark of "social disorder", since they gained popularity among the young people who made up the hippie movements and rock bands of the time. Due to its countercultural character, the repression of use was not long in being unleashed. Alongside

these drugs, the proliferation of synthetic drugs, such as ecstasy, methamphetamine, and others, has been observed since the 1990s (DIEHL et al., 2011).

In recent years, there has been a growing spread of substances that have effects similar to those of illicit drugs, the so-called "new psychoactive substances" (NPS).[3] This result is guaranteed through combinations of herbs and chemical substances, such as herbal smoke, which cause the same effects as marijuana. An example is Salvia Divinorum, a type of sage used for ritualistic purposes. Its use has been widely disseminated due to its intense effects, which resemble marijuana, because it does not have a strong smell, because it is not an illicit substance and because of its easy access, whether in tobacco shops or on internet sites (DIEHL et al., 2011).

In Brazil, psychoactive substances also fulfilled significant functions, linked to ritualistic, therapeutic and commercial activities (AVELAR, 2014). When the Europeans arrived, the native peoples made use of tobacco and caiun, a drink distilled from the cassava root. Later, the cultivation of sugar cane and slave labor provided the production of "cagaça" or cachaça, from molasses, which became popular among slaves and free men. Due to the low circulation of metallic coins, drugs played the role of facilitating exchanges in trade. Brandy, for example, was exchanged for beans, potatoes and cassava among African slaves in the state of Bahia (AVELAR, 2014).

The legislation, which assumed to a certain extent a permissive character in the use of psychoactive substances, gradually adapted to the logic of controlling addictions, with the objective of establishing civilized coexistence, and control of profits, imposing restrictions on the sale of alcohol and other drugs (TRAD, 2010). In the mid-seventeenth century, the Portuguese Crown drafted laws that prohibited the production and consumption of cachaça. The objective was to avoid competition with Portuguese wines. In response to pressure, at the end of the same century, the Portuguese again allowed the sale of the drink. At the beginning of the nineteenth century, the prohibition of public drunkenness in Rio de Janeiro was discussed. It was alleged that the measure of provisional incarceration of the drunk person had a protective function, aiming to avoid damage until the effect of drunkenness wore off. This measure was only authorized three years later (AVELAR, 2014).

In 1830, the publication of the Code of Postures presented in its article 7 the prohibition of the use and sale of marijuana cigarettes, with the penalty being a fine and

[3] New psychoactive substances are those of misuse, either in pure form or in a preparation, which are not controlled by the Single Convention on Narcotic Drugs of 1961 or the Convention on Psychotropic Substances of 1971, but which may pose a threat to public health. In this context, the term "new" does not necessarily refer to new inventions, but to substances that have recently become available.
Source: United Nations Office on Drugs and Crime, The Challenge of New Psychoactive Substances (Vienna, March 2013).

three days in jail for slaves and other people. Rodrigues (2014) says that Rio de Janeiro was the first city in the world to enact a law against the use of marijuana, for associating it with the black capoeiras who frightened the slave society. Throughout the twentieth century, the repression of the consumption of plants, beverages and smoke only increased in Brazil, a reflection of the world scenario, which was waging the war on drugs (AVELAR, 2014).

At the end of the first quarter of the twentieth century, drug consumption was classified into "elegant vices", which categorized drugs such as heroin, morphine and cocaine, used by the white elites, and into "inelegant vices", belonging to the habits of the poor strata, formed by blacks and their descendants and popular classes, who made use of drugs such as marijuana and alcohol. It did not take long for stigmatized drugs to be spread to all social classes, even enslaving the elites (BRASIL, 2014). This picture of distinctions was also manifested in the scientific community. Trad (2010) reports that there were no studies on the evils of opium, heroin or cocaine, but they highlighted the evils of alcoholism and tobacco. It is noteworthy that Brazil was influenced by the standards determined by countries, such as the United States and others on the European continent.

It is observed that, historically, the consumption of psychoactive substances fulfills expectations and needs of a given moment in the culture, economy and social conditions of a people's life. Thus, the issue of drugs is not merely a social problem, but needs to be understood as an integral part of human history. The considerations made allow us to analyze the changes in social perception and the posture assumed by the State with regard to drug use: from sweet to bitter, from resolutive to poisonous, as well as their implications in the elaboration of public policies on drugs.

THE LEGISLATIVE TRAJECTORY AND POLICIES ON DRUGS IN BRAZIL

Until the middle of the nineteenth century, the consumption of psychoactive substances was not considered an alarming problem for Brazilian society and the State, so Brazil had not systematized official control over drug use. In the twentieth century, events that went beyond Brazilian borders3 and changes that occurred within their own limits announced the need for rearrangements in the political system (TRAD, 2010).

In the Colonial Period, social control and profit control were on the agenda in the elaboration of legislation on drugs, as already exposed. The first attempts by the State to establish control over the use, production and sale of drugs do not achieve, according to Ribeiro (2013), the status of a true legal system. The Philippine Ordinances, published in 1737, prohibited the sale of "poisonous substances", such as opium, in establishments that did not belong to doctors, apothecaries or surgeons, but the decision was revoked a year later due to pressure from merchants on the king of Portugal (TRAD, 2010).

Even during the Imperial period, there was still no legislative framework on the issue of drugs. The Criminal Code of the Empire itself, sanctioned in 1830, was subject to the positions taken by municipalities, such as Rio de Janeiro, Santos and Campinas, which prevented the sale of marijuana in public places. Ribeiro (2013) considers this provision as a prohibitionist framework.

With the Proclamation of the Republic (1889), the universal standards disseminated by world powers, such as the USA, France and England, were articulated with the Brazilian republican ideology (TRAD, 2010). The framework of legitimation and institutionalization of psychiatric medicine as a field of knowledge already experienced by Europe, reproduced similar effects in Brazil. Trad (2010) highlights that the State and psychiatric medicine were similar due to their dualistic ideologies about the individual and society: order/disorder, reason/madness, normal/pathological. Thus, as a parameter "Brazilian physicians identified the psychic 'deviation' by observing the habits and behaviors of the population in general and in contrast with the urban world of large metropolises" (ENGEL, 1999 apud TRAD, 2010, p. 106).

During this period, numerous legislative changes were felt, based on international agreements, such as the Hague Convention (1912), [4]which committed to strengthening control over the growth and use of drugs such as opium and cocaine. In 1921, the government issued a decree that established punishment for all types of use of opium, morphine, heroin and cocaine. There was also the first typification of the drug addict, followed by the institution of sanatoriums for hospitalization, whether requested by the family, judge or the user himself (TRAD, 2010).

With the Vargas Era, the State's role as a regulator and controller over drug use was intensified, establishing a specific body to fulfill this task - the National Narcotics Inspection Commission (CNFE) - in 1936 (TRAD, 2010). Among the CNFE's attributions were the establishment of standards and supervision of the production, sale, purchase and repression of the use of narcotic substances. Addiction gained the status of a contagious disease, stigmatizing users as infected people, who should be treated so that they did not spread "the plague". Trad (2010) observes that the care model was based on health intervention, without discussions for the elaboration of preventive actions.

[4] In 1912, the First International Opium Conference took place, held in The Hague, which issued the first resolutions on the international prohibition of the trade and consumption of this substance. In 1961, one of the milestones for the consolidation of the prohibitionist paradigm took place: the 1961 United Nations Convention on Narcotic Drugs, in which countries committed themselves internationally to fight drugs (FIORE, 2012).

The military dictatorship strengthened the prohibitionist-criminalizing discourse, with special repression of Brazilian countercultural movements that were born inspired by student and hippie actions in the USA and Europe around 1960.

> If before the 1960s the consumption of drugs such as marijuana and cocaine was associated with prostitution, criminality and madness, with the military dictatorship drugs were associated with youth, incorporating new meanings into the social imaginary, such as juvenile delinquency and political-social alienation (OLMO, 1990 apud TRAD, 2010, p. 116).

Ribeiro (2013) says that among the first legislative changes introduced by the military regime is the amendment of article 281 of the Penal Code, which now equates the conduct of the person who uses drugs with that of the trafficker, in 1968. The separation between the figures of the consumer and the dealer, that is, the "sick" and the "delinquent", was changed in 1976, with the advent of Law No. 6368/76, which became known as the Narcotics Law. The law provided for different disciplines for the conduct of the user (art.16) and the trafficker (art.12). It is important to emphasize that the changes made did not erase the traces that still stigmatize the user today, equating him with the trafficker. The Narcotics Law marked the structuring of official government measures, presenting actions to prevent and repress the trafficking and misuse of substances that determine physical or psychic dependence. The Law also instituted mandatory medical treatment for individuals with behaviors defined as dependence, says Trad (2010).

The government's priority was the repression of use, sale and trafficking, so financial investments were aimed at reducing supply. To this end, between 1980 and 1993, it established bodies responsible for coordinating research and actions in the field of drugs, such as the National System for the Prevention, Inspection and Repression of Narcotics, the Federal Council of Narcotics, the National Secretariat of Narcotics, linked to the Ministry of Justice. The actions developed by the Ministry of Health, on the other hand, were based on the hospital-centered model, prioritizing hospitalization in psychiatric hospitals, producing practices that violate rights, supported by the criminal/moral/disease model, and promoting incarceration and treatment with the goal of abstinence (TRAD, 2010).

Discontent with the assistance provided erupted social movements and organized groups that placed themselves in a position of criticism of the State, generating changes. The advent of the Federal Constitution of 1988 conferred the condition of public policy to health, social assistance and social security, constituting the tripod of social security in the country. From the Constitution, there is the enactment of the Organic Health Law (No. 8,080/90) and the institution of the Unified Health System (SUS), and later the Organic Law of Social Assistance (No. 8,742/93); The first expanding the concept of collective health and

the second expanding the notion of social assistance network, both, along with other social achievements, refer to bets on the integrality of care and the intersectoriality of actions that expand attention, care and protection to the individual, family and community.

For Trad (2010), these achievements heralded the emergence of a new perspective on the issue of drugs. As a result, pharmacological and criminal criteria gave way to the discussion of a sociocultural approach, pointing to new intervention models, based on preventive education and humanization in user care.

In the context of the drug issue, these changes brought about the institution of the first National Anti-Drug Policy (PNAD), establishing objectives and guidelines for prevention, treatment, recovery and social reintegration, repression of trafficking and studies, research and evaluations resulting from the misuse of drugs. It is important to highlight that the policy recognized, along with other actions, actions to reduce social and health damage as measures to be developed. In 2003, the Ministry of Health presented a Policy for Comprehensive Care for Users of Alcohol and Other Drugs, which clarifies the attribution of the Unified Health System to serve this population and establishes intersectoriality in health-related actions (primary care, CAPS, outpatient clinic, beds in general hospitals and harm reduction).

Later, in 2006, Law No. 11,343 or the Drug Law was sanctioned, which revoked laws No. 6,368/76 and No. 10,409/02, which were in force in the country until then. The new law places Brazil in the spotlight on the international scene in aspects related to prevention, care, social reintegration of drug users and addicts. Among the main highlights is the distinction between users, addicts and dealers and the end of mandatory treatment for drug addicts. The possession of illicit substances continues to be characterized as a crime, but users and addicts will no longer be subject to deprivation of liberty, but to socio-educational measures. Ribeiro (2013) states that despite maintaining the criminalization of the consumption of psychoactive substances, the Drug Law takes a more moderate position on prohibitionist policies. The Drug Law establishes the National System of Public Policies on Drugs (SISNAD), which is responsible for the organization and execution of public actions on drugs in the scope of prevention, treatment and social reintegration and the coordination of actions to repress the production and trafficking of illicit substances.

In 2008, Law No. 11,754 was instituted, which changed the name of the National Anti-Drug Secretariat to the National Drug Secretariat. The change had been awaited since the process of realigning the PNAD, which was renamed the National Policy on Drugs, in 2004. It is important to emphasize that this change is not limited to the simple arrangement of letters, but signals the attempt to address the issue of drugs from a less repressive and

stigmatizing perspective, more welcoming and humanized, although the actions undertaken by the State still adopt as a reference the "war on drugs" model, inherited from countries such as the USA.

The maintenance of obsolete models does not overshadow progress in the field of drug care policies. The proposal for the next few moments is to address in more detail the National Policy on Drugs and Ordinance No. 3,088, which establishes the Psychosocial Care Network to care for people with suffering or mental disorders and with needs resulting from the use of psychoactive substances, since the performance of these actions prioritizes the guarantee of comprehensive care.

THE NATIONAL DRUG POLICY (PNAD)

The National Drug Policy (PNAD) is a milestone for new public policies on drugs in Brazil. Its birth resulted from the interaction between government, society and the scientific community, in a broad process of discussion, with the objective of realigning the policy in force since 2002. The basic assumptions and objectives of the PNAD (prevention, treatment, recovery and social reintegration, reduction of social damage and health, reduction of supply and repression, studies, research and methods of evaluating the effectiveness of actions) were on the agenda of the debates.

The PNAD is based on assumptions, of which the following stand out: the construction of a society free of illicit drugs and misuse of licit drugs, recognition of differences and search for articulation equal treatment of illicit and licit drug users; guarantee of the right to access adequate services for all people who have problems resulting from drug use; priority to prevention actions, due to their effectiveness and low cost to society; recognition of the irrational use of illicit drugs as an important factor in the induction of dependence, and for this reason should be the object of adequate social control; integration of education, social assistance, health and public safety policies; principle of "shared responsibility", which consists of the coordination of efforts between the segments of government and society, seeking the effectiveness of actions to reduce supply, demand and damage resulting from drug use. On the topic of assumptions, PNAD highlights that harm reduction actions cannot be confused with incitement to consumption, as they are preventive strategies.

Some of the objectives presented by the PNAD are: social awareness of the losses and negative implications resulting from the misuse of drugs; education, information and training to the various segments of society for effective action regarding the reduction of supply, demand and harm from drug use; implementation and implementation of the

comprehensive public and private care network for people with disorders resulting from the consumption of psychoactive substances; evaluation and monitoring of the different treatments and therapeutic initiatives, in order to promote those that obtain favorable results; reduction of social and health damage resulting from drug misuse.

When addressing the development of preventive actions, PNAD emphasizes the philosophy of shared responsibility, through the construction of social networks that aim to improve and promote quality of life. The development of these actions relies on the continuous training of the various social actors on the prevention of misuse and licit and illicit drugs and support for preventive activities that consider the individual and his sociocultural context. The policy also deals with the realization of interdisciplinary and multiprofessional work, in order to expand, articulate and strengthen the care networks.

With regard to treatment, recovery and social reintegration, the general orientation is the development of actions so that society, including drug users and dependents, can assume ethical responsibility in treatment, recovery and social reintegration. Treatment and recovery actions should promote family, social and occupational reintegration actions, due to their usefulness in breaking the consumption/treatment cycle.

When discussing the implementation of harm reduction actions, the PNAD recognizes the strategy as a measure of preventive intervention, assistance, health promotion and human rights and provides guidance on the promotion of harm reduction strategies and actions, in an inter and intrasectoral articulated way, aiming at reducing the risks, adverse consequences and damage associated with the use of alcohol and other drugs for the person, the family and society.

ORDINANCE NO. 3,088 AND THE PSYCHOSOCIAL CARE NETWORK (RAPS)

Ordinance No. 3,088, of December 23, 2011, which establishes the Psychosocial Care Network (RAPS) for people with suffering or mental disorders and with needs resulting from the use of alcohol and other drugs, within the scope of the SUS, is addressed here because it highlights the interest of the Ministry of Health in linking the topic of drugs to an articulated care network.

As guidelines, the RAPS: brings respect for human rights; combating stigmas and prejudices; guarantees access to and quality of services that are articulated in order to provide comprehensive care and multiprofessional assistance; it promotes humanized care centered on people's needs; diversifies care strategies; develops territorial actions, considering the socio-cultural dimensions of places and relationships; develops and carries out harm reduction strategies; it emphasizes community-based services, with the

participation and social control of users and their families; promotes permanent education strategies; and develops care strategies that have the singular therapeutic project (STP) as their axis.

As objectives, the Psychosocial Care Network sustains: the expansion of access to the care network; the promotion of the link to people suffering from mental disorders and with needs resulting from the use of alcohol and other drugs to the care services; and the guarantee of the articulation and integration of the points of the network. From these general objectives, specific objectives are established, such as: health promotion to groups in vulnerable situations; the prevention of the consumption of psychoactive substances; the reduction of harm linked to alcohol and drug consumption; the promotion of rehabilitation and social insertion; the provision of information on civil rights, prevention measures and services available on the web; and the permanent training of professionals.

The Psychosocial Care Network highlights the need for integration and articulation of different sectors that offer comprehensive care, obeying the principle of integrality that, together with universality and equity, subsidize the SUS. The constitution of the RAPS includes: Primary Health Care; Specialized Psychosocial Care; Urgent and Emergency Care; Transitional Residential Care; Hospital Care; Strategies for Desistitucionalization and Psychosocial Rehabilitation.

Primary Care, also known as the gateway to the integrated network of health services, aims to offer care to the patient and family in welcoming the demand and directing and monitoring the case in the service network. In Primary Care, Ordinance No. 3,088 highlights the Basic Health Unit (UBS) as reference points, which are services made up of a multiprofessional team responsible for health actions, individually and collectively, aiming at promotion, prevention, diagnosis, treatment, rehabilitation and harm reduction actions. The Primary Care Team for populations in specific situations is another Primary Care device, such as the street clinic team, which is made up of professionals who work in an itinerant way, in order to offer actions and services to homeless populations. The Family Health Support Center (NASF) is made up of professionals from different areas, who work in the matrix support of the Family Health Teams (ESF) and Primary Care Teams for specific populations.

Specialized Psychosocial Care is made up of Psychosocial Care Centers (CAPS), made up of a multiprofessional team, which provides assistance to people with severe mental disorders and people with needs resulting from the use of alcohol and other drugs. The work at the CAPS is carried out primarily in collective spaces, in an articulated way with other points of the care network. The work is carried out with the PTS, built by the team,

user and family. The CAPS AD (Alcohol and Drugs) is the main care device, within the CAPS organization modality (CAPS I, II, III and I), in the care of people with needs resulting from the use of alcohol and other drugs. It is an open service, of a community nature, operating 24 hours a day, including holidays and weekends, as provided for in the ordinance.

In cases of hospitalization or transitional residential services, Residential Care is responsible for coordinating actions. It consists of a Shelter Unit, a point of care that offers continuous health care, operating 24 hours a day, in a residential environment, for people with needs resulting from the use of alcohol and other drugs, in situations of social and family vulnerability, who require transitional protective shelter.

In Hospital Care, specialized wards in General Hospital are articulated with CAPS and other points of the network, offering hospital care for severe cases, especially abstinence and detoxification.

The Deinstitutionalization Strategies are made up of initiatives that aim to guarantee people with mental disorders and with needs resulting from the use of alcohol and other drugs who are in a situation of long-term hospitalization, comprehensive care, through strategies that aim to promote autonomy and exercise of citizenship through progressive social reintegration. Residential services are devices responsible for welcoming people coming from long-term hospitalization.

FOR AN INTEGRATED AND TRANSVERSAL POLICY

The construction of the National Policy on Drugs has in its assumptions the integration and articulation of the various sectors (education, social assistance, health and public security) for the development and implementation of actions that range from prevention to strategies of social reintegration. If the elaboration of the policy, with its priorities and contents, was not without difficulties, the implementation process also involves many challenges.

When the discussion refers to the care of drug users, we find in Public Health Policies a fertile soil, which points to the commitment to germinate strategies that encompass all levels of care. However, in view of the accentuated social vulnerability and the shortcomings not only in the field of health, but also in education, public security and social assistance, the debate on an Integrated and Transversalized Policy is imperative. Because if, on the one hand, we can point to the advances in the care and management of public policies on drugs, with an increase in the levels of universality, equity and comprehensiveness, on the other hand, we see the fragmentation and consequent

compartmentalization of work processes, which weaken and overload the care instances, when they do not fail to assist the user, family and community.

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DEVELOPMENT OF EFFECTIVE TEACHING PRACTICES IN HIGHER EDUCATION IN SOIL SCIENCE

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ABSTRACT

Higher education in soil sciences needs to adapt to contemporary demands, using innovative and interactive pedagogical practices to promote students' autonomy and critical thinking. Teaching should involve the practical application of knowledge, such as the diagnosis of agricultural inputs, to connect theory and market reality.

Keywords: Higher education. Active methodologies.

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INTRODUCTION

We live in an educational scenario in constant transformation, where pedagogical innovation is naturally the great challenge of today's higher education. A relevant aspect of higher education didactics is its ability to adapt to the contemporary demands of education, incorporating technologies, active learning methodologies, and interdisciplinary approaches (Silva et al., 2024). According to the same authors, this didactics of higher education should be converted into pedagogical practice that focuses on the formation and development of effective teaching methods in higher education institutions. Through these innovative pedagogical practices adapted to the needs of students, higher education didactics will promote autonomy, critical thinking, and problem-solving skills (Silva et al., 2024).

Within the aforementioned context, the teaching of soil science, considering its different disciplines, is mostly aimed at a small slice of society, notably the one that reaches the university (Diniz, 2005), in undergraduate courses, for example, in geology, agricultural sciences, biology, environmental engineering, ... and so on. During the school period, the performance of mechanical literature review work during the courses, presented later in the classroom, only to obtain grades and approval, does not seem to be the way to build a more dynamic and effective educational environment. Higher education in soils needs to be bold in its teaching practices, providing quality education, capable of forming critical, creative citizens prepared for the professional challenges of the future (Silva et al., 2024).

Teaching in soil science, as it is an important subject as a natural resource, cannot be neglected in the training of undergraduates, as their knowledge is what governs the internal and external modifications of planet earth, directly influencing human life. Thus, it is worrying to note the difficulty that students have in relating certain theoretical knowledge acquired during the course of the disciplines with their technical, practical and economic applications during their training process. For example, in the disciplines of Soil Fertility and Plant Mineral Nutrition, the fact that students do not know the correctives and fertilizers, their nutrients and their market realities, hinder the relationship between theoretical knowledge and practice, causing discouragement in teaching and learning.

Therefore, there is a great challenge for teachers in soil education, which is to seek to break with the traditional teaching model, in which the teacher is the holder of knowledge and the student is a mere passive receiver (Silva et al., 2024). Students learn best when they are actively involved in the learning process, where they are protagonists of their own educational process. In this way, effective teaching practices in higher education in soil science promoted via research and/or extension will be presented below. Teachers need to find inspiration and resources to transform their lessons into dynamic and engaging

learning environments, through pedagogical approaches that are able to prepare students for an ever-changing world.

DEVELOPMENT

TEACHING PRACTICE I: "DIAGNOSIS OF THE TRADE OF CORRECTIVES AND FERTILIZERS: A NECESSARY PRACTICE TO STIMULATE THE TEACHING OF SOIL FERTILITY AND MINERAL NUTRITION OF PLANTS"

Based on the principles discussed in Freire (1996), when he states that no one teaches anyone, but we learn from each other, it is clear that students needed to maintain social and market relations in their learning process. In this way, some practices began to be adopted experimentally in soil education, notably in the disciplines of Soil Fertility and Plant Mineral Nutrition, initially at the Parauapebas Campus and later at the Capanema Campus of the Federal Rural University of the Amazon - UFRA, in an attempt to contribute to the teaching and learning process in soil science.

Theoretical work passed on by the professors at the beginning of the semester was done in a hurry, practically in the last week of class, and usually only one or two students on the team really worked in a committed way. Practically the only students interested were those who still needed a grade for their approvals. Thus, in place of this inadequate practice, the students have been carrying out a diagnosis of the agricultural houses in the region, where they are put in contact with the local trade of agricultural inputs, to get to know the reality up close and understand what the real technical and economic difficulties are encountered by most producers when investing resources in the purchase of limestone and fertilizers.

When the student experiences the market relations of the rural man through a continuous process of dialogue with society, the transformation of his knowledge happens in real time. In turn, the student is encouraged to be the protagonist of their own learning, developing autonomy, critical thinking, and problem-solving skills (Silva et al., 2024). The use of active methodologies, such as project-based learning that goes beyond the classroom, seeks to involve students in a more direct and participatory way, promoting deeper and more lasting learning.

Methodology

At the beginning of each academic semester, the Soil Fertility and Plant Mineral Nutrition class is divided into several teams, which must carry out a diagnosis of the trade of chemical correctives and fertilizers in the region of the municipality where the UFRA Campus is located, notably in Parauapebas or Capanema in the state of Pará. The students

conducted interviews with the agricultural houses in the municipality, that is, a team for each different commercial establishment (Figure 1).

Figure 1. Facade of some agricultural houses diagnosed as to the sale of correctives and fertilizers.



Source: Prepared by the authors.

The work begins with a discussion in the classroom with the teacher about what correctives and fertilizers are, reaching the elaboration of a questionnaire based on some basic questions (Chart 1).

Table 1. Main questions made (script) by the Soil Fertility and Plant Mineral Nutrition classes that participated in the diagnoses of the agricultural houses.

a) For the Corrective:
▪ Do you sell any kind of limestone?
▪ Which one or which?
▪ Is there always for immediate delivery or should I place an order?
▪ Is it sold in bulk, in bags (how many kg?) or only closed trailer?
▪ Where does your limestone come from?
▪ What are the main specifications (PRNT and PN) of the product?
▪ What is the current price? and What is the cost of freight to deliver to the property?
▪ When is the peak season?
b) For fertilizers as isolated sources of N, P and K:
▪ What are the fertilizers as isolated sources of N, P and K do you have to sell under prompt delivery?
▪ Which ones need to be ordered?
▪ What are the best sellers?
▪ What are the current prices?
▪ Are they in granulated or powdered form?
▪ What is the form of sale? (in bulk and/or in a bag of how many kg?)
▪ Where do fertilizers come from? (see which manufacturer company)
▪ Delivery to the property? and What is the cost?
▪ When is the peak season?
c) For NPK formulations:
▪ What are the best-selling formulations and which are available for immediate delivery? (he had tried to find out why)
▪ Which ones are still sold, but only by order?
▪ What are the current prices?
▪ Are they in granulated or powdered form?
▪ Where do fertilizers come from? (see which manufacturer company)
▪ Delivery to the property? and What is the cost?
▪ When is the peak season?
(d) additional information or information on other fertilisers:

Source: The authors.

Subsequently, each team goes to a different commercial establishment in the region to carry out the interviews, apply the questionnaire and other surveys (Figure 2). By having the opportunity to see, touch and handle the stored inputs, students begin to visually recognize each input, linking them to their technical characteristics and forms of action in the soil, without losing sight of the economic aspects of commercialization (Figure 3). On the return to the University, the data are discussed within the teams and presented in the classroom in the form of an expository, with the democratization of the acquired knowledge and the technical and academic debate, already giving direction in the final considerations of what are the procedures for the second teaching practice, presenting this information to the rural producers.

Figure 2. A team of students from the disciplines of Soil Fertility and Plant Mineral Nutrition applying questionnaires to diagnose the market for correctives and fertilizers.



Source: The authors.

Figure 3. Teams of students from the discipline of Soil Fertility and Child Plant Nutrition in the warehouse of commercial establishments identifying available correctives and fertilizers, as well as the storage and marketing conditions.



Source: The authors.

Results and Discussion

Prior to this teaching practice, more specifically when addressing in the classroom the content of interpretation of soil fertility analysis and the mineral nutrients essential to the life of a plant, a certain difficulty in understanding was perceived by most students. The question did not cause a collective lack of interest in the subject, but it caused some frustration or even discouragement in the learning process. Much of this was due to the fact that many students did not know, if not visually, the fertilizers to be worked on, nor whether or not they were sold in the region and what nutrients they provided. It is of fundamental importance that the university leaves its "walls" and places its students closer to the real world and at the disposal of the basic interests of society (Lima et al., 2021).

It is impressive how a simple practice such as having students diagnose local commerce allows them to cross the limits of the University, enriches their experience and knowledge. The student stimulus is latent for everything that is to come in the discipline of Soil Fertility and Plant Mineral Nutrition. During the semester, as soon as the discussions about fertilizers and fertilizers begin, the students will really know which are the most common inputs in the region, which ones need to be ordered in advance, what are the prices of inputs and freight and the technical parameters related to plant nutrition. Therefore, not only technical knowledge about correctives and fertilizers are necessary for the interpretation of soil analyses and fertilization calculations, but also economic knowledge of the market for these inputs, especially regarding the local trade of dolomitic limestone and NPK fertilizers available to technicians and producers (Alcarde; Guidolin; Lopes, 2014). In this way, the student will be able to put into practice the knowledge acquired in the academy, developing the ability to dialogue with society, exchanging knowledge, articulating academic knowledge with reality (Lima et al., 2021).

All the aforementioned context facilitates the learning process throughout the disciplines, from the interpretation of soil fertility analysis, to liming and fertilization calculations, reaching plant nutrition to its production. The student begins to realize that fertilizing is not only the act of "throwing" fertilizer on the soil, but that fertilizing is effectively understanding soil fertility and plant nutrition, applying inputs in a technical, economical, and sustainable way. This adopted methodology encourages student participation through practical, collaborative and reflective activities. They also encourage the development of socio-emotional skills, which are fundamental for professional and personal success. All of this not only improves knowledge retention but also develops critical and problem-solving skills (Silva et al., 2024).

A finding, specific to the Amazon region, that students usually detect, is that the high cost of correctives and fertilizers is evident, mainly due to the value of freight. This ends up affecting the supply of traders and the demand by producers, considering the high cost of logistics for production and transport, as well as for commercialization in a regionalized way. In the field of research, the importance of establishing a participatory research linked to the area of soil science has already been demonstrated, aiming at the exchange between the academic environment and the rural environment, in order to consolidate teaching and extension within the research action. Thus, there is a challenge for higher education educators to rethink their academic practices, and to adopt strategies that value the personalization of learning in soil science and its interdisciplinarity.

The teaching practice reported so far helps in the training of future professionals in Agricultural Sciences and other related areas, so that they can make technical and economic decisions about which correctives and fertilizers should be used. With this, year after year, the study of Soil Fertility and Plant Mineral Nutrition has been boosted, with regard to the teaching of content about fertilizers and fertilizers, allowing the evolution of knowledge in line with the reality of the local market of correctives and fertilizers. This preparation of the student to work with the community from the time he is in the academic environment is a way to encourage the student's protagonism and make available to the job market more complete professionals in their training (Paula et al., 2023). This should contribute significantly to the change in the training of the professional profile, especially of students trained in the agricultural sciences courses at UFRA (Santana et al., 2003).

TEACHING PRACTICE II: "PRESENTATION OF WORKS BY HIGHER EDUCATION STUDENTS TO RURAL PRODUCERS DEVELOPED IN DISCIPLINES RELATED TO SOIL SCIENCE"

It is another effective teaching practice, also with the extension bias, which stimulates students, aiming at their commitment and application in the preparation and execution of their academic work, where at the end of them the presentations will be made to rural producers, sharing their knowledge in a responsible and real way, while society lends and transmits its values, desires and culture. The participation of rural producers is of the utmost importance in the generation of knowledge for themselves and in the training of students, having, as a perspective, the intervention in the social, economic and environmental reality. Therefore, practices such as these in higher education play a key role in the training of students, as it goes beyond the transmission of content and involves the creation of meaningful learning environments.

Papers presented in the form of seminars, only in the classroom for the teacher, tend to generate a very small sharing of knowledge between the teacher and the team that did that work. In general, the other teams do not make an effort to attend and participate in the discussions of the work of other colleagues. Each one is only interested in his merely mechanical evaluation to obtain a grade. In this way, the new practice adopted contributes to the integral development of individuals, preparing them not only for the job market, but also for conscious citizen participation in society (Silva et al., 2024).

The theme of education in soils should not be neglected, and in this conception, dialogue cannot be reduced to the act of the teacher depositing ideas in the student subject, nor to the simple exchange of ideas within the classroom (Muggler et al., 2006). It is necessary for students to approach reality, in a protagonist way, through a two-way street between academia and society. This is nothing more than a pedagogical process of extension, which is not a novelty in the higher education environment, where currently, through the so-called "curricularization of university extension", it has been established as a mandatory curricular component in the academic training of students and as a transformative contribution to society (Paula et al., 2023). The extension disciplinary activities practiced are potential mechanisms to make classroom learning be applied in practice, which will make the content learned more participatory and meaningful for students (Vieira, 2020).

Methodology

At the beginning of the semester, based on the different works that were planned in the preparation of the teaching plan of the disciplines of Soil Fertility and Plant Mineral Nutrition, among them the "Diagnosis of the trade of correctives and fertilizers", it was implemented, as a form of culmination, the presentation of the works to rural producers in the municipality, with the protagonist performance of the students effectively evaluated, generating participation in its final grade.

The class, already divided into teams, based on the realization of their previous practices, was responsible for preparing a practical presentation in the form of interactive stands, indicating the main correctives and fertilizers for the region, in the specific case of the work of "Diagnosis of the trade of correctives and fertilizers". Thus, together with the producers, their needs were characterized in terms of soil fertility and plant mineral nutrition. The main purpose was to relate the proper management of soil fertility with the mineral nutrition of the species used, aiming to move towards a better environmental, economic and productive sustainability of the region, concomitantly with the practical academic learning of undergraduate students.

The great differential for the students of the two extension teaching practices mentioned above, carried out in an integrated way, was the responsibility that at the end they would have to present their work to rural producers. The teams had to prepare a true portfolio of information, as the presentation would no longer be only for the teacher in the classroom. The students would have to make themselves understood in the dialogue that would take place between the academic environment and the rural environment.

Usually, the presentations are made to small producers in the municipality and region, often indicated by people linked to university extension and rural extension. All logistics made with resources from the university, but also being able to count on partnerships, such as the transportation of students and teachers to the producers' association, the municipality provided a school bus (Figure 4). Thus, the teacher is seen not only as a transmitter of knowledge, but as a facilitator and mediator of learning, as an environment conducive to the construction of knowledge has been created (Silva et al., 2024).

Figure 4. Displacement of professors and students to present the works, developed as part of the evaluation of the disciplines of Soil Fertility and Mineral Nutrition of Plants to rural producers.



Source: The authors.

Results and Discussion

At the end of the semester, the presentation, for example, of the work "Diagnosis of the trade of correctives and fertilizers", caused a lot of anxiety on the part of the students. They were aware of the responsibility of interacting with a community of rural producers and their association, when they had to present their work. For the producers, it is usually a real event, and they mobilize to organize the meeting in the form of a beautiful event, even if in a simple way in a shed covered with straw (Figure 5). It should be recognized that the learning process is the result of the interaction of the student subject, with the environment and with all its social and cultural conditions where his professional performance will occur (Rosa, 1997).

On the day set by the producers, the work of all the Soil Fertility and Plant Mineral Nutrition teams is presented, as well as other disciplines of the same semester (Figure 6). It is noteworthy that in addition to the teachers of these subjects, teachers from other disciplines also participate, and they, in a multidisciplinary way, are also responsible for evaluating each team. The average of the evaluations of the teachers involved generates the final grade of the students. Dialogue should be the best way to teach, because, in this way, there is no imposition of knowledge, but an exchange that results in benefits for both the student and the rural producer, regardless of who is passive or active in this process of interaction (Freire, 1996).

Figure 5. The presentation of the students' work was organized by the community of small rural producers in the form of a beautiful event.



Source: The authors.

Figure 6. Presentation of the works to rural producers in a community within an Association of Rural Producers.



Source: The authors.

The impact of the action is so great that it generates a mobilization in the municipality as a whole, as authorities linked to the rural environment are also present to participate, such as: the secretary of agriculture, the head of IBAMA and representatives of private companies (Figure 5). There is a true exchange of experiences, demonstrating that the University really must go beyond its walls and act effectively with its community. This allows the full development of the student in the professional and social spheres, that is, the student learns at the same time as he teaches. The educational process must reach all the actors involved; students and producers, because there is an interaction in the dialectic in the teaching and learning process, where both have become subjects of knowledge, constituting a two-way street in the search for a coherence between theory and practice.

The responsibility of the students and the seriousness of having to face, perhaps for the first time, an audience eager for information, makes all the students engage, taking to the producers in addition to oral and merely expository communication, different visual resources, such as: posters, flip chart, folders, booklets, realhas, collection of fertilizers, seed samples, tools, augers used for soil collection and plants developed in pots (Figure 6). The reported extension teaching practices, observed from the point of view of "emancipatory intentionality", will have a positive impact on the broad training of new professionals, as it is being offered the opportunity for undergraduate students to experience their academic theories in the practice of society, strengthening their citizenship education (Lima et al., 2021).

In this way, after the implementation of the two integrated extension teaching practices discussed so far, students are able to understand more broadly what is the true role of the study of soil fertility and plant mineral nutrition, as they begin to have the perception of analyzing, together with the producer, how and why the soil has certain attributes. Thus, the student will be able to solve the problem technically after interpreting the soil, explaining the reason for the problem to himself and effectively solving the producer's problem. Know the inputs, correctives and fertilizers, dialogue with the producer and, after recommendations, know if the problem will return; This is the broadest sense of understanding soil fertility and plant mineral nutrition.

The establishment of extension teaching practices such as those reported here or in their different configurations, should now occur more frequently in higher education institutions with the advent of the "extension curricularization", which by the National Education Plan (PNE), mandatorily provides for the inclusion of at least 10% of the total curricular credits required for graduation in extension actions (Paula et al., 2023). In this sense, through extension actions, teaching practices that transform society can be

provided, in view of their characteristics of socialization, integration, cooperation, and participation, which lead the knowledge and professional practices generated and learned at the university to society (Lins et al., 2016).

University extension actions are powerful instruments to put teaching in the classroom into practice, which will make the content to be learned more meaningful to the student, making them able to translate theoretical concepts into responsible practices towards the community (Vieira, 2020). The protagonist participation of the students from the planning of actions in the classroom to the presentation to the producer was a fundamental experience not only for technical and scientific training, but also for allowing them, from an early age, to maintain important social relations with the farmer and to experience market relations. Therefore, university extension is a powerful tool, meeting the demands of social relevance, allowing it to also reach its pedagogical dimension in the training of undergraduate students.

TEACHING PRACTICE III: "IMPLEMENTATION OF EXPERIMENTS RELATED TO SOIL SCIENCE IN AREAS OF RURAL PRODUCERS: A CONTINUOUS DIALOGUE BETWEEN COMMUNITY AND UNIVERSITY"

The soil theme, even though it is an essential component of the environment, is neglected since basic education and, several times, it is disregarded and devalued, not receiving the attention and care necessary for its protection and conservation (Jesus et al., 2013). In addition, didactics in higher education is also related to building a closer relationship between professors and students, favoring effective communication, constructive feedback, and encouraging the active engagement of students in their own learning process (Silva et al., 2024).

In universities that offer courses related to the teaching of soil science, regardless of the importance and relevance of the disciplines, a large part of academic research is carried out through scientific experiments carried out in laboratories and greenhouses. Classical statistical designs are usually used in agronomic research, which considers small plots in homogeneous areas (Silva, 2013).

The research carried out in the field is often implemented within the university's premises or even in experimental units belonging to them. Thus, only at the end of the research, after some presentations of partial results at scientific congresses, or even in the form of a full article published in a journal of a recognized editorial board, the information is disclosed in a restricted way. It is unlikely that, after all the effort generated before, during and after the conduct of the experiments, the final result of a research will reach the knowledge of rural producers.

The distance between research, extension and producer is historically an obstacle in rural development programs (Silva, 2013). It is logical that, in order to minimize the

distortions previously reported, some research bodies have their technology diffusion centers. Research cannot have, as its sole principle, the generation of specific knowledge to be transmitted vertically to those served by its results. Thus, the very transfer of technology has been questioned in its conception and efficiency. In addition, one cannot forget the pedagogical role of research in the training of students.

Most teaching and research institutions have developed work based on the linear model of technology transfer, in which research generates knowledge, extension transfers and the farmer adopts. This approach has been questioned due to the low appropriation by farmers. This is mainly due to the little weight given to the local values of these workers, to the detriment of global ones.

Producers, in the same territory and productive arrangement, react differently to the incentives received (Lima; Gomes, 2014). Several projects are doomed to failure because they are standardized, so that the uniformity of the information pointed out to the producers does not correspond to the diversity of the situations they experience (Dufumier, 2007).

With research restricted to the walls of universities, a great opportunity to disseminate knowledge in the field, in a natural way and in real time, is lost. A research conducted in the area of a producer becomes a true demonstrative unit, in addition to achieving the objectives preconceived by the teacher-researcher. It is believed that the implementation of research in areas of rural producers allows, in addition to obtaining its final result, that several stages of knowledge are made available, also enabling the action of teaching and extension.

Using Haguete (1987), participatory research is a good alternative for the generation of scientific knowledge, in a concomitant process on the part of the research center and the researched center (rural community) [...]. Participatory research also allows for an educational process, which seeks the "intertransmission" and "sharing" of the knowledge already existing in each pole, provoking immediate changes that go beyond the scope and temporality of the research.

Still in relation to participatory research, Uhde et al. (2014) clarify that participatory research has the emancipatory and transformative purpose of discourse, conducts and social relations, that is, a modality of social research, in which there is a dialogue between the researcher and the researched who are involved in the solution of a problem detected in order to, then, set up strategies aimed at solving the detected issue.

Thus, it is important to implement scientific experiments related to soil science in the areas of rural producers, aiming at the exchange between the academic environment and the rural environment, through a continuous dialogue, in order to establish teaching and extension, in addition to the final result of the research.

Methodology

Considering and recognizing the responsibility and social relevance of the University, as well as the potential of university extension in its dialogical conception of social intervention, below is the report of a proposal for the construction of solutions for development with sustainability applied by the Federal Rural University of the Amazon - UFRA in rural communities.

The first practice of connection between teaching, research and extension emerged in 2003 from a need, from the advanced campus of UFRA in Parauapebas (PA), at the time newly created. Being a new campus, with a structure still under construction to serve teaching, research and extension, it was decided to establish the first field experiments related to soil sciences in the areas of rural producers. The purpose was that, in addition to the research itself, it would be possible to establish partnership ties, taking, directly and indirectly, teaching and extension, with interaction between the academic environment and the rural environment, in the form of participatory research.

The idea of participation involves the active presence of professors/researchers, undergraduate students and a certain part of the population in a common research project that is at the same time presents an educational process, produced within the action of research/extension (Haguete, 1987). Therefore, the present study was carried out considering the intentions of participatory research, according to Chart 2.

At first (diagnosis of the community), the Association of Rural Producers of the APA of Igarapé Gelado (APROAPA) was sought, through its president, which led to the holding of a first meeting with the associated producers (Figure 7). Initially, the main problems of its agricultural production were discussed, defining that the university would act in the recovery of degraded pasture areas (determination of problems and hypotheses). Then, the possibility was launched for the rural producers present to make areas available for the development of experiments that would provide solutions for the recovery of degraded pastures (characterization of the actors involved). It was defined by the use of three properties, in which the university would implement experiments related to the recovery of worn pasture areas, focusing on topics such as: soil fertility, no-tillage, crop-livestock integration, forage, pasture management, entomology (study and control of mound termites

and pasture leafhoppers) and application of steel slag (a by-product of the pig iron industry that can be used as fertilizer and soil corrective alternative).

Table 2. Main procedures in participatory research (limitations and potentials).

Procedimentos	Limitações	Potenciais
Diagnóstico das comunidades	Impossibilidade de um completo diagnóstico da realidade e pretensões das comunidades.	Permitir ao pesquisador inteirar-se dos problemas da comunidade, conhecer a sua evolução histórica, social e cultural.
Caracterização dos atores envolvidos	Desconhecimento do nível de comprometimento com o trabalho de cada participante, bem como diferentes objetivos individuais.	Escolher membros da comunidade para desenvolver o trabalho, os quais irão difundir os resultados obtidos.
Determinação dos problemas e hipóteses	Os problemas levantados podem ser casos extremamente particulares que dificultam o trabalho grupo	Escolha de problemas de interesse comum, os quais estimulem os atores na busca de soluções.
Proposição de alternativas aos problemas e hipóteses	As alternativas levantadas podem ser adaptadas a pequenos grupos e não a toda comunidade.	Utilizar o conhecimento local, junto com o conhecimento científico disponível, buscando alternativas de interesse da comunidade
Elaboração do projeto	Dificuldades na adequação científica do projeto	O conhecimento científico disponível e as alternativas propostas podem ser mesclados, construindo novas perspectivas
Condução dos trabalhos	Os atores podem não estar suficientemente estimulados a participar do projeto originando falhas na sua condução	Os atores, adquirirão o conhecimento prático das alternativas, as quais podem ser difundidas aos demais membros da comunidade economizando esforços da extensão rural
Avaliação final	Em função da condução inadequada podem inferir em conclusões equivocadas ou levadas a super valorização de uma determinada alternativa.	Estimular os participantes, construindo resultados a partir de sua própria experimentação, despertando para novos estudos e elaboração de conclusões adaptadas localmente

Fonte: Silva (2013)

Figure 7. First meeting of UFRA (Campus de Parauapebas - PA) with rural producers belonging to APROAP to enable the implementation of experiments on their lands.



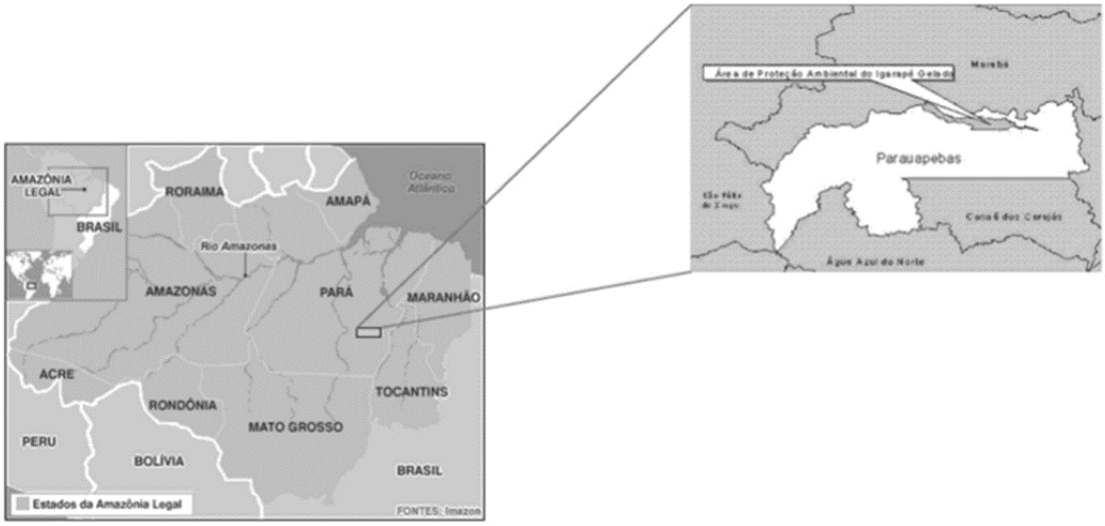
Source: The authors.

The awakening to the elaboration of participatory research projects took place, mainly, through meetings between the actors, in which each participant had the freedom to

question and launch proposals, establishing goals of common interest, without losing methodological rigor and not always reaching a consensus. This practice of participatory research was also used as an effective and active methodological tool for learning, showing itself as an innovative approach in the higher education process, centered on the student as the protagonist of his own education.

Regarding the conduction of the work, the experiments were implemented and conducted in rural properties in the Environmental Protection Area (APA) of Igarapé Gelado, from 2006 to 2010 (first phase of the project). The experimental areas were located at the intersection of the Igarapé Gelado and the Carajás Railroad (Figure 8).

Figure 8. Location of the Igarapé Gelado Environmental Protection Area. Parauapebas - PA.



Fonte: Imazon (2011).

As a reference, we have latitude 06°00'10"S and longitude 49°57'43"W, 30 km from the municipality of Parauapebas, Pará. The average annual temperatures, in general, are higher than 23°C, average rainfall of 1,700 to 2,000 mm $^{year-1}$ and average relative humidity of approximately 70% in the dry season. The APA of the Igarapé Gelado has most of its relief classified as flat to smooth undulating (up to 8%), in which a large extension is formed by Ultisols (Embrapa, 2006).

The selected properties represent the reality of the municipality (lots with a maximum of 75ha), a former agrarian reform settlement, with *Brachiaria brizantha* pastures, formed more than fifteen years after the primary forest was cut down. These properties have, as their main activity, dairy farming, a predominant characteristic in the region.

Prior to the installation of the experiments, the renewal of pastures in the selected experimental areas occurred through soil preparation, which included raking, using a crawler tractor with blade (D6R-XL), and the removal of stumps, tree weeds and termite

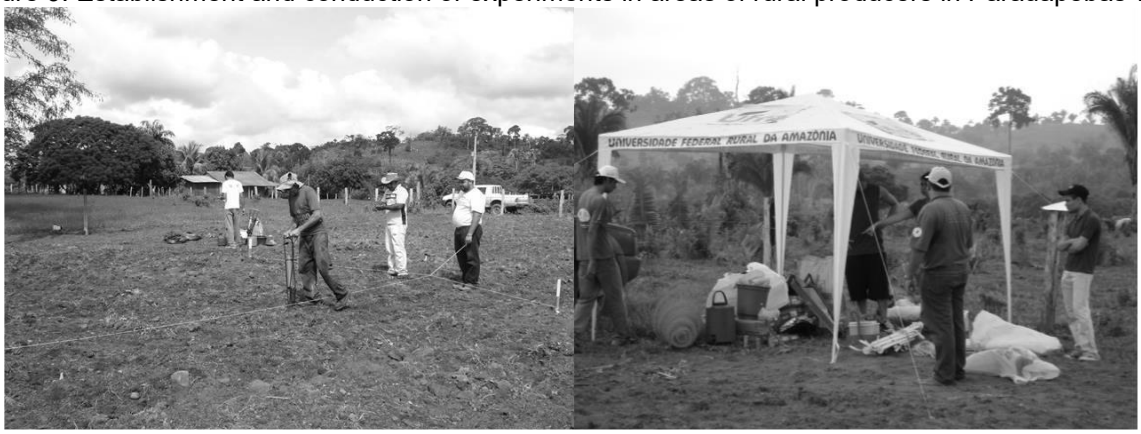
mounds. Subsequently, the tire tractor with a harrow was used, with the intention of eliminating the smaller vegetation. Then, the second harrowing was carried out in the area, with the use of the tire tractor only with the drag harrow, aiming at leveling. Beaconing, staking and the installation of rain gauges were carried out in the various experimental areas.

Results and Discussion

Naturally, at first, there was some distrust of rural producers, as some resisted and were not willing to make areas of their properties available for the installation of experiments. In subsequent meetings, it can be detected that the reason for the aforementioned problem was the fact that experiences of previous partnerships between researchers and rural producers were not successful. According to the producers, researchers from other institutions had already worked there, however, as reported: " they collected what they wanted, left and left us nothing as a teaching in favor of the development of the community ". This is a strong indication of the decadence of traditional research, in which researchers often do not return the results of their research to their objects of study. This is more difficult to occur in research carried out in a participatory way.

Once the first obstacle was overcome, it should be emphasized that all the activities of implementation and establishment of the experiments were, day after day, actively monitored by all the producers in the region, with the democratization of everything that was happening in the ordinary meetings of the association. From a scientific point of view, any participatory research can be carried out in a coherent way, as long as all participants are engaged in the objective of the work and that correct analysis alternatives are used, based on available scientific knowledge and local contributions, in the preposition of new alternatives and results (Silva, 2013). Therefore, the work was implemented and conducted, with a large flow of professors, students and producers in all stages of the execution of the experiments (Figure 9).

Figure 9. Establishment and conduction of experiments in areas of rural producers in Parauapebas-PA.



Source: The authors.

The students exercised teaching and training, in which teaching and research took on an emancipatory sense, as research is done to know what is not yet known, and to communicate or announce the novelty (Freire, 1996). The participation of the students in the experiments was a fundamental experience not only for technical and scientific training, but also for allowing them, from an early age, to maintain important social relations with the countryside and to experience market relations. Several students did internships recognized by the university, others obtained scholarships from the Institutional Program for Scientific Initiation Scholarships (PIBIC/CNPq), and even a master's thesis was developed from experimental areas (Pinheiro, 2010).

This experience report allowed us to better understand some principles discussed by Silva et al. (2024), where learning becomes more meaningful and applicable to everyday situations, contributing to the promotion of autonomy and intrinsic motivation of students, essential factors for effective and lasting learning. Returning to Haguete (1987), we emphasize that, at certain moments of the research (and our experience shows this), the educational process reached the team involved and researchers and participants interacted in the dialectic of the teaching/learning process (they all became subjects of knowledge) constituting a two-way street in the search for praxis.

With the same importance as they were for academic training, the experiments linked to soil science in rural areas made it possible for all producers in the region in question to have the opportunity to follow the entire process of knowledge construction. The rural environment was actively involved in the teaching process, with significant learning in soil science, in which teaching was not only the transfer of knowledge, but the creation of possibilities for its production or construction (Freire, 1996).

The producers were able to analyze new techniques, follow the data collection and discuss among themselves and with the research professors, drawing their own

conclusions. Taking into account the components of participatory research – investigation, education and action – Haguete (1987) defined participation as an action reflected in an organic process of change, whose protagonists are the researchers and the population interested in change.

Another interesting fact observed was the report of some producers that if a few years ago they had had access to the information acquired today, their properties would not have so many degraded pastures or those in the process of degradation. Thus, the need to make knowledge about soil reach all spheres of society for an awareness of sustainability became evident.

During the construction of new knowledge, following the experiments and in direct contact with the academic environment, the producers realized that, from now on, they could carry out some low-cost practices of soil management, phytotechniques and animals, to avoid the degradation of their pasture and soil. This reinforces that in participatory research, the researcher usually returns the data to the community studied for possible interventions (Demo, 2000). This type of research cultivates scientific neutrality and presents a double challenge: to research and to participate, with the concern of returning the information collected to the population, with coherence between theory and practice (Thiollent, 2002).

In subsequent meetings, to evaluate the projects in progress and the partial results of some experiments, several producers who were initially reluctant made their areas available for the development of new participatory academic research projects. An important communication channel between the community and the University was opened, and could be expanded in a more expressive way, thanks to the development of the idea of dialogue between researchers and producers and not about them.

Freire (1996) believes that dialogue is the best way to teach, because, in this way, there is no imposition of knowledge, but an exchange that results in benefits for both the educator (researcher) and the learner (rural producer). In this context, the subject (learner/rural producer) is neither active nor passive, he is interactive; and, from this interaction of the subject with the environment, with language as the main mediating agent, learning occurs (Muggler, 2006).

In short, participatory research, as an excellent alternative, refers to the need not only for the insertion of the researcher in the environment, but also for an effective participation of the researched population (through dialogue) in the process of knowledge generation, fundamentally conceived as a process of collective education, in order to minimize social inequalities in their most varied shades (inequality of power, to know,...

etc.) (Haguete, 1987), because education promotes the opportunity for the individual to build a critical consciousness, promoting the transformation of the subject (Freire, 1996). Therefore, the participation of rural producers is of the utmost importance in the formation and execution of research projects developed in rural areas (Lima; Gomes, 2014).

TEACHING PRACTICE IV: "AN EXPERIENCE IN THE TEACHING OF SOILS OF THE DEGREE COURSE IN NATURAL SCIENCES – UFRA/PARFOR DOM ELISEU, PARÁ"

PARFOR is the result of a set of actions by the Ministry of Education - MEC, in collaboration with the state and municipal education departments and public institutions of higher education, to provide free and quality higher education courses to teachers working in public schools without adequate training (Ufra, 2014). In the state of Pará, the Federal Rural University of the Amazon is present in the municipality of Dom Eliseu with the Degree in Natural Sciences, and the discipline of Geosciences aims to provide knowledge about the geological phenomena that govern the internal and external modifications of the Earth and understand their influences on human life, however, no focus has been given to soil science in the context of the discipline (Ufra, 2014). And the soil, as it is an important subject as a natural resource, cannot be neglected in teacher training.

Thus, this work reports the actions that were carried out in the municipality of Dom Eliseu, southeast region of the state of Pará, using as teaching practice the material "Experimentoteca em solos" as a way to provide basic knowledge about soil science in the training of basic education teachers.

Methodology

From January 6 to 11, 2014, Geosciences classes were taught to students of the undergraduate course in Natural Sciences in the municipality of Dom Eliseu, southeast region of the State of Pará. The undergraduate course in Natural Sciences is part of the National Teacher Training Program (PARFOR), and in the municipality of Dom Eliseu the Federal Rural University of the Amazon is the institution responsible for the execution of the program.

During the elaboration of the teaching plan of the discipline of Geosciences, it was detected that the syllabus of the discipline described in the Pedagogical Plan of the Degree Course (PPC) in Natural Sciences, did not address contents about the teaching of soil science. And the objective of the Geosciences discipline was only to provide information for the knowledge of the internal and external geological phenomena of the earth and to understand their influences on human life. Thus, the following subjects were included: Weathering in soil formation; The ecological function of soil and; the soils of the Amazon,

and a didactic activity with soil samples in the classroom. The students of the Licentiate Degree in Natural Sciences are predominantly teachers of basic education in the municipality, average age group of 30-35 years old and most with more than 15 years of experience in basic education. It was proposed to include the new subjects in the course syllabus, as it would complement the study of the process of earth formation with the formation of rocks and their weathering, and the formation of soil as an essential component of the ecological relations of the earth and humanity.

As for the subject "The soils of the Amazon", the objective was to provide information on the main physical and chemical characteristics of the soils of the Amazon and their aptitudes and limitations. Relating them to the economic, social and environmental reality. The current situation of the municipality of Dom Eliseu was used, as its main economic activity is agriculture and livestock, and to a lesser extent forest production. To carry out the didactic activities, the materials created by the team of the Soils at School Project of the Department of Soils in Agricultural Engineering of the Federal University of Paraná, called "Experimentoteca em solos" (Ufpr, 2005), were used. In the didactic activity, the students were organized into four groups, and each group was responsible for carrying out the didactic experiments and explaining the theoretical foundations during the conduction of the experiments. For this, previously the didactic class, printed materials were passed on to the teams to study.

The didactic experiments carried out were: 1 – soil texture, 2 – soil consistency, 3 – soil porosity and 4 – water and wind soil erosion. After the presentation of the didactic experiments, questions were asked to the other students in the class about the activity presented, following the questions suggested in the printed material of the "Experimentoteca em solos" (Ufpr, 2005).

Results and Discussion

The students did not encounter difficulties in carrying out the didactic experiments. Due to the versatility in the acquisition of materials and the ease of conducting the experiments, the students reported that they would carry out the Experimentoteca in the disciplines that are responsible for teaching classes in basic education.

In the didactic activity regarding soil texture (Figure 10), the first team presented two soil samples: sandy soil and clay soil. Through touch analysis, they were able to demonstrate the feeling of roughness of the sandy soil and silkiness of the dry clay soil. With this information, the students emphasized that in the field, it is possible to have general information on the predominance of soil texture, and that only by laboratory

analysis is it possible to identify and classify with greater precision the granulometric composition and textural classification of the soil. In addition, they found that different proportions of sandy and clayey materials modify the soil texture, and consequently, each type of soil has intrinsic characteristics due to the presence of water, sand, clay that vary in proportion to the constitution of each soil.

The second team was able to discuss what soil consistency is (hardness, friability, stickiness, plasticity) (Figure 11). The practical aspects of consistency, which were easily observed by the students, were the hardness that certain soils present when dry, or the stickiness that some present when wet, especially clay soils. They were also able to argue that consistency can vary along the soil profile, in its different horizons.

The third team achieved the objective of the experiment on soil porosity (Figure 12), demonstrating the existence of pores with the undisturbed samples collected, the infiltration of water in the soil occupying the porous spaces and demonstrated that in the porous spaces of the soil there is the presence of air. And that in these small empty spaces called soil pores, the air and water that the roots of plants and other organisms need for their hydration and respiration are stored.

The fourth team, when exposing soil erosion, demonstrated wind and water erosion outside the classroom (Figure 13). He was able to discuss that erosion is the dragging of particles that make up the soil, by the action of moving water, resulting from rainfall, or by the action of winds and waves. And that the two main agents of erosion are rainfall (water erosion) and wind (wind erosion). And that the action of rainwater is what causes the greatest damage, as it removes the surface layer of the soil, and promotes siltation of rivers and lakes. The process tends to accelerate, as more land is deforested for logging and/or agricultural production, since the soils are unprotected from vegetation cover and, consequently, the rains fall directly on the surface of the land.

Figure 10. Presentation of team 1 on soil texture.



Source: The authors

Figure 11. Presentation of team 2 on soil consistency.



Source: The authors

Figure 12. Presentation of team 3 on soil porosity.



Source: The authors

Figure 13. Presentation of team 4 on soil erosion.



Source: The authors

Regarding erosion, the other students reported the effects that agriculture with intensive soil mobilization and absence of effective soil cover, in the municipality of Dom Eliseu has caused serious environmental damage over the years, such as the silting of the rivers of the municipality. As a proposal to solve the problems, they indicated the use of conservation practices that reduce the problem of soil erosion and siltation of water sources.

Finally, regarding the characteristics of the Amazonian soils studied, they reported that some geography books generalize by commenting that Amazonian soils are unproductive and have serious limitations to agriculture. They found that the main limitations are chemical, but most soils have physical properties favorable to mechanization, as they do not have limitations regarding physical impediment such as shallowness, rockiness or stony in the soil profile, and that they are soils that have good capacity for infiltration and storage of water in the soil profile.

FINAL CONSIDERATIONS

The teaching practices reported can and should be adopted in an integrated way, helping in the training of future professionals, as demonstrated. The significant impact of active methodologies employed on the motivation and engagement of students in higher education in soil science was evident. However, the implementation of the teaching practices presented here requires a decisive change in the teaching methodology regarding the planning and structuring of classes.

The first two teaching practices developed were carried out in an integrated way, being clearly promoted through extension. Thus, the students, by maintaining direct contact with the market and with the rural producer, developed the security so that they can make technical and economic decisions in the future about which correctives and fertilizers should

be used. This dynamization of the teaching of Soil Fertility and Plant Mineral Nutrition, notably with regard to the teaching of content on correctives, fertilizers, fertilizers and nutrition, allows the evolution of knowledge in line with the reality of the local market and the reality of the rural producer's field.

Not only issues related to Soil Fertility and Plant Mineral Nutrition, but also any and all information generated within the academic environment can and should be shared with those who are of interest, strengthening higher education and social relations between students and rural producers, for example. Regardless of the discipline or content, the form of evaluation suggested here, with the presentation of the works to a certain target audience within society, can perfectly be employed, developing the student's applied skill and obtaining a broad and quality learning.

In the third teaching practice, the research presents its pedagogical facet, where all actors (teacher, student and rural producer) are involved on an equal footing in the teaching and learning process. When a partnership of trust is established between the University, through the research professors and their students (academic environment) with the rural producer (rural environment), the fruits of a participatory research work are harvested daily during its execution, in a continuous process of dialogue in which the producer sees, in real time, the transformation of his knowledge and the research also has its pedagogical role in the training of students.

With the approximation of the producer to the condition of subject of the process of generation and production of knowledge, participatory research reveals its political component, which makes it possible to discuss and dialogue about the importance of the investigation process, having, as a perspective, the intervention in the social, economic and environmental reality, without, therefore, necessarily losing methodological rigor, in addition to providing opportunities for the protagonist participation of students.

In the fourth teaching practice, all students of the Degree in Natural Sciences approved the "Experimentoteca" as a didactic resource for their future classes in basic education, which can be used in science fairs and also in higher education in disciplines related to the teaching of soil science. The "Experimentoteca" achieved its objective of contributing with basic education information on soils in teacher training and dissemination in the teaching of soil science for basic education. And after this case study report, it was proposed that the subjects presented here about soil science be discussed and definitively inserted in the syllabus of the Geosciences discipline of the Degree in Natural Sciences at PARFOR-UFRA, via "Experimentoteca".

Constant reflection on pedagogical practices for teaching in higher education in soil science should be valued. The updating of practices should be constant, always through a collaborative dialogue between teachers and students, aiming to promote a possible transformative education that is aligned with the demands of the current century.

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UPDATES ON THE TREATMENT OF OBSTRUCTIVE LOWER URINARY TRACT DISEASE IN CATS

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ABSTRACT

Feline lower urinary tract diseases affect about 15 to 57% of cats, being one of the most important causes of cat visits to the veterinarian. Pandora's syndrome affects cats with lower urinary tract diseases (FLUTD), resulting in dysuria, hematuria, periuria, frequency, and stranguria. Most clinical cases of cats that present these alterations are considered as "clinically unexplained syndromes" or idiopathic, and may be related to genetic factors and epigenetic influences. Cat obstructive lower urinary tract disease can be potentially fatal because it involves a water, electrolyte and acid-base imbalance and acute kidney injury. Treatment options include clinical treatment, surgery, and changes in environmental management and behavior adaptation of cats. Clinical treatment, in many cases, is ineffective, penectomy and perineal urethrostomy surgeries are effective surgical techniques for clearing urinary flow in felines, more frequent in males, but they are associated with high rates of postoperative death (8%-22%). Through the use of the implantation of a subcutaneous ureteral device, the urine passes through an artificial system, surgically placed, preserving the animal's ureter that is not viable. The use of this device is associated with good long-term results and a lower lethality rate. To date, no official guidelines are available in veterinary medicine to assist veterinarians in making decisions about the best treatment for these diseases, however the placement of a ureteral device remains the standard treatment of choice and is associated with the highest success rates, in addition to medications to minimize stress and management changes.

Keywords: Pandora's syndrome, Urethral obstruction, Ureteral device, Urinary tract, Urology.

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INTRODUCTION

Lower urinary tract disease (FLUTD) affects between 15 and 57.1% of cats, with 55 to 69% of these cats having Feline Interstitial Cystitis (FIC) and 12 to 22% having urolithiasis. Bacterial infections represent 1.5 to 20% of cases and bladder neoplasms affect 0.3 to 3.6% of felines. Neurological disorders, such as urinary incontinence, are between 0.2 and 3% of cases. Among the factors involved in the etiopathogenesis of this disease, the following stand out: dietary, hydric and behavioral management, as well as uroliths, microstones or crystals. The complications involved in FLUTD can lead to kidney injury, electrolyte and acid-base imbalances (NERI et al., 2016).

Although the pathophysiology of FLUTD is not fully understood, it is believed that factors such as sedentary lifestyle, low water consumption, exclusive use of dry food, and lack of access to the street can cause the disease. Stressful elements for the cat are capable of causing Pandora's Syndrome, which can result in urethral obstruction or ICF. Therefore, it is necessary for the cat's owner to be aware of their cat's eating habits, water intake, use of the litter box and behavioral changes, which may indicate that this feline is experiencing some stress (WESTROPP et al 2019).

Obstructive FLUTD can also be caused by physical factors such as uroliths, microstones, or crystals when there is a pH that favors its formation or urethral plugs that are associated with remains of organic matrix, mineral compounds, tissues, blood, or inflammatory cells. Smaller uroliths that are located in the bladder can pass into the urethra causing obstruction. Urethral obstruction occurs mainly in male cats, due to the greater length of their urethra and the fact that the diameter of the penile urethra is much smaller than that of the prostatic urethra, whereas, in females, the urethra is smaller and wider, and can be more easily distended (WESTROPP et al 2019).

The most common clinical signs of obstructive FLUTD are vomiting, mild to moderate dehydration, frequent visits to the litter box, dysuria, scuria, anuria, abdominalgia, anorexia, adipsia, prostration, vocalization, and full urinary bladder (1). Because it is a potentially fatal condition, emergency care for the obstructed feline involves correcting the water, electrolyte and acid-base imbalance (3). Fluid therapy should correct the acute kidney damage caused by dehydration. The measurement of blood gas parameters is necessary for ion correction, evaluation, and treatment of metabolic acidosis (NERI et al., 2016).

The catheters used for clearance should cause minimal trauma and inflammation in the urethra. Flexible catheters can remain in place until the patient's metabolic reestablishment occurs. The advantage of the flexible catheter is the better adaptation to the patient's urethral anatomy (WESTROPP et al 2019).

FLUTDs are considered diseases belonging to Pandora's Syndrome, pointed out as "unexplained syndromes" or of genetic origin or even as a result of a set of factors. The choice of the most appropriate treatment is a challenge for the veterinarian, due to the high rates of recurrence and complications, and the placement of the subcutaneous ureteral device is the technique with the lowest reports of associated complications. In addition to medical or surgical treatment, behavior modification, management of the environment and the use of psychotropic drugs are essential measures to avoid feline stress and should be associated with treatment to prevent new episodes of urethral obstruction (BUFFINGTON et al., 2014).

PANDORA SYNDROME

According to Greek mythology, the figure of Pandora refers to the problems thrown by Pandora, when she opened the mythical box she found. Cats with Pandora Syndrome experience varying combinations of an adverse experience or serious stressful events, leading to comorbid health problems. The common clinical signs of cats with Pandora's Syndrome are dysuria, hematuria, periuria, frequency, and stranguria (BUFFINGTON CAT 2018).

Most clinical cases of cats that present the alterations related to Pandora's Syndrome are considered idiopathic. Feline idiopathic cystitis is considered the most common lower urinary tract disease in cats. Other urinary tract diseases that are common in cats are obstructive FLUTD and urolithiasis (BUFFINGTON et al., 2014).

"Pandora Syndrome" is a term used to describe the problems observed in some cats, but it is not related to a specific reason or organ. It may be related to genetic factors and epigenetic influences (WESTROPP et al., 2018).

In humans, there is chronic pelvic pain syndrome, interstitial cystitis. In veterinary medicine, it is observed that feline interstitial cystitis exists, both conditions, both human and feline, describe these abnormalities as "clinically unexplained syndromes" or "body distress syndromes" or "central sensitivity syndrome" (BUFFINGTON CAT 2018).

Cats are more sensitive to the environment in which they live, when compared to other species. Therefore, depression in cats can occur if he feels threatened or conflicted. Depression can also be a response to stressors of your fetal development. Another consequence is the aggressiveness that some cats show towards their owners (NAUREEN et al., 2017).

Pandora's syndrome" is known within veterinary clinic, especially when it comes to urinary tract diseases such as Feline Interstitial Cystitis (FIC) and obstructive and non-

obstructive FLUTD. Many risk factors, such as age, race, sex, sterilization, dry food, overweight, decreased water consumption, season, life restricted to the internal environment, lifestyle, among other factors, are identified as triggers of Pandora's Syndrome (NAUREEN et al., 2017). When these cats respond well to changes in the environment (MEMO), the rate of comorbidities is reduced (BUFFINGTON CAT 2018).

At the moment when stress activates the Central Nervous System (CNS), the endocrine and immune systems are activated together, resulting in a pathology. Even before birth, when the cat's mother communicates the events to the fetus, there is a sensitization of the cat that is being gestated, so that these traumas can manifest themselves at any time in life (BUFFINGTON CAT 2018).

The consequences of Pandora's Syndrome can be observed in several systems, and can cause: aggressiveness, hypertrophic cardiomyopathy, obesity, type II diabetes, vomiting, diarrhea, upper respiratory tract problems, asthma, dermatitis, interstitial cystitis, bladder or urethral stones, and chronic kidney disease (BUFFINGTON CAT 2018).

The physiological and neuroanatomical abnormalities identified in the bladder of cats with FIC showed significant changes in the components of acetylcholine synthesis and release in the esophageal mucosa. These changes suggest that changes in the non-neuronal cholinergic system may contribute to changes in cell-to-cell contacts and possibly in communication with underlying cells that lead to sensory and visceral changes, causing hyperalgesia. Sensory differences in neuron anatomy and physiology are also present in cats with CIT, for example, the dorsal root of sensory neurons, urinary vesicle of cats with interstitial cystitis, are 30% larger and express changes in the profile of neuropeptides and cell bodies of dorsal root ganglia of both neurons of the bladder (BUFFINGTON et al., 2014).

The cat's depressive state is related to external (environmental) and internal factors. Environmental events affect the hypothalamus and interfere with mood, generating gastroenteric disorders, anorexia, decreased water intake, difficulty in social interactions, urination outside the litter box, among others (NAUREEN et al., 2017).

It is recommended that the veterinarian obtain the history of this patient, perform a physical examination and institute a therapy to manage these clinical signs, considering that this problem results from an activation of the CNS in response to threats, responding variably, at sensory, autonomic and motor levels, activating some systems, such as the endocrine and immunological (BUFFINGTON CAT 2018).

Veterinarians should consider whether FLUTD episodes are recurrent and what other health problems the cat may have. It is necessary to identify appropriate diagnostic tests

and individual treatment protocols for each cat. The veterinarian should consider that cats may have multiple factors to justify their clinical signs. It is important to check the environment in which the feline lives, environmental management, food, interaction with other animals and people (BUFFINGTON et al., 2014).

Several studies show that the Persian breed is the most affected by the Syndrome, the predilection for the Persian breed, is linked to genetic and epigenetic factors (NAUREEN et al., 2017).

FLUTD can occur as a result of placing a "sensitive" cat in a "provocative" environment. Even healthy felines can develop pathological behaviors if they are exposed to an environment with stressful factors. For this reason, the recommendation is that the environment meets the cat's environmental needs, to ensure its health and well-being. The feline's owner is responsible for adapting the cat's environment so that it does not suffer from threatening factors (BUFFINGTON et al., 2014).

CLINICAL TREATMENT PROTOCOLS FOR URETHRAL OBSTRUCTION

Urethral obstruction mainly affects male cats, neutered, obese and that live confined inside the residence. The most common causes of obstruction are urethral plugs (60 to 70% of cases), stones (10%), infections (2%) or urethral spasm that are preventing urine from coming out (CRIVELLENTI & BORIN-CRIVELLENTI, 2015).

The patient with obstructive FLUTD should be seen on an emergency basis, as the metabolic disorders of the obstructed feline develop in less than 24 hours after the obstruction. If these cats are not treated quickly, death can occur within 3 to 6 days of obstruction (SEITZ et al,. 2018).

During emergency care, blood should be collected for blood count, biochemical and blood gas analysis. Due to intravesical pressure, the bladder stretches beyond its capacity, causing an increase in renal intratubular pressure. As a result, there is an impairment of the glomerular filtration rate, sodium and potassium excretion and the capacity for water reabsorption. These changes generate hyperkalemia, metabolic acidosis, arrhythmias, due to the excess of circulating potassium, which can result in cardiac fibrillation. (MONTANHIM et al., 2019).

Cats should be examined and systolic blood pressure (SBP) should be measured, the physical examination should mainly cover body temperature, heart rate, respiratory rate, mental status, color of mucous membranes, capillary refill time, cardiac and pulmonary auscultation, and abdominal palpation (NERI et al., 2019).

There is an imminent risk of hypothermia secondary to circulatory shock. The heart rate is usually increased due to stress and pain, so the evaluation of the electrocardiogram and serum potassium dosage are essential to evaluate the clinical picture. Hyperkalemia can cause a drop in heart rate, in which case the patient must be placed in an oxygen mask and introduce an intravenous catheter for the administration of fluid therapy and medications (LITTLE, 2015).

The administration of fluid therapy can solve some metabolic changes, but in some cases specific treatment needs to be instituted. Metabolic acidosis has compromising effects on the cardiac, respiratory, and CNS systems. Treatment with sodium bicarbonate can be used in cases of intense metabolic acidosis, with a dose of 1 to 2 mEq/kg, administered slowly into a vein. Bicarbonate lowers the concentration of ionized calcium and as some patients are already hypocalcemic, hypocalcemia should also be corrected (LITTLE, 2015, GEORGE et al., 2016).

Cats with hyperkalemia should be treated with calcium gluconate, at a dose of 50 to 100 mg/kg intravenously, administered within 3 minutes. Calcium gluconate antagonizes potassium in the cell membrane. The effects are almost immediate and last around 30 minutes (LITTLE, 2015).

After fluid therapy is instituted and there is no severe hyperkalemia, the patient can be sedated for cystocentesis (LITTLE, 2015). However, there is a risk of urinary gallbladder rupture (MONTANHIM et al., 2019). The veterinarian should introduce the needle into the bladder between the apex and the neck of the ventral wall, at an oblique angle, and directed in a caudal direction (LITTLE, 2015). After cystocentesis, urine should be sent for culture analysis and antibiogram, in addition to complete urinalysis (NERI et al., 2019)

Low epidural or coccycygenic anesthesia in association with sedation or anesthesia of the patient should be performed before probing clears (CRIVELLENTI & BORIN-CRIVELLENTI, 2015). Renal excretory drugs should be used with caution. A frequently used protocol is the combination of ketamine at a dose of 2 to 5 mg/kg and Diazepam (0.2 to 0.5 mg/kg) or midazolam at a dose of 0.2 to 0.5 mg/kg, administered intravenously. However, ketamine should not be used in felines with cardiac arrhythmias. Induction can be performed with an isoflurane mask or intravenous propofol (LITTLE, 2015).

To perform the clearance, the animal must be probed, exposing and evaluating the penis, observing for abnormalities and massaging with heated saline solution. In some cases it is possible to clear the animals, just with these maneuvers. For clearance, a flexible urethral probe number 4 can be used directly, in most felines the urethral plug is located in the distal portion of the urethra, so the ideal is to use the silicone tomcat probe or catheters

numbers 20 and 22, without the stylet, coupled to a 10mL syringe with heated saline solution, applying small jets in an attempt to unclog (CRIVELLENTI & BORIN-CRIVELLENTI, 2015).

Another suggestion to unclog the feline is to attach an extension set and with a 10mL syringe, rinse the urethral lumen thoroughly, using a sterile lubricant when rinsing with saline solution. Walpole's solution should never be unused, as it has an acidic pH and is very irritating to the already traumatized mucosa; use can result in intense inflammation of the urethra and bladder and even urethral stricture (LITTLE, 2015).

Urethral probing carries the risk of urethral rupture, inflammation and trauma to the site. If the urethra ruptures, penectomy and perineal urethrostomy will be necessary. The patient should be hospitalized for complete stabilization of the parameters (MONTANHIM et al., 2019). During the clearance, the veterinarian should observe if there will be expulsion of plugs or stones. The clearance procedure must be carried out carefully, observing whether there will be the expulsion of plugs or stones. The catheter should not be used to push the obstructing material into the bladder. If catheterization is not performed carefully, there is a risk of perineal hematoma, penile deviation, and scrotal swelling (LITTLE, 2015).

Next, the bladder is flushed with heated saline solution until the liquid comes out as clear as possible. Sterile saline should be warmed to avoid hypothermia. During hospitalization, the cat should remain with the Elizabethan collar to prevent it from removing the probe (NERI et al., 2016). The urethral catheter that was placed in the animal should be removed after normalization of urine production, and the urine should be free of sediments and not present hematuria. The disadvantage of using a tube that remains in the patient is the cost to the owner, which usually becomes an obstacle to good care (SEITZ et al,. 2018).

During clearance, if urethral probing is not possible, the patient should undergo medical treatment with fluid therapy and reliever cystientesis 3 to 4 times a day. Analgesia and antispasmodics (acepromazine and prazonsin) should be applied.

In cases of failure to clear the obstruction, cats may need surgery. Felines that arrive at the hospital, with a history of three episodes of clearance or after successive attempts to clear clearance, should be referred for penectomy, followed by perineal urethrostomy (NERI et al,. 2016).

It is important to keep the animal hospitalized, as diuresis can occur in large quantities, requiring the use of fluid therapy with Lactated Ringer's serum plus 3mL of 19.1% potassium chloride. Serum creatinine and potassium levels should be measured daily (KYLES et al., 2005, CRIVELLENTI & BORIN-CRIVELLENTI, 2015, MONNET et al., 2020).

Radiographic evaluation should be performed after stabilization of the patient and placement of the urethral catheter. The radiographic image will show uroliths and confirm proper probe placement. The ultrasound examination of the urinary gallbladder will evaluate the presence of urethral stones and neoplasms in the urinary bladder (SEITZ et al., 2018).

The drugs butorphanol, buprenorphine, and hydromorphone, as well as other opioids, are suitable agents for analgesia. Nonsteroidal anti-inflammatory drugs (NSAIDs) are not recommended due to the degrees of electrolyte disturbances and azotemia (LITTLE, 2015). However, if there is no marked azotemia, meloxicam at a dose of 0.1mg/kg can be used subcutaneously (SC) or ketoprofen at 1mg/kg orally or SC in a single application (CRIVELLENTI & BORIN-CRIVELLENTI, 2015).

In some cases, the patient can be kept without the tube, with stimulation of diuresis with intravascular or subcutaneous fluids, associated with manual compression of the bladder 4 to 6 times a day, if the cat allows this type of manipulation. After removal of the tube, the use of antibiotics based on urine culture and antibiogram is necessary (CRIVELLENTI & BORIN-CRIVELLENTI, 2015).

The use of the indwelling catheter aids in the resolution of azotemia, normalization of the cat's metabolic status (dehydration and electrolyte abnormalities), and should be maintained until the acceptable urine output of > 0.5 mL/kg/h and normal urine color is reestablished (SEITZ et al., 2018).

After clearance, the therapeutic protocol comprises the anti-inflammatory meloxicam at a dose of 0.1 mg/kg only on the first day, followed by 0.3 mg/kg/in 24 hours for 2 days. Another option is to administer corticosteroids, in combination with prazosin, and dexamethasone can be used at a dose of 0.05-0.1 mg/kg intravenously (IV) every 24 hours followed by 0.05 mg/kg IV every 24 hours. Or use prednisolone orally (PO) at a starting dose of 0.5 mg/kg/day (range 0.3-1.3 mg/kg/day) for a median of 33 days (MERINDOL et al., 2023).

It is important to associate amitriptyline with treatment at a dose of 5 mg/cat every 12-24 hours for up to 6 months. After 6 months, the dose will be reduced for withdrawal, associated with MEMO. Prazosin can also be prescribed, at a dose of 0.125 mg/cat every 12 hours to 0.5 mg/cat PO every 8 hours, with an interval of 3 days to approximately 1 year (MERINDOL et al., 2023).

Analgesics are prescribed in approximately 67% of cats, the most commonly used are remifentanil (3-9 µg/kg/h), buprenorphine (0.010-0.015 mg)/kg IV or sublingual every 8-12 hours). The use of gabapentin, remifentanil, and buprenorphine may also be options for the clinician during treatment. One of the antibiotic treatment options for cats with

pyonephrosis consists of the use of chloramphenicol and enrofloxacin for up to 30 days, depending on the clinical picture (MERINDOL et al., 2023).

The tube should remain in the animal for 3 days, with daily washing with saline solution. The tutor should be guided and monitored for 6 months, in relation to environmental management and stress reduction, through environmental enrichment (MEMO), should increase his cat's water intake, making more water pots available to the feline. The diet will be changed to Urinary food and wet food (LITTLE, 2015).

Environmental modification is a necessary measure when the feline returns to its residence. The tutor should be guided on food management, water supply and the use of hormones that favor the cat's well-being (SEITZ et al., 2018). The MEMO should be instituted, which is behavior modification (M), management of the environment and psychotropic medication, if the veterinarian deems it necessary (LITTLE, 2015).

SUBCUTANEOUS URETERAL BYPASS (SUB) OR A URETERAL STENT FOR TREATMENT OF URETERAL OBSTRUCTION IN CATS

There are some options available for the treatment of urethral obstruction in cats, however medical treatment may be ineffective in some cases, due to acute kidney injuries present in 13% of cases. Urethral surgeries are associated with high postoperative mortality rates, ranging from 8% to 22%. Subcutaneous by-pass implantation showed good results, with a lower lethality rate between 7.5% and 9%, compared to other treatments. However, after the placement of the stent, about 20 to 54% of cats may present frequency, dysuria, and hematuria. Despite the complications that can occur, the placement of the subcutaneous ureteral bypass (SUB) device is an effective treatment option for cats.

The placement of a subcutaneous ureteral bypass (SUB) or a ureteral stent to treat ureteral obstruction in cats, generates fewer complications and failure rates than clinical and surgical treatments (WUILLEMIN et al., 2021, GEDDES et al., 2023).

Cats submitted to placement of a subcutaneous ureteral bypass device are discharged from the hospital in 94% of cases, with a survival of approximately 2 to 3 years. The most common complications associated with the placement of the by-pass device are folds in 3%–10% of cats, luminal mineralization occurs in approximately 17%–25%, chronic bacterial infection in 24% to 25% of cats undergoing this procedure, frequency, hematuria, or stranguria in cats with FLUTD. Some cats may also have pyelonephritis, marked by increased serum creatinine concentration, positive urine culture associated with the presence of systemic clinical signs such as hyperthermia (WUILLEMIN et al., 2021, KITELOCK et al., 2023).

After the by-pass device is placed, it is observed that the catheter tip can irritate the bladder trigone and contribute to signs of LUTD. Recently, straight bladder catheters have been replaced by locking bladder catheters or shorter straight bladder catheters, resulting in a lower incidence of bladder discomfort. It is important to encourage the cat under treatment to increase water intake in the postoperative period, in addition to washing the SUBs frequently in the next 7 days after surgery, with saline hyperthermia (WUILLEMIN et al., 2021, KITELOCK et al., 2023).

It is observed that an average of 24% of cats with a SUB device will die from complications of FLUTD, but survival will be longer with treatment. Cats undergoing SUB placement should be monitored for postoperative and long-term complications in relation to renal function to ensure a favorable treatment result, in addition to associating gabapentin or buprenorphine with the treatment to avoid the stress generated by the surgical procedure4 (WUILLEMIN et al., 2021, KITELOCK et al., 2023).

SURGICAL TREATMENT OF URETHRAL OBSTRUCTION

Feline cases with urethral reobstruction have an incidence of approximately 36%, and occur most commonly due to urethral plugs (43%), causes of idiopathic obstruction add up to 36% and urolithiasis account for 30%. Urethrostomy is indicated in cases of recurrent obstructions or in patients in whom clinical treatment could not be performed or in cases of urethral or penile trauma, priapism, neoplasms, or distal urolithiasis (NYE & LUTHER, 2018). The decision to perform surgery should be based on the functional aspect of the urethra (LITTLE, 2015).

Male cats have a long and narrow penile urethra, which can cause obstructions. Perineal urethrostomy reduces the risk of recurrence of urethral obstruction, but dietary and environmental changes are necessary to prevent urethral plugs and urolithiasis. Perineal urethrostomy is the surgery that results in the creation of a permanent stoma in the wider pelvic urethra through anastomosis with the perineal skin and involves amputation of the narrow penile urethra (NYE & LUTHER, 2018).

During the surgical procedure, cats are placed in the supine position and a ventral celiotomy, in the midline, is performed to expose the urinary tract and dissect the ureter of the retroperitoneum. The ureteral artery and vein are connected with absorbable monofilament suture. The ureteroliths are collected and submitted for analysis. The distal segment of the ureter is attached proximal to the bladder, resected, and submitted for histopathology. Patency of the proximal ureter is assessed with direct visualization of urine coming from the sectioned end of the ureter, as well as using a biological repair to treat

ureteral obstructions, retrograde passage of a feeding tube. Urine is collected from the renal pelvis and subjected to culture examination (LITTLE, 2015).

At the time of surgery, a cat stent is placed in the ureter to divert urine and maintain the functionality of the ureter. When an intravesicular technique is used, replantation is completed prior to insertion of the temporary ureteral catheter. The catheter is placed prior to completion of extravesicular reimplantation. A temporary ureteral catheter should be used after surgery. The temporary catheter is introduced into the ureter from the penis or urethral papilla and advances until it reaches the proximal ureter. The location is confirmed by palpation. The opposite end of the catheter is then connected to a closed suction bag to monitor urine output (LITTLE, 2015).

The outer portion of the catheter is attached to the cat with a suture in the foreskin. After catheter placement, postoperative abdominal radiographs are required to confirm proper implant positioning. Renal function blood tests are necessary to monitor the evolution of the clinical picture (LORANGE et al., 2020).

The temporary ureteral catheter is inserted from the penis or urethral papilla until it reaches the proximal ureter. The opposite end of the catheter is connected to a closed suction bag to monitor urine output. The external portion of the catheter is fixed with a suture in the foreskin (LORANGE et al., 2020).

Ureteral stones that become lodged in the proximal third of the ureter should be removed by ureterotomy followed by placement of a nephrostomy tube to allow urine drainage. Ureteral stones can be controlled by means of partial ureterectomy and implantation of the remaining portion of the ureter in the bladder (ureteroneocystostomy) (KYLES et al., 2005).

There are situations in which not all stones can be removed because some are firmly attached to the ureteral mucosa. The subcutaneous ureteral device is placed in the animal under general anesthesia and through laparotomy as a way to expose the affected kidney, ureter, and bladder. The nephrostomy catheter is usually fixed in the caudal pole of the kidney, while the cystostomy catheter is inserted in the apex of the bladder. Both catheters are connected to a port system that is positioned underneath the animal's skin. After the device placement surgery, the animals should remain hospitalized between 3 and 5 days (KYLES et al., 2005, LORANGE et al., 2020).

Postoperative complications, defined as complications that developed in the first month after surgery, are mainly the uroabdomen, observed in approximately 25% of cats undergoing this procedure. Surgical wound dehiscence, dermatitis due to an acid agent

(urine), extravasation of urine into perineal tissue, perineal hernia and urinary incontinence may occur (LORANGE et al., 2020).

The most common reported complications include urine leakage (3.4%), twisting of catheters (5%), and occlusion of catheters with blood clots (7.5%). In the long term, device mineralization may occur (25%), and in only 13% of patients a second surgical intervention is necessary in order to unblock the ureteral device. About 21% of cats can develop urinary tract infections, and only 10% develop recurrent infections. There are also reports of animals presenting dysuria (painful urination) after surgery (8.2%) (LORANGE et al., 2020).

There is also the possibility of sepsis, pulmonary edema, peritonitis, and pancreatitis in the postoperative period. Ureteral obstruction may be persistent after ureteroneocystostomy in 11% of cats and in 2.9% of cats after ureterotomy. The complications described can be avoided or minimized when the procedure is performed by a trained and experienced veterinary surgeon and the patient is monitored postoperatively (KYLES et al., 2005).

ENVIRONMENTAL MANAGEMENT AND BEHAVIOR MODIFICATION

A behavior management program consists of rewarding the patient with positive reinforcement, rather than punishing for inappropriate behavior (2). Thus, it is essential to understand the theory of learning and the effects of operant and classical conditioning before recommending any treatment. Classical conditioning consists of equating a stimulus that is not linked to a neutral one. The latter should result in conditioned stimulus and response. It does not use rewards, but the cat learns to pair an involuntary behavior with another neutral stimulus (BUFFINGTON et al., 2006).

All behavior modification strategies for felines can be tedious, time-consuming, and challenging for owners to implement with consistency regarding the need to change the environment. These behavioral change programs can be successful, but they can also be harmful if improperly carried out in the environment (LITTLE, 2015).

Some cats with FLUTD are more sensitive to the environment. Studies in zoos and research laboratories show that cats subjected to environmental impoverishment or unpredictable environments decreased activity levels and increased hidden behaviors (Buffington et al., 2006).

Environmental enrichment helps improve cat health and well-being, multimodal environmental modification (MEMO), institutes changes in the cat's environment to reduce FLUTD, seeking to decrease the stress response. For these changes to occur, it is important to educate the tutor, changes in the environment, changes in diet, variations in

the physical environment and improvement in interactions with people and animals (BUFFINGTON et al., 2006).

MEMO aims to include and extend the concept of environmental enrichment, covering environmental characteristics of the feline. The patient should not be blamed for the frustration of his or her tutor with the occurrence of FLUTD (CAMERON et al, 2004).

To reduce the stressful effect on the environment, you should avoid punishing the cat, changing the diet to wet food, increasing water intake, improving the management of the litter box, placing a greater number of litter boxes in the feline's environment and ensuring that it is always clean, placing vertical structures in the environment, places to rest and objects for the feline to scratch (CAMERON et al,. 2004).

It is important for the client to identify the changes that he believes to be most relevant to the environment and make them gradually to allow the cat to adapt to them (DEPORTER et al., 2018).

Another important point is to encourage the feline to do physical activities, as lack of exercise can be an indication of stress, and stressed cats manifest fewer exploratory behaviors and spend more time hiding (DEPORTER et al., 2018).

Some studies prove that male cats are more predisposed to obstructive FLUTD. Pill-haired felines are more affected by interstitial cystitis; the justification may lie in the fact that owners of long-haired cats do not promote access to the street for their animals, due to the poor climatic and structural conditions of the environment (CAMERON et al., 2004).

It is important to associate the management treatment with drug treatment, in reference to the MEMO. Some therapies are used such as diazepam, clomipramine, fluoxetine and buspirone, however, many owners are unable to administer tablets orally and are hesitant to provide such medications to their cats (CAMERON et al,. 2004).

Another important characteristic is when the feline shows stressful behavior in areas where there are conflicts such as the sight, sound or smell of another cat. One of the causes is the fear of neighboring cats or the need to defend their territory and be able to control their environment. Felines are also afraid of strange people and strange sounds. Therefore, neighboring cats, a new animal in the house, a different person in the house, a change of house or change in the family's routine, can lead the feline to feel stress (LITTLE, 2015).

Cats form complex relationships with their family members and with cats related to their environment. However, they generally do not accept an unknown cat and manifest this rejection through behaviors such as: growling, whistling, vocalizing and spitting (DEPORTER et al., 2018).

In an attempt to improve the domestic environment in which there is aggression between cats, a therapeutic intervention can be carried out, using a synthetic analogue of a commercial feline pheromone fraction F3. There is a hypothesis that there is a natural and causal relationship between the presence of commercial pheromones and the enhancement of social interactions between cats. It is expected that the positive effect on social relationships will be achieved and minimize aggressive behaviors (DEPORTER et al., 2018).

In homes that use the feline facil comercial synthetic pheromone, there was a positive impact on the reduction of fights between cats, providing reconciliation between the animals. Thus, it is expected that the long-term use of this pheromone will be beneficial (LITTLE, 2015).

In addition, changing the punitive form to positive reinforcement can reduce the stress between the cat and its owner. The implementation of environmental enrichment would reduce the effects of feline cognitive dysfunction and physical exercise and change in diet can have a positive effect on the patient's well-being. Adequate enrichment can reduce stress, relieve boredom, prevent obesity and associated problems such as diabetes mellitus and hepatic lipidosis. With the reduction of stress, there would be greater prevention of FLUTD and irritable bowel syndrome. In this way, environmental change can help reduce the number and severity of outbreaks of chronic diseases, such as FLUTD, and other diseases (DEPORTER et al., 2018).

CONCLUSION

Pandora's Syndrome is considered an unexplained syndrome, which affects cats with FLUTD, which can generate hydric, electrolyte and acid-base imbalances, generating acute kidney injuries that can culminate in the patient's death.

So far there is no guideline to indicate the best treatment that the veterinarian should follow. However, clinical and surgical treatments are the most used, although they have low success rates in some cases, reducing the life expectancy of affected patients.

Clinical and surgical treatment have higher rates of failure and complications, so the placement of the SUB device may be a viable option for the treatment of cats with benign ureteral obstruction, associated with environmental changes, behavioral management, adequacy of water consumption and use of psychotropic medications.

HOW CONTINUOUS IMPROVEMENT METHODOLOGY – LEAN SIX SIGMA CAN INCREASE THE PRODUCTIVITY OF LOADING AND HAULING EQUIPMENT

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ABSTRACT

The objective of this work is to increase the productivity of truck and excavator fleets using Lean Six Sigma methodology in the mine production process. The application of the Lean Six Sigma methodology has proven to be highly effective in several areas, for improving processes through the use of statistical tools for problem identification, cause analysis, optimization actions, resolution, sustainability and improvement of results, thus being a powerful methodology for companies seeking operational excellence and greater competitiveness. The fleet of excavators and trucks are the main equipment for material handling and production in the mine, in which through a case study it is possible to evidence the use of statistical tools in the development and identification of problems that affect productivity. In this case study, it is possible to demonstrate the application of all stages of the Lean Six Sigma methodology – DMAIC (Define, measure, analyse, improve, control), as a result of this project, it was possible to increase the overall productivity of the trucks of about 21% and an increase in the effective productivity of the excavators of around 31%, thus generating relevant financial gains estimated at R$ 4,502,141 per year and non-financial gains with improved safety conditions, well-being of employees and reduction of carbon emissions by saving hours operated and diesel. The gain from reducing carbon emissions is estimated at 3,056 tons of carbon per year. In addition to the project's gains, the development of a culture of continuous improvement can be observed.

Keywords: Lean Six Sigma. Mining. Productivity. Infrastructure. Continuous improvement.

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INTRODUCTION

The objective of this work is to increase the productivity of truck and excavator fleets using Lean Six Sigma methodology in the mine production process. The application of the Lean Six Sigma methodology has proven to be highly effective in several areas, for improving processes through the use of statistical tools for problem identification, cause analysis, optimization actions, resolution, sustainability and improvement of results, thus being a powerful methodology for companies seeking operational excellence and greater competitiveness.

The open-pit method is the predominant one in the world's exploitation, covering 98% of the metallic ore mines and 97% of the non-metallic ores in the United States (Hartman and Mutmansky 2002). The mine in this case study fits this profile, using trucks and excavators for the extraction and transportation of the ore. The cost of transportation can be as high as 50% of a mine's costs. The productivity of the trucks is correlated by the average speed developed during the truck's journey (Hustrulid, 2013), other factors such as the average load transported and the conditions of the accesses are paramount for the fulfillment of good productivity in the mine.

In a study developed by Oliveira (2023), he presents results of increased productivity of 13% for the Caterpillar fleet and 10.8% for the Komatsu fleet.

Continuous improvement tools are methods used to constantly improve processes, products, and services. The objective is to increase efficiency, quality, and customer satisfaction, reducing waste and identifying opportunities for improvement according to Leão et al (2024).

The combination of Lean philosophies, focused on eliminating waste and non-essential activities, with the Six Sigma approach, dedicated to reducing variations and defects, becomes a catalyst for increased efficiency and effectiveness in the mining industry. Optimized workflows, better resource utilization, and higher product quality result in significant benefits for mining operations, such as reduced costs and increased productivity (Perez-Wilson, 1999).

The general objective of this article is to demonstrate how the application of the Lean Six Sigma methodology with a set of techniques and procedures can increase productivity in the mining sector, thus forming a reference material for professionals in the sector, thus fostering its use for the development of a culture of continuous improvement.

THEORETICAL FRAMEWORK

The methodology is widely used in mining, as an example, the work done by Silva (2019) can be cited, where from the use of the methodology, it was possible to obtain an increase in the drilling rate of a drill in the clean water mine by 13%, which resulted in a financial gain of R$ 275,025.16 for the company. For this, the author did a research on the history of the drilling rate to define an average of how much the company drilled over time, in addition to site visits and analysis of the materials used and the professionals working. From there, the author suggested some changes such as increasing the drilling place, sharpening the bits more frequently, adjusting the air pressure and feed according to the lithology of the site and more trained workers. The results were analyzed for six months.

In a case study developed by Pedrosa et al (2014) in the maintenance area, Six Sigma is an important ally in unveiling the main losses by identifying the cause-problem, determining blocking actions and solving problems that negatively interfere with performance indicators. Although recent and still lacking some adjustments in the conduct of Six Sigma projects, the results obtained so far confirm the potential to achieve the organization's strategic goals.

The Lean Six Sigma methodology was used by Pereira et. al (2021) for the increase in the operational efficiency of the High Intensity Magnetic Separation stage, given the fact that the metallurgical recovery was, on average, 7.21% lower than the expected value. The execution of the project was carried out following the DMAIC cycle, where the investigations carried out showed that 52.3% of the root causes were attributed to the operation of the equipment itself (magnetic separator). Interventions in the process and adjustments in the operation of the separator resulted in an increase of 9.66% in the average metallurgical recovery, which was 1.75% higher than the established goal (94.63%). A 65.66% reduction in the standard deviation of this variable was also observed, which translates into a reduction in the overall variability of the process.

In his master's thesis, Coutinho (2017) presents a set of continuous improvement projects applied in unit loading and transportation operations, in open-pit mining. Based on the Lean Six Sigma methodology, on good practices analyzed and on data collected in the field, some process improvements were applied, composing three case studies: a project to reduce the cost of tires, a project to increase the productivity of the trucks and a project to increase the production in the belt system, resulting in estimated financial gains in the order of R$ 31.6 million per year. in addition to gains in reducing environmental impact and increasing safety in mine operations.

Fleet management systems, such as smartime, among others, used in the company, provide information to identify failures and help in the management of the operation. These are applications that help automate the management of trucks and excavators, allow analysis of indicators, maximize production and minimize operating expenses from decision-making using real-time information. Therefore, it maximizes the use of the equipment and reduces operating costs (Campelo, 2018).

METHODOLOGY

This article was based on a historical database of a Brazilian mining company, located in Minas Gerais, focusing on the extraction, processing and commercialization of iron ore. The mine has a high annual production capacity and products with a high standard of quality. The database consists of information on loading and transport equipment managed by the fleet management system at the mine (Smartmine) in the period of 12 months of production. The data collected were mass transported, origin, destination, type of equipment, load times, transport times, hours operated, transport distance, among others. With the historical data, the project began.

Using techniques, graphs and statistical tools within them boxplot, histogram, pareto chart, among others, he applied the lean six Sigma methodology combined with the DMAIC cycle (Define, measure, analyse, improve, control). Lean Six Sigma - DMAIC is a methodology with a structured roadmap, which aims to identify and eliminate inefficiencies, ensuring the quality and efficiency of processes. In the Define phase, the problem or opportunity is clearly identified and documented. Then, in the Measure phase, relevant data is collected to understand the extent of the problem. The Analyze phase involves identifying the root causes of problems. In the Improve phase, solutions are implemented to eliminate the identified root causes. Finally, in the Control phase, mechanisms are established to ensure that improvements are sustainable over time (PACHECO, 2014). Rigorous application of these steps allows organizations to achieve significant results in terms of operational efficiency and quality.

Each of these steps has a specific objective to achieve the expected improvement result, which in this case will be increased productivity in cargo and transportation operations.

EQUIPMENT USED

The transport operation at the mine is carried out by off-highway diesel trucks with a payload capacity of 60t. The excavation and loading equipment has a payload capacity of

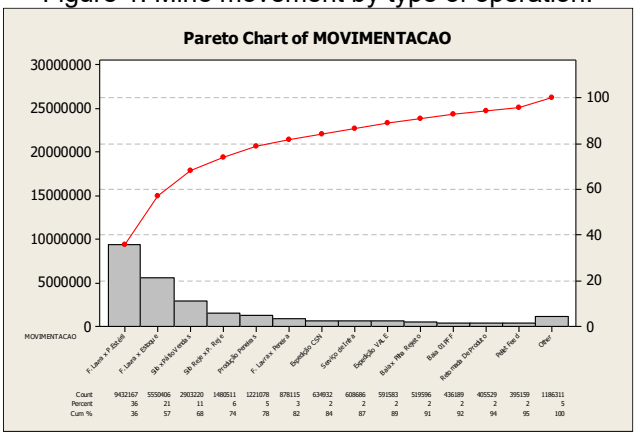
4.6 m³~12t (itabirite ore). These equipment form an ideal set of cargo and transport due to their potential specifications and dimensions, generating around 5 passes for each load. According to PERONI (2015) and COUTINHO (2017), the optimal ratio of the number of passes should not be less than three and not more than six.

LEAN SIGMA METHODOLOGY - DEFINE PHASE

The first step in the development of a lean six sigma work consists of identifying and defining the opportunity for improvement, a step known as Define, through the DMAIC cycle (Define, measure, analyse, improve and control). Through a survey of performance data we can identify the need for improvements, it was identified for this case the need to improve the productivity of loading and transport equipment, which is one of the main KPI´s (Key performance indicators) of the mine. Loading and transportation operations are carried out for various materials, such as ore, overburden, products, tailings, basin cleaning, infrastructure, among others. In order to identify which of these operations directly influence the project indicator, the Pareto test was performed.

Vilfredo Pareto, creator of the Pareto Diagram, was born in 1848 in Paris and was a sociologist, political theorist and economist. (BEZZERA, 2019). The Pareto Chart is considered one of the seven basic tools of quality and has as its principle that 80% of the consequences come from 20% of the causes. According to Koch (2015), the 80/20 principle states that there is an imbalance between causes and results, where the majority have low impact and the small majority have high impact. From the pareto test applied to the project data (Figure 1), ore operations were identified as priority operations as they represent the majority of operations with about 57% of the total movement in the mine. In this way, opportunities in the loading and transportation operations of ore and waste rock were prioritized.

Figure 1. Mine movement by type of operation.



Source: authors, 2024.

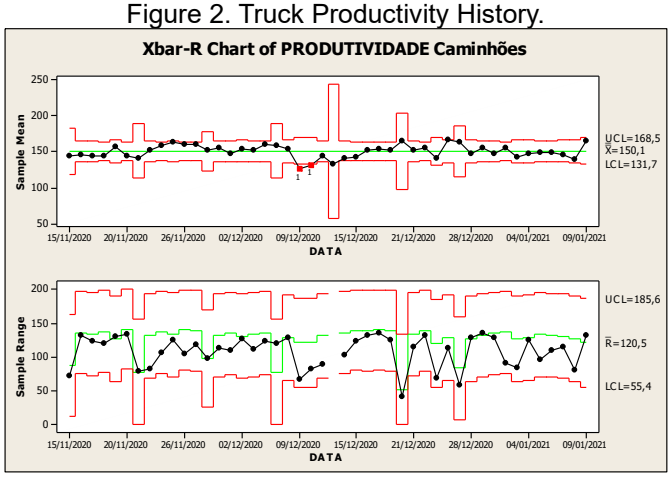
LEAN SIGMA METHODOLOGY - MESURE AND ANALYSE PHASE

The use of graphs and statistical bases are used in defining an achievable and challenging goal for the project. Figures 2 and 3 represent the productivity and normality test graphs of the truck fleet and figures 4 and 5 represent the excavation fleet.

The productivity history carried out by the control chart aims to identify stability (inside or outside control) and process healthiness (variability over time).

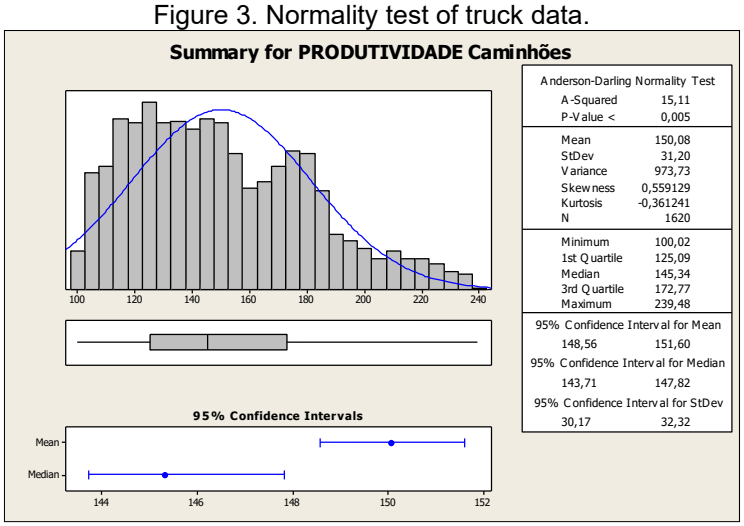
Normality tests are carried out to verify that the data are part of a normal and predictable distribution, which will influence the statistical analyses and methods to be developed throughout the project. To define the goal of the project, the normality test was used with the Anderson Darling Test 3rd quartile method. This method divides the data into four parts, in which each part represents the average of 25% of the results, with the 3rd quartile representing 25% of the best results in the historical productivity base, establishing the project goal for the truck transport fleet of 172.77 t/h (Figure 3 – Anderson Darling 3rd Quartile). In the excavator fleet, the mean confidence interval was used, using the maximum and minimum limits identified by the normality test (Figure 4 – Anderson Darling 95% Interval for Mean), highest average productivity: 540.98 / lowest average productivity: 513.43 * global average productivity: 527.21, establishing a target for the excavator fleet of 555 t/h.

Figure 2. Truck Productivity History.



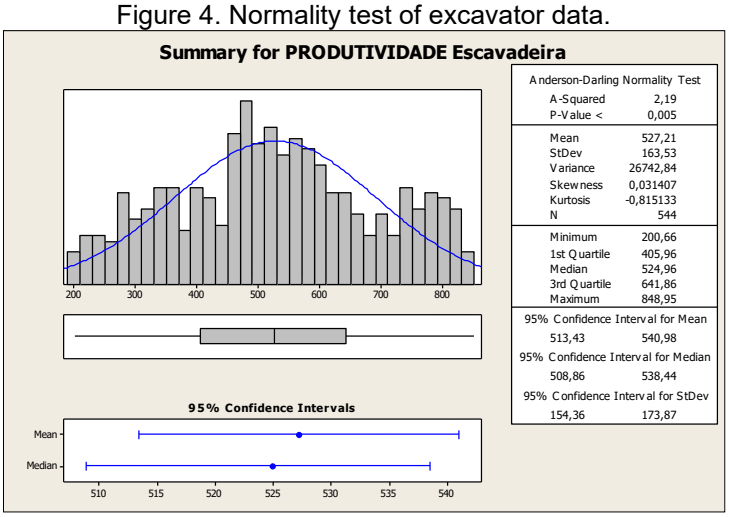
Source: authors, 2024.

Figure 3. Normality test of truck data.



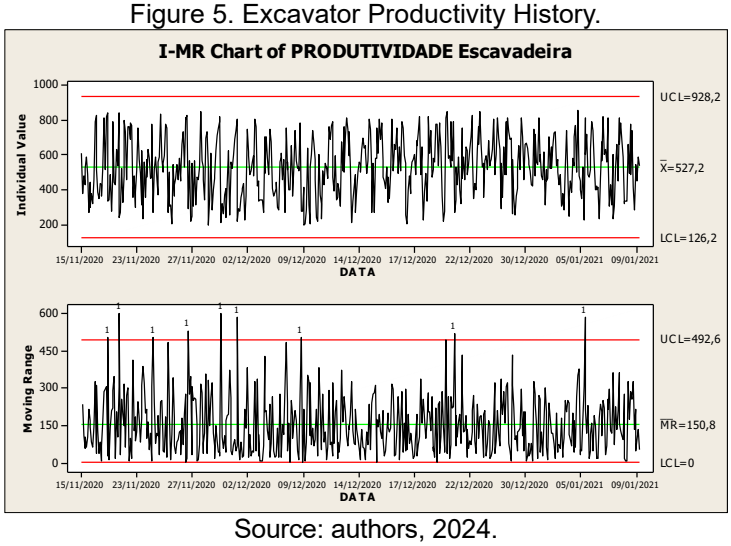
Source: authors, 2024.

Figure 4. Normality test of excavator data.



Source: authors, 2024.

Figure 5. Excavator Productivity History.



Source: authors, 2024.

The productivity of the equipment is calculated through the mass moved divided by the hours operated, productivity = mass moved (t) / hours operated (h). The increase in

productivity generates a reduction in hours operated, since the process was more productive, we made the same dough with fewer hours, that is, the type of gain is avoided cost. The formula is used to calculate the financial and environmental benefit of the project.

Project Gain (h) = [(Mplanned / Prod.fin) - (Mplanned / Prod.ant)] * Ccost R$/h (1)

- Planned Mass of Waste Waste and Ore Handling (t): (Mplanned)
- Productivity before (t/h): Prod.ant truck ; Prod.ant excavator
- Productivity After(t/h): Prod.fin Truck; Excavator Prod.fin
- Equipment operating cost (R$/h): Truck cost + Excavator cost
- Productivity gain target in the truck fleet (t/h): Truck fin product: 173 - Truck product: 150: 23 t/h, estimated gain of 15%;
- Productivity gain target in the excavation fleet (t/h): Excavator end product: 556 - Excavator product: 488: 68 t/h, estimated gain of 14%;]

With the estimated gain in reduction of hours, we can estimate the cost avoided over one year of project operation (R$) = 634 thousand reais per year (Formula 2)

Project financial benefit (R$/year) = Project gain (h) * Ccost R$/h (2)

An extremely relevant benefit for our current situation is the environmental one, which with this project we will gain in reducing carbon emissions. With the estimated gain in hours reduction, we can estimate the carbon emission reduction = 500t/year equivalent to a 13% reduction;

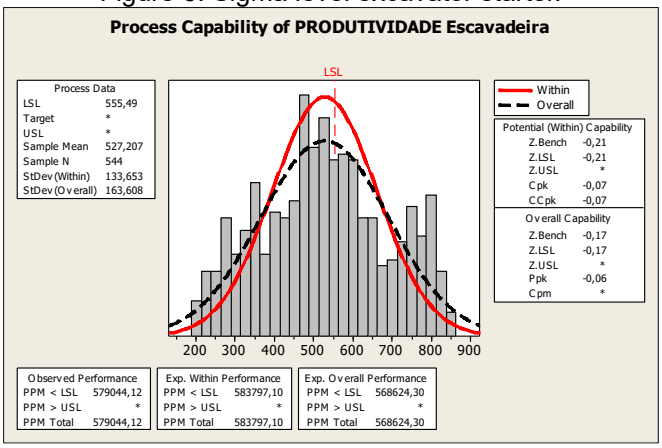
Environmental benefit of the project (carbon emission reduction/year) = Project gain (h) * Carbon emission/hr (3)

With the definition of the project scope, goal and calculated gain, a thorough analysis was initiated to measure the problem, measurement stage (Measure) using several tools applied from Lean Sigma. The first step was to calculate the sigma level of the project (capability) so that we can see the current loss level of the process. It indicates the probability of defects occurring and helps organizations direct their improvement efforts, representing how many standard deviations (sigma) fit between the process average and the nearest specification limit. A process with sigma level 6, for example, has a very low probability of producing defects, with only 3.4 defects per million opportunities.

The sigma level is determined by the number of failures in the process, for mine equipment it was calculated based on historical data and the productivity target stipulated as a reference (trucks: 173 t/h and excavators: 556 t/h), where all productivity data that is below the target would be a failure.

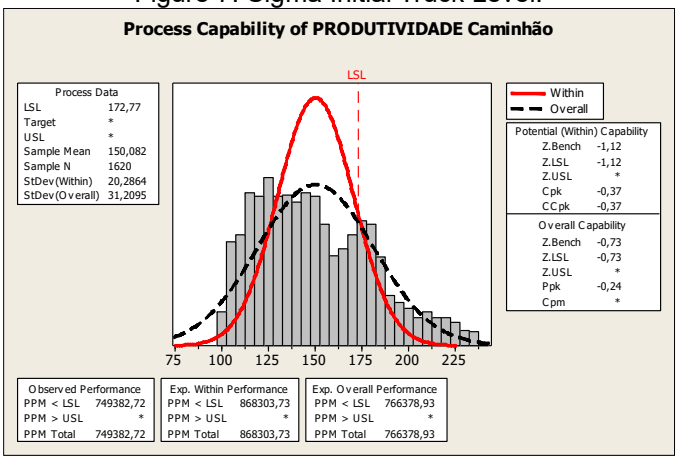
In the graphs below, we have the graph of productivity capability in cargo equipment (Figure 6) and transport equipment (Figure 7). In the graph of the excavators, the LSL (upper specification limit) was used at 556 t/h, which is the goal of the project, thus generating a sigma level of -0.17 (Z.LSL) which, added to 1.5 (convergence factor), generates a current level of 1.33 sigma. In the truck graph, the LSL (upper specification limit) was used at 173 t/h, which is the target of the project, thus generating a sigma level of -0.73 (Z.LSL) that added to 1.5 (convergence factor) generates a current level of 0.77 sigma.

Figure 6. Sigma level excavator starter.



Source: authors, 2024.

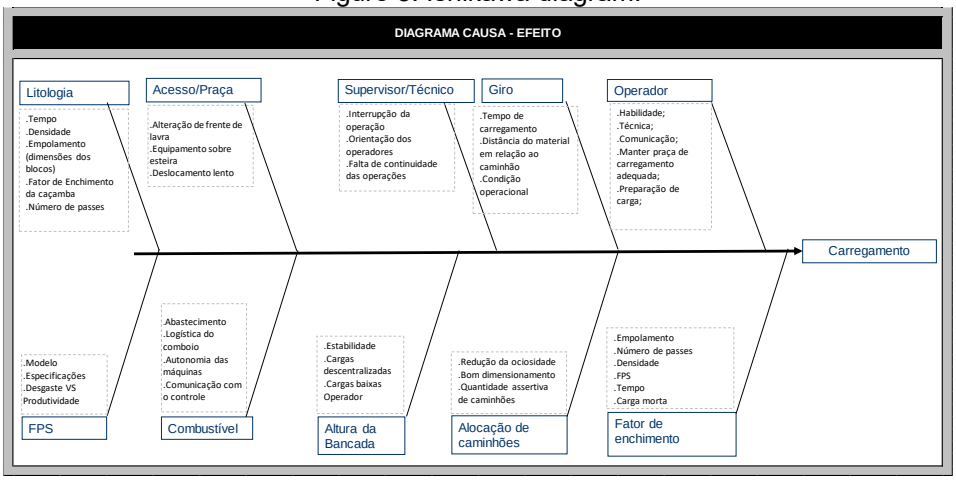
Figure 7. Sigma Initial Truck Level.



Source: authors, 2024.

The next stage of the project is the analysis phase (Analyze) of the DMAIC methodology, in which analyses of the problems were generated to identify the causes, using some tools such as the Ishikawa Diagram (fishbone).

Figure 8. Ishikawa diagram.



Source: authors, 2024.

All variables (x's) throughout the mine production process that influence the productivity process were then identified, being quantified in 35. Therefore, there was a need to use the prioritization matrices to determine the main variables (x's) to be improved. The effort x impact matrix was generated, where the variables (x's) of high impact with low effort, high impact with high effort, low impact and low effort respectively were prioritized, and the items identified as low impact and high effort were discarded.

Figure 9. Effort and impact matrix.

MATRIZ DE ESFORÇO x IMPACTO

ESFORÇO	IMPACTO: ALTO	IMPACTO: BAIXO
ALTO	Número de passes	Balança
	Largura do acesso	Controlar a chegada dos ônibus
	Continuidade de operação	SETUP do inclinômetro
	Despacho otimizado	Cerca virtual de velocidade
	DMTs longas	Uso de celular na mina
	Automatização da manobra	
BAIXO	ângulo de giro; Fator de enchimento da caçamba	Preferência pelo caminhão carregado; Aumentar para 5% as pesagens
	Alocação de caminhões; Desgaste do FPS	Preparação de carga
	Grade do acesso; Melhoria de sinal do smartmine	Instalar registro de ponto no escritório novo
	Volume de concha; Carga morta	Eliminar Armários
	Altura da bancada	Eliminar o Check-list de papel
	Padronizar a troca de turno	Finalizar distribuição de mochilas
	Pré-manobra	Padronização da manobra
	Condição do piso	Controlar KPI Km cheio/KM vazio
	Velocidade média	Utilização do rolo nas frentes de carregamento e basculamento
		Padronizar as configurações dos rádios

Source: authors, 2024.

LEAN SIGMA METHODOLOGY - IMPROVE PHASE

A set of actions were carried out in order to ensure the improvement of the productivity process with standardization, where first, materials discarded from the plant were used, which previously did not have a defined destination for maintenance of the accesses, material with a known granulometry favoring the condition of the accesses, improving the productivity of the transport equipment, as seen in the figure below.

Figure 10. Improvement of access conditions with ceiling material.



Source: authors, 2024.

There was also a need to standardize some processes such as ROM tipping of the plant and equipment supply, so fixed layouts were defined for these activities, thus defining an adequate supply location, which generate gains in reducing supply time, maintaining the cycle of standardized equipment.

It was implemented along with fleet monitoring definition of the logic between some states such as tipping and moving empty, or loading and moving full, as well as the check-list state automatically, ensuring greater data reliability.

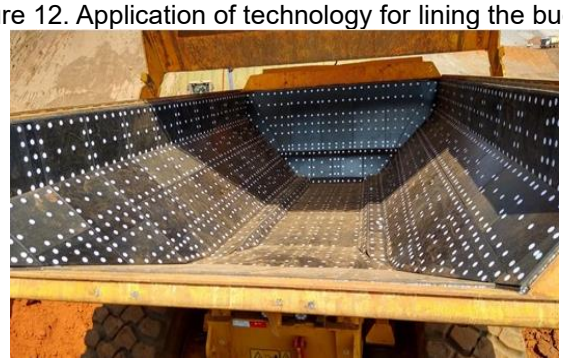
Figure 11. Improvements in the logic of the dispatch system.



Source: authors, 2024.

It was verified, especially for waste rock operations, a recurrent presence of material remaining in the truck bed, also called death load. From this, the team went to the market to look for a technology to apply to the truck's bed, also called lining, to reduce the remaining material and to mitigate this situation. After application testing, a coating material was defined for the truck bed, which solved this problem of material overload after tipping.

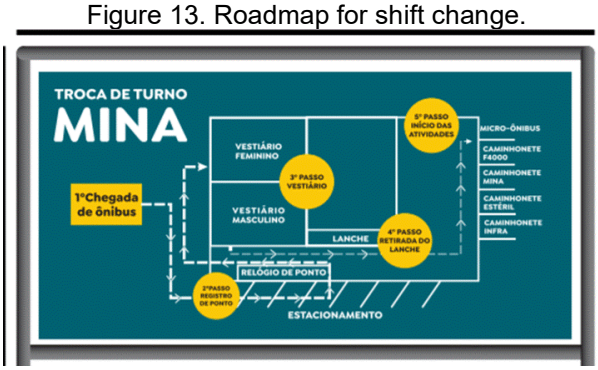
Figure 12. Application of technology for lining the bucket.



Source: authors, 2024.

Actions were carried out to map and classify the accesses, creating a maintenance schedule, in addition to the creation of an online form for inspection of the conditions of access. From this form and mapping, routines were created with the infrastructure team, to act on the problems raised and thus improve the general conditions of the accesses. In addition to the actions mentioned above, standards were also created for shift change as a roadmap and the shift change board in order to facilitate the flow of employees in shift changes, to improve the utilization indicator, reducing idle hours.

Figure 13. Roadmap for shift change.

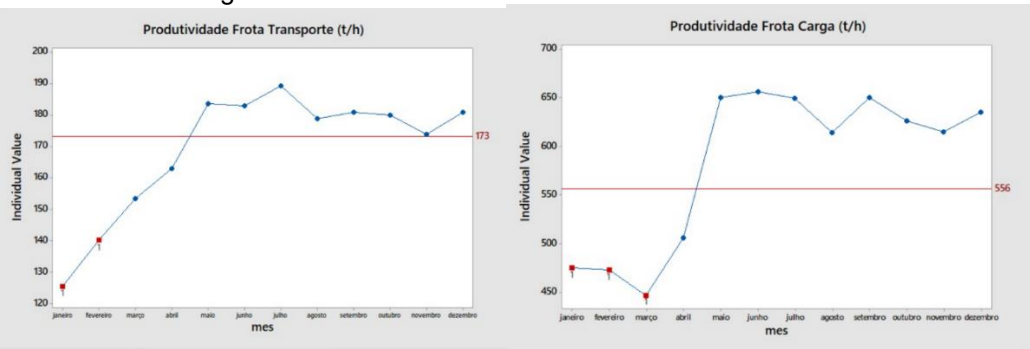


Source: authors, 2024.

LEAN SIGMA METHODOLOGY - CONTROL PHASE

With all the actions put into practice, we started the results control stage. A statistical process control (SPC) was implemented to monitor the results and prevent the process from being out of control.

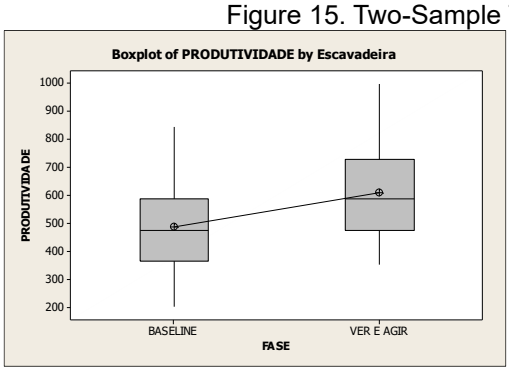
Figure 14. Statistical control of trucks and excavators.



Source: authors, 2024.

The Two Sample t-test is a statistical analysis used to determine whether there is a significant difference between the means of two independent populations. A two-sample test was performed with the excavator process with an average of 622.83 t/h and a truck process of 179.21 t/h.

Figure 15. Two-Sample T Test for Excavators.

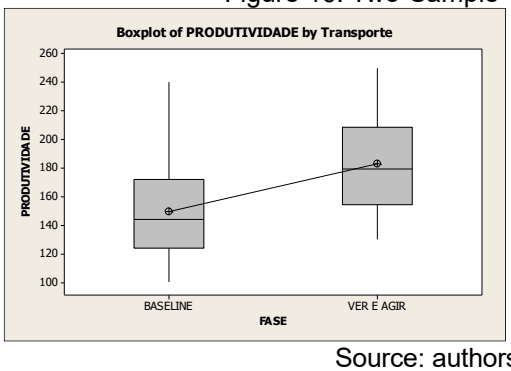


Two-Sample T-Test and CI: PRODUTIVIDADE; FASE

```
Two-sample T for PRODUTIVIDADE
FASE          N  Mean  StDev  SE Mean
BASELINE    598   475    155      6,4
VER E AGIR  735   622    162      6,0
Difference = mu (BASELINE) - mu (VER E AGIR)
Estimate for difference:  -121,892
95% CI for difference:  (-139,001; -104,783)
T-Test of difference = 0 (vs not =): T-Value = -
13,98  P-Value = 0,000  DF =1295
```

Source: authors, 2024.

Figure 16. Two-Sample T Test for Trucks.



Two-Sample T-Test and CI: PRODUTIVIDADE; FASE

```
Two-sample T for PRODUTIVIDADE
FASE           N   Mean  StDev  SE Mean
BASELINE    3440  145,34   32,1     0,55
VER E AGIR  2181  179,21   32,9     0,70
Difference = mu (BASELINE) - mu (VER E AGIR)
Estimate for difference:  -33,0844
95% CI for difference:  (-34,8315; -31,3373)
T-Test of difference = 0 (vs not =): T-Value
= -37,12  P-Value = 0,000  DF =4551
```

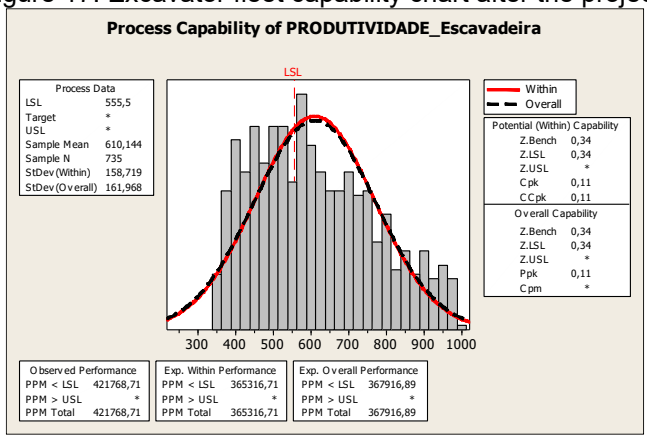
Source: authors, 2024.

RESULTS AND DISCUSSIONS

As a result of the projects, after all the improvements were made, we can see that the sigma level (capability) that measures the number of losses per million reached 1.84 for excavators and 1.8 for trucks, thus significantly improving the processes.

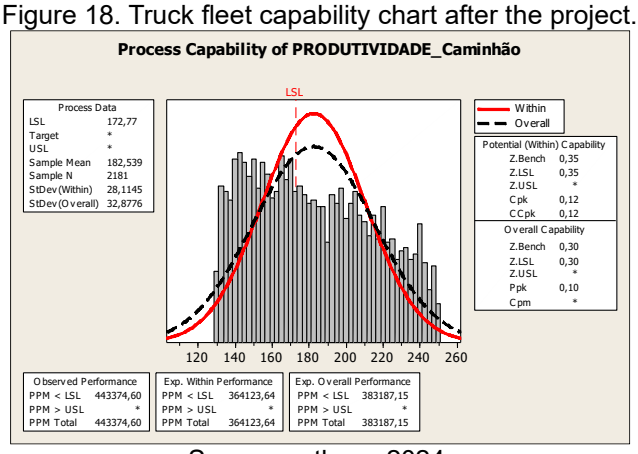
After the end of the project, all the stipulated goals were achieved. Through a detailed analysis and as a result of the actions taken towards these objectives, we achieved an increase in the overall productivity of the trucks of about 21% (the initial target was 15%), and an increase in the effective productivity of the excavators of around 31% (the target of 14%), thus exceeding the initially proposed targets.

Figure 17. Excavator fleet capability chart after the project.



Source: authors, 2024.

Figure 18. Truck fleet capability chart after the project.



Source: authors, 2024.

CONCLUSION

Through this project, with the gains in productivity of cargo (31%) and transportation (21%) equipment, relevant financial gains estimated at R$ 4,502,141 per year and non-financial gains were generated with improved safety conditions, employee well-being and reduced carbon emissions by saving hours and diesel generated with increased productivity. The gain from reducing carbon emissions is estimated at 3,056 tons of carbon per year. In addition to the financial gains of the project, it is possible to observe the development of the Lean Six Sigma methodology, fostering a culture of continuous improvement and technical development of people, reinforcing the importance of teamwork with a multidisciplinary team involving supervisory people, engineers, analysts, mine

operators and professionals from other sectors such as mine planning and maintenance. The planning of actions and the involvement of those responsible were fundamental for the good development of solutions, with quality and speed.

We can conclude that the Lean Six Sigma methodology and its tools allow, in a practical and efficient way, to identify and solve problems inherent to the production processes in mining, thus helping several professionals and society as a whole through this methodology. With this case study, the applicability of this methodology with all stages of DMAIC (Define, Measure, Analyze, Improve, Control) can be proven and its effectiveness can be proven by optimizing the productivity of the excavator and truck fleet.

LIMITATIONS OF THE RESEARCH AND RECOMMENDATIONS FOR FUTURE WORK

In this work we had the application of the methodology to increase the productivity of loading and transport equipment in mining, where in this scope it can be demonstrated its effectiveness through the results. For future work, it is suggested the application and demonstration of the Lean Six Sigma methodology for objectives and in processes different from the one applied, such as the environment, safety, maintenance, processing, among others.

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HISTORY OF WOMEN'S EDUCATION IN BRAZIL AND PARÁ: A BRIEF STATE OF KNOWLEDGE (2019 – 2023)

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ABSTRACT

The research integrates the studies of the Laboratory of Interdisciplinary Studies and Research in the History of Education and Teacher Training (LABINVE) and investigates the history of women's education between 2019 and 2023, based on dissertations and scientific initiations surveyed in three databases: BDTD, CAPES and graduate programs of public universities in Pará. The analysis highlights the absence of a consolidated subfield of the History of Women's Education, with studies often subsumed into broad categories such as gender, institutions or social movements. Based on the methodology of the state of knowledge, the study seeks to map gaps and achievements in academic production, highlighting the need for greater recognition of this subfield. Through a careful analysis, the research contributes to broadening the understanding of the historical role of women in education, proposing advances in the organization and categorization of studies in the area.

Keywords: History of Women's Education. Gender and Education. State of Knowledge.

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INTRODUCTION

This research is part of studies by the research group – Laboratory of Interdisciplinary Studies and Research in the History of Education and Teacher Training (LABINVE),[5] based on the partial survey of dissertations[6] and scientific initiation, carried out on the assumption of works from the last five (5) years (2019-2023) on the History of Women's Education. The searches were conducted in three (3) databases - Theses and Dissertations Bank - BDTD; the CAPES theses and dissertations database[7]; and the Graduate Programs in Education of public universities in the state of Pará: UFPA – Federal University of Pará; UEPA – University of the State of Pará; UFRA – Federal Rural University of the Amazon; UFOPA – Federal University of Western Pará); and UNIFESSPA - Federal University of the South and Southeast of Pará, which are justified by providing us with a comprehensive, national and local view of the North/State Region of Pará.

We also consider other balance initiatives, which serve as a reference framework, in an attempt to "recognize the historicity of production in the scientific field", as proposed by Morosini and Fernandes (2014, p. 159), whether at the national, regional and local levels. Only then, we proceed to our attempt to produce a state of knowledge of studies on the history of women's education, and thus, propose this nomenclature as a subfield of the History of Education. We make it clear that we do not consider literature review initiatives, which we believe to be something other than the state of knowledge, nor other thematic states of knowledge, that is, other themes that were not the history of women's education.

With regard to previous works presenting a state of knowledge specifically on the History of Women's Education, we did not find it. The study by Krause and Krause (2016) is what comes close when carrying out a literature review to understand the process of feminization of teaching and how it does not realize a state of knowledge in yes discusses the theme from authors such as "Hamilton (2001), Paiva (2011), Rosa Fátima de Souza (1998), Nóvoa (1986), Ribeiro (2011), Stamatto (2002), Algranti (1996), Souza (2013), Vianna (2001), Cramer; Grandson; Andrade, (2002), Ferreira (2008)". Of these, only Leila Algranti (1996) with the text *"Female education: dissonant voices in the eighteenth century and colonial practice"*; Cramer; Grandson; Andrade, (2002) with *"The insertion of the*

[5] Research Group/CNPQ – Laboratory of Interdisciplinary Studies and Research in History of Education and Teacher Training (LABINVE): Instagram @labinve_ufpa and YouTube Channel LABINVE_ufpa.
[6] Survey from the dissertation: "History of Education by Women: the protagonism of women educators in the city of Belém-Pa in the first half of the twentieth century"; and the dissertation: "The professional trajectory of black teachers in basic education in Altamira-PA in the period from 2003 to 2023" – funding CAPES (Coordination Foundation for the Improvement of Higher Education Personnel); and the scientific initiation work plan: The importance of women for Education in the twentieth century in Belém/Pará: the story they didn't tell you – funded by FAPESPA (FAPESPA - Amazon Foundation for the Support of Studies and Research).
[7] Coordination Foundation for the Improvement of Higher Education Personnel.

feminine in the masculine universe: representations of higher education"; Arilda Ribeiro with the text *"Women educated in the colony"*; Stamatto, *"A look at History: the woman at school (Brazil:1549-1910)"*; Vianna (2001; 2013) *"Sex and gender in teaching"; "The Feminization of teaching in basic education and the challenges for teacher practice and collective identity"*; they are really texts about women's education. The others discuss teaching work, primary education and Jesuit education.

On the other hand, we have other studies that deal with the History of Education in general. At the national level, we have the works of Alexandra Ribeiro, Alboni Vieira and Adriana Alflen (2021) who analyzed 367 works approved for communication, in the thematic axis History of Education, of Educere – National Congress of Education, between the years 2008 and 2017. Of the total number of works, only (10) were identified under the nickname "Education and gender in the History of Education". It is difficult to measure since other works on women may have appeared under the nickname of Intellectuals, Institutions gestated by women, but it is not specified in the text.

Damasceno, Pantoja, and Dourado (2023) investigate works that have carried out the state of knowledge about the History of Education in the Amazon, from initiatives at the National and Regional levels, since the 1980s. The works and articles highlighted are: Vidal and Faria Filho from 2003, *"History of education in Brazil: the historical constitution of the field (1880-1970)"*; the creation of the GT-02 (History of Education) of the National Association of Graduate Studies and Research (ANPEd) in 1984; in 1986 the creation of the Study and Research Group "History, Society and Education in Brazil" (HISTEDBR); and the creation of two important scientific associations - in 1996 the Association of Researchers in Education. History of Education (ASPHE); and in 1999 the Brazilian Society of the History of Education (SBHE). As well as the "I Seminar on the History of Education: Teaching and Research" held in October 1996. In addition to these, he indicates: Almeida – *"The Initiation to Research in Education at UFPA (1980 - 2000) - Drawing the Profile of the Production of the Bachelor's and Licentiate Course in History*"; Alves, Nery, Silva – *"Cartography of productions in the history of education in the Graduate Programs in Education in Pará (2005-2018)*"; Necklaces with two texts – *"History of education in the Amazon: critical methodological theoretical issues and propositions"* and *"Educational historiography of the Amazon: an introduction"*; Corrêa, *"History and educational historiography in the Amazon: An X-ray of knowledge production in the Graduate Programs in Education in the Northern region of Brazil"*; Costa and Moraes – *"History of education in the Brazilian Amazon: a recent historiographical balance"*; Costa and Rosário – *"HISTEDBR AND GEPHE: a decade of history of education in the Amazon";* Damasceno *et*

al. - The history of education in graduate programs in education in the Amazon: the state of knowledge of production in the field"; Maia, Damasceno and Tomé – "History of education in the TCCs of Pedagogy at UFPA (1983-2018); Saviani, D. Preface in Estácio e Nicida - "História e educação na Amazônia"; Schueler, Preface in France, Lobato and Nery, V. (ed.). *"History of education in the Amazon: multiple subjects and educational practices"*; and Vieira and Cury – "*The writing of the history of education in Brazil: experiences and perspectives".*

Regionally, we have the study by Corrêa (2013) who conducts a survey in research groups in the North region, in those held in the field of History of Education, from 1993 to 2010. And, it observes a growth in the number of GPs in the country in general, and in the North – from 77 (1993) to 1433 (2010). And, in Pará, from 20 (1993) to 582 (2010). Of these, only 18 are in the history of education, or that have a line of action in this area. 11 of these, in Pará. As this study is more than ten years old, it needs to be updated.

Costa and Moraes (2018, p. 211), deal with the "academic production on the History of Education in the Brazilian Amazon, based on the theses and dissertations defended in the Graduate Programs in Education and History of the region, from their foundations until 2014". With a focus on the North Region, whose territories are in the Amazon area. In this sense, they elected thirteen (13) PPG'S – 10 of them in Education and 3 in History – according to the last CAPES evaluation of 2013. According to the authors, there is a concentration of works in the History of Education in only two states, Pará and Amazonas[8]: Of the survey of 50 dissertations and 47 defended in Education programs (94%) and only 3 in History (6%), none was indicated as history of women's education and/or gender.

The text by Damasceno *et al. (2021),* addresses the production in eleven (11) graduate programs in education in the Legal Amazon, namely: Graduate Program in Education (PPGED/Federal University of Pará), Graduate Program in Education and Culture (PPGEDUC/UFPA), Graduate Program in Curriculum and Management of Basic School (PPEB/UFPA), Graduate Program in Education (PPGED/UEPA), Graduate Program in Education (PPGE/UFAM)

Graduate Program in Education (PPGE/UFOPA), Graduate Program in Education (PPGED/UNIFAP), Graduate Program in Education (PPGE/UERR), Graduate Program in

[8] the Graduate Program in Education and the Graduate Program in History at the Federal University of Amazonas (UFAM); the Graduate Program in Education at the State University of Pará (UEPA); the Graduate Program in Social History of the Amazon, the Graduate Program in Science and Mathematics Education, and the Graduate Program in Education, at the Federal University of Pará (UFPA) (Costa and Moraes, 2018, p.213).

Education (PPGE/UFAC); Graduate Program in Education (PPGE/UNIR); Graduate Program in Education (PPGE/UFT).

According to this study (Damasceno *et al.*, 2021), the PPEB is the first program to make official a line of History of Education, since until 2018, the year of analysis of the work, the programs analyzed had their lines focused on the following axes: public policies in education and educational management, curriculum, knowledge, culture and diversity, teacher training and pedagogical work, and education and development in the Amazonian context. This does not mean that there was no production in the field of the history of education in these programs, but that these productions were due to biases of lines of research other than the History of Education, inaugurated at the PPEB in 2021 (UFPA| PPEB, 2024).

Also according to Damasceno *et al.* (2021) of 1886 works, including theses and dissertations, only 114 are in the History of Education. The PPGED of UFPA as the largest number (48), followed by the PPGED of UEPA (20), PPGE of UFAM (16) and PPGE of UFAC (16). There is an indication of five works on the nickname of Education, Social movements, ethnicities and gender. It is another work that does not highlight the history of women's education as a subfield.

At the local level, we have the publications of Karla Almeida who aimed at a survey of TCC's – Course Completion Work, in the history course at UFPA, on the production of knowledge about Basic School/Elementary Education, in universities, in the State of Pará, in the 80s and 90s of the twentieth century? When identifying the works that referred to the History of Education, he observed that from 1982 to 2000 there were 57 works, of which three (3) referred to gender – "which were concerned with female education in the late ninth and early twentieth centuries, rescuing the histories of girls' schools of the period and the Normal School" (2004, p.6).

Alves, Nery and Silva (2019) carry out a survey in the PPG's of UFPA (PPGED) and UEPA (PPGED), from 2005 to 2018, when considering the creation of both programs to start the survey. In PPGED|UFPA 444 works in total, 325 dissertations and 119 theses defended in all. Of these, only 53 dissertations and 19 theses were considered to be in the field of History of Education, being organized according to the axes established by the SBHE. Under the nickname "Education, Social Movements, Ethnicities and Gender" only four (4) dissertations and one (1) thesis. Other works deal with underprivileged girls and education, but are characterized in the "Educational Politics and Institutions" axis. At UEPA, from 2007 to 2016, there are a total of 215 dissertations defended, of these, only 35 are characterized by the authors as being from History of Education; and there was still no

thesis defended. Only four (4) works under the nickname "Education, Social Movements, Ethnicities and Gender"; In the same way, it assumes the history of women's education not as a study of gender, but of school institutions. One way or another, there is no established subfield such as History of Women's Education.

Maia, Damasceno and Tomé (2020) provides an overview of the productions in History of Education in the Teaching Degree Course in Pedagogy at the Federal University of Pará – UFPA| Belém Campus. To this end, they survey Course Completion Papers - TCC from 1983 to 2018. It was discovered that of the total in 1965, only 65 were in the area of History of Education. The axes adopted are that of SBHE, and therefore, works on women will appear under the nickname of gender or institutions. The "Education, Social Movements, Ethnicities and Genders" axis add up to only seven (7).

Socorro França (2018) initially points out other historiographical studies of Brazilian education, among these, almost all of these indicated productions are not included in the references to be consulted, but can be consulted on page 23. As it is a work that deals with the *"History of Education in the Graduate Program in Education of the State University of Pará (2007-2017)".* These are results that, in this ten-year interstice, forty-three (43) dissertations were defended, none of which are related to gender, or may be subsumed to the axes created. The organizational axes are: public instruction, youth and adult education (EJA), intellectual production, educational policy, intellectual and education, school discipline, teacher training, educational institution and non-school educational process and practice.

When analyzing the data collected on the History of Women's Education, a significant gap in the academic production specifically dedicated to this subfield is observed. Although there are studies and literature reviews that touch tangentially on the issue of gender and women's education, such as the works of Krause and Krause, which explore the feminization of teaching, most research is still focused on broader or different themes within the history of education. This lack is evidenced by the lack of studies explicitly categorized under the nickname of History of Women's Education in surveys carried out at various universities and graduate programs, both nationally and regionally.

The studies carried out show a tendency to frame research on women and education under broader categories, such as "Education and Gender", "Social Movements", or "Educational Institutions", which can dilute the specificity necessary to establish the History of Women's Education as a distinct subfield. The analysis by Damasceno *et al.* (2021), for example, reveals that of the 1886 works between theses and dissertations in graduate

programs in the Legal Amazon, only 114 are in the History of Education, and a minimal fraction addresses the education of women or gender directly.

Therefore, it is evident that there is a need for greater recognition and a clearer categorization of studies on the History of Women's Education in order to consolidate this subfield within the History of Education. This differentiation is crucial to promote a deeper and more specific understanding of the contributions and challenges faced by women in education throughout history. The creation of dedicated lines of research and the systematic inclusion of this theme in research groups are fundamental steps to fill this gap and advance knowledge in this area.

For the organization of the work, we followed the methodology of the State of Knowledge, which as a bibliographic study, consists of the systematization of scientific production in a certain area of knowledge. However, as stated by Joana Romanowski and Romilda Ens (2006), it is not restricted to the identification of production, but plays a fundamental role in the appreciation of knowledge already elaborated, in the sense of pointing out the most researched themes, the approaches, and, mainly, existing gaps.

The concept of "state of knowledge", as presented in the text by Silva, Souza, and Vasconcellos (2020), refers to an approach that seeks to map, analyze, and synthesize accumulated knowledge, highlighting the main advances, gaps, and trends in academic production. The main objective is to provide a panoramic and integrated view of the development of the field, allowing a deeper and contextualized understanding of the studies carried out.

According to Morosini and Fernandes (2014), in order to make a state of knowledge, it is necessary to follow a series of methodological steps that involve the collection, analysis and synthesis of information about a given field of study. The main steps for the construction of a state of knowledge according to the authors are described below: clearly determine the theme or area of research that will be investigated; explain the relevance and importance of the chosen theme; identify and select relevant bibliographic sources, such as scientific articles, theses, dissertations, books, among others; establish criteria for the selection of studies that will be included in the analysis; organize the selected references according to thematic, chronological, methodological or other pertinent categories; use bibliographic management software to assist in the organization and cataloging of references. These are survey stages, regarding reading and Critical Analysis, they suggest carrying out an initial reading to obtain an overview of the selected works; then an Analytical reading, a more detailed and critical reading of the studies, identifying the main findings, methodologies, gaps and trends.

Also according to Morosini and Fernandes (2014), it is important to carry out a Synthesis of Knowledge - Synthesize the information collected, highlighting the main contributions, convergences and divergences between the studies and contextualization, by situating the findings in the broader context of the field of study, identifying advances, gaps and possible future directions.

Thus, the descriptor: *"history of women's education" was used*, always with the following. And, in the reading of the abstracts, we sought to highlight the themes/objects, objective, methodology and main contributions of these works, now inventoried.

In order to investigate the evolution and current state of intellectual production, in the area of education, on the history of women's education in Brazil and Pará between the years 2019 and 2023, identifying the constitution of the field, the changes that have occurred, the gaps and the achievements achieved; that this State of Knowledge was carried out.

Such an analysis will also contribute to broadening the understanding of the role played by women in education over time, highlighting their relevance and impact in the educational sphere.

OVERVIEW OF THE STATE OF KNOWLEDGE

This section presents an overview of the state of knowledge on the History of Women's Education. In order to provide a comprehensive and critical overview, we reviewed the existing literature, identifying the main contributions, gaps and trends in the area. This survey allows not only an understanding of the historical and current development of the field, but also highlights future directions and emerging issues that need further investigation. By contextualizing the research carried out, we seek to offer a solid basis for new studies and practices, promoting significant advances in the understanding and application of knowledge on the subject.

Table 1 – Total Findings in the databases, CAPES Journals, BDTD and Graduate Programs of UFPA

Kind						
	Articles	Theses		Dissertations		Total
		HE	HIM	HE	HIM	
CAPES Periodicals	18	-	-	-	-	
BDTD[9] CAPES	-	-	4	-	11	
PPGED| UFPA	-	10	4	2	1	190
PPGEDUC| UFPA	-	-	-	11	2	146
PPEB| UFPA	-	-	-	10	3	131

[9] In the BDTD, given the volume of studies, the studies were selected under the principle of using the descriptor HEM. Therefore, there is no differentiation between HE and HEM.

PPGED| UEPA	-	-	-	9	4	144
PPGE| UFOPA	-			4	-	94

- HE: History of Education
- HEM: History of Women's Education

Source: The Authors, based on the findings of BDTD, Capes and Graduate Journals of the universities of Pará (UFPA, UEPA, UFRA, UFOPA, UNIFEESPA).

Chart 2 presents a selection of publications made between 2019 and 2023, available in CAPES Journals, which explore the history of women's education in Brazil. The articles address several themes, such as the contributions of female figures to education, the autobiographical narratives of teachers, and the analysis of the role of women in educational and social contexts. In addition to examining the trajectories of educators throughout history, the publications reflect on the social and cultural changes that have impacted teacher training and female participation in education. These researches, based on renowned academic institutions, contribute significantly to the understanding of the role of women in Brazilian education and their struggles for recognition and equality.

The Graduate Program Education – PPGED| UFPA| Belém began in 2003. And, in our interstice from 2019 to 2023, it has a total of (190), of which (92) dissertations and theses (98) defended. In 2019 (59) in total, Dissertations (35), none are by HE or HEM, and Theses (24) – (5) by HE and none by HEM; 2020 has (33) works defended in total, Dissertations (17) – (1) HE/HEM and Theses (16) – without HE or HEM works; 2021 has (22) works defended in total, Dissertations (8) and Theses (14) – three (3) of these theses are by HE; 2022 (27) studies, in total, were defended, Dissertations (12) and Theses (15) – among the theses four (4) are by HE and none by HEM; and in 2023, Dissertations (20)- (1) HE, and Theses (29) – (3) HE, two of them by HEM.

The Graduate Program in Education and Culture – PPGEDUC| UFPA began in 2014 and has a total of (146) works defended, all dissertations. In 2019 (28) dissertations, HE (5). HEM (1); in 2020 (27) dissertations, HE (1). HEM (0); in 2021 (33) dissertations, HE (2). HEM (0); in 2022 (27), HE (1), HEM (0); and in 2023 (31), HE (2), among these two (1) is HEM.

The PPEB - Graduate Program in Curriculum and Management of Basic School was created in 2015, and makes available the dissertations defended from 2017 to 2022. We are interested in the period 2019-2023, where a total of (131) dissertations were found[10], of these, only ten (10) from HE and three (3) that can be considered from HEM. In 2019, thirty-one (31) dissertations were defended, three (3) by HE, and none by HEM; in 2020, (28) dissertations defended, (3) HE and (2) HEM; in 2021, twenty-one (21) dissertations were

[10] The PPEB approved the doctorate in 2024 and therefore does not yet have a thesis defended.

defended, only two (2) are from HE and none from HEM; in 2022, twenty-two (19) dissertations were defended, two only in the History of Education, only one (1) in the History of Women's Education (HEM) subfield; and in 2023, (32) dissertations defended, (1) HE, none HEM.

The PPGED - Graduate Program in Education | UEPA was created in 2005 and has been making its defenses available since 2013. We are interested in the last five years, so in 2019 (30), only Dissertations; (3) HE, no HEM; in 2020 (21), HE (3), no HEM; in 2021 (30), HE (1), none of HEM; in 2022 (21) Dissertations; HE (1) HME (1); and in 2023 (42) defended works, (31) dissertations and (11) theses. Of these, only three (3) are HE and they are HEM. In total, he has (144) defended in the period from 2019 to 2023, (133) dissertations and (11) theses, of which (9) are from HE and (4) from HEM.

The Graduate Program in Education – PPGE| UFOPA, started its activities since 2014. And, when considering our interstitial, in 2019 (27), HE (2), HME (0); 2020 (18), HE (0), HME (0); 2021 (19), HE (0), HME (0); 2022 (16), HE (1), HME (0); 2023 (14), HE (1), HME (0). Only considering dissertations, as there were no theses available.

Chart 2 - Publications from 2019 to 2023 of CAPES Periodicals, on the History of Women's Education

TITLE	AUTHOR	NEWSPAPER	YEAR	KIND
Spaces to educate: female biographies and teaching the history of education.	VALDEZ, Diane; ALVES, Miriam, Fábia.	State University of Maringá – UEM	2019	Article
Power games and teacher professionalization: discussing the subjectivities of the feminine in the classroom.	SANTOS, Welson B. et al.	São Paulo State University – UNESP	2019	Article
History and memory of teacher training at the Institute of Education of Pará, (1964-1985).	ROSÁRIO, Maria José Aviz do; CUNHA, Célio.	State University of Maringá – UEM	2019	Article
Autobiographical Narratives of the Black Teacher Maria Helena Vargas da Silveira: training and teaching practice in the book "É Fogo!".	ZUBARAN, Maria Angélica. et al.	Universidade La Salle	2019	Article
Maria Junqueira Schmidt: a Catholic intellectual in dialogue with the New School.	ORLANDO, Evelyn de Almeida.	Catholic University of Paraná - PUC PARANÁ	2020	Article
Pioneers of Education in Brazil: Women, teachers and intellectuals.	MACHADO, Rita de Cássia Fraga; PAULO, Fernanda Santos.	Federal University of Rio Grande do Norte – UFRN	2020	Article
Intellectual women, culture and education in Brazil: presentation notes on a theme.	ORLANDO, Evelyn de Almeida	Catholic University of Paraná - PUC PARANÁ	2020	Dossier
Between Memories and Stories: the trajectory of training and professional performance of a teacher from Acre.	CARVALHO, Mark Clarkassen de. et al.	Federal University of Piauí – UFPI	2020	Article

Elisa Scheid: a teacher in the workers' movements of the central railroad of Brazil (Engenho de Dentro, Rio De Janeiro, 1890 to 1910).	RIZZINI, Irma. et al.	State University of Campinas – UNICAMP	2020	Article
"Feminism Overflows": Teaching, Written Production and Political Action by Aurea Corrêa in the city of Rio De Janeiro.	RIZZINI, Irma; SCHUELER, Alessandra Frota Martinez de.	State University of Southwest Bahia – UESB	2020	Article
Control and resistance of the capixaba teaching profession (1908-1909): "the drama of teacher Joanna Passos".	BEZERRA, Ariadny; SIMÕES, Regina Helena Silva.	Federal University of Espírito Santo – UFES	2020	Article
Training of rural teachers in the distant corners of the federal territory of Guaporé, in the north of Brazil, in Porto Velho/RO (1947 -1951).	SOUZA, Cleicinéia Oliveira de; FERREIRA, Nilce Vieira Campos.	São Paulo State University – UNESP	2020	Article
Professional training of educator Maria Lília Imbiriba Sousa Colares.	FIALHO, Lia Machado Fiuza. et al.	State University of Southwest Bahia – UESB	2021	Article
Unveiling the subjective constitution of a teacher: Sofia's story.	BAUM, Virginia Dornelles.	Pontifical Catholic University of Rio Grande do Sul – PUCRS	2021	Thesis
Brazilian women and the covid-19 pandemic: reflections on the consequences for teaching work.	SOUZA, Ana Laura Bonini Rodrigues de; CASTRO, Rosane Michelli de.	São Paulo State University – UNESP	2022	Article
The presence of women in the history of education in Brazil.	GUEDES, Rayane Silva; PASSOS, Daniela Oliveira Ramos dos.	State University of Rio de Janeiro – UERJ	2022	Article
Ester Troian Benvenutti: for education and culture in the rural areas of Caxias do Sul-RS (1940-1950).	DEWES, Elisângela. et al.	State University of Maringá – UEM	2023	Article
Trajectories of principals of school groups in Maranhão.	FRAZÃO, Maria das Dores Cardoso.	Federal University of Maranhão – UFMA	2023	Article

Source: The Authors, based on information from the Capes Journals database.

In the CAPES Periodicals, eighteen (18) publications were found, originating from universities such as the State University of Maringá (UEM), São Paulo State University (UNESP), La Salle University (UNILASALLE), Pontifical Catholic University of Paraná (PUC PARANÁ), Federal University of Rio Grande do Norte (UFRN), Federal University of Piauí (UFPI), State University of Campinas (UNICAMP), State University of Southwest Bahia (UESB), Federal University of Espírito Santo (UFES), São Paulo State University

(UNESP), Pontifical Catholic University of Rio Grande do Sul (PUC RS), State University of Rio de Janeiro (UERJ) and Federal University of Maranhão (UFMA).

Regarding Chart 2, when considering the searches carried out on the CAPES Periodicals platform, I found works that address several issues related to education and the role of women in the educational context. They explore topics such as valuing the biographies of educators; female subjectivity in education; the training of teachers and principals; the influence of gender and race on teacher identity; the trajectories of educators and intellectuals in the history of education; and the resistance of teachers in the face of educational challenges and reforms. Each work offers a unique perspective on the impact of women in the field of education, highlighting their contributions and challenges faced over time. Let us see these works below.

The article by Valdez and Alves (2019) discusses the sharing of an experience involving the use of biographies of educators in the context of teaching the history of education in a Graduate Program in Education, problematizing the excessive male use in classic works of the history of education and in dictionaries published in the twentieth and twenty-first centuries. It also shows us the idea that by granting students the opportunity to explore a variety of accounts, it also reveals the journeys of women in the history of education. This, in turn, leads to the investigation of the ideological, political and social conflicts faced by teachers, encouraging the formulation of new perspectives on the role of teaching in the history of Brazilian education.

The article by Santos, et al (2019) addresses the issues of female subjectivity in education, seeking to deconstruct the idea that teaching is a profession for women, focusing on the conditions in which women/teachers were/are submitted, from the salary issue to motherhood, presenting some historical aspects in which women were subjected to some practices that devalued them as women and professionals.

The article by Rosário and Cunha (2019) portrays the course of teacher training at the IEP (Institute of Education of Pará) in the years 1964 to 1985, the authors through documents and interviews present us with how the training of these teachers took place at the same time as the military dictatorship occurred. The authors also reveal the few studies on this period in Pará.

The article by Zubaran, et al (2019) examines the autobiographical narratives of a black teacher and writer, named Maria Helena Vargas da Silveira. The central objective is to analyze how the representations of gender and race influence their identity and teaching practice. Such research is a way of emphasizing the lives of black teachers who were

hidden in the History of Education, expanding the visibility in the formation of teachers' identity.

Orlando's article (2020) portrays the life of educator Maria Junqueira Schmidt, an active Catholic figure and a fervent supporter of modern pedagogy. She applied concepts from the New School, which she acquired during her training in Europe and the United States, to the teaching of living languages, especially French, in the Brazilian context. The research was based on information from newspapers and travel reports published in the periodical press, revealing how the educator assimilated and incorporated these ideas.

The article by Machado and Paulo (2020) addresses how intellectuals Nísia Floresta, Ana Maria Saul and Maria Lacerda de Moura have influenced Education in various dimensions throughout history. Their trajectories help to rethink the university from a perspective of liberating education. As women intellectuals and educational activists, they went through political training, contributing to understanding Education as part of a project for society in dispute. The research highlights the impact of these pioneers of Brazilian Education on educational research and studies on education and women.

The Orlando dossier (2020) deals with the need to fill a gap observed in the academic literature; after analyzing four journals of the History of Education in Brazil and the Annals of the main congress in the area, the author noted the scarcity of works that addressed women as historical subjects, although there are studies on their experiences, training and contributions to culture and education, they are rarely recognized as intellectuals. Similarly, studies on intellectuals rarely address women. This dossier addresses this gap and highlights the role of women as intellectuals in the history of education.

The article by Carvalho, et al (2020) is based on an autobiographical narrative, exploring the professional development of a teacher from Acre who made significant contributions to public education in Xapuri. The objective is to analyze her life, education and career, as well as conversations with the teacher, personal and official documents.

The article by Rizzini, et al (2020) explores the life of Elisa Scheid, a teacher from Rio de Janeiro active in the labor movement. The research reveals that she built a solid social network based on her educational background, teaching practice, and political involvement. Elisa played a leading role in advocating for workers' rights by challenging the gender norms of the time.

The article by Rizzini and Schueler (2020) analyzes the perspectives of a professor from Rio de Janeiro, named Aurea Corrêa, based on her productions written in newspapers, especially Gazeta de Notícias. This study is part of a broader research on the

trajectory of female teachers and their involvement in the civil, political, and labor rights movements. Aurea Corrêa built a social network based on her experience in teaching and political activity, defending teachers' rights, the improvement of schools, socialism and rational teaching for women.

The article by Bezerra and Simões (2020) explores the resistance of teacher Joanna Passos in the face of her dismissal during the Educational Reform in Espírito Santo. The authors analyze their opposition strategies, considering personal and contextual elements, based on documentary and journalistic sources; the teacher challenged the authoritarianism and coronelist practices of the Public Power, questioning the provision of educational services.

The article by Souza and Ferreira (2020) investigates the training of rural teachers in the Carmela Dutra-CNRCD Regional Normal Course, between 1947 and 1951, based on official documents. The focus is on preparing women for rural teaching in the North region, specifically in Porto Velho, which is currently the capital of Rondônia. The text is divided into two parts: an analysis of training for rural education and an exploration of the details of training at the CNRCD in Porto Velho, at the time part of the Federal Territory of Guaporé.

The article by Fialho, et al (2021) analyzes the educational trajectory of teacher Maria Lília Colares, which demonstrates the difficulties faced by many women in the search for higher education; this professor contributed to the expansion of the Graduate Program in Education in western Pará. Using Cultural History, the research interviewed Maria Lília Colares and found that, despite economic challenges and family instability, she obtained a master's and doctorate, allowing her contribution to the educational system of Santarém.

Baum's thesis (2021) is a case study that examines how a pedagogue named Sofia shapes her view of teaching throughout her life. The research suggests that educators like her, who value dialogue, attribute importance to their practice and learning, influencing new perspectives. The author demonstrates how Sofia's teaching is based on essential values, such as affection, empathy, honesty and respect, which guide her practice and how her affective memories play an important role in promoting dialogic education as an agent of social mobility.

The article by Souza and Castro (2022) portrays the negative impact of the COVID-19 pandemic on the work of women who are teachers in Basic Education in Brazil; Using a bibliographic approach, it examines gender and race relations, highlighting the influence of whiteness since the nineteenth century.

The article by Guedes and Passos (2022) presents us with the construction of the field of the history of education in Brazil and how women educators are recognized in this

context; revealing a lack of recognition of influencers in history of education books, but highlighting the existence of research and projects that seek to value the trajectories of women as protagonists in Brazilian education.

The article by Frazão (2023) explores the training and practices of principals of school groups in Maranhão, focusing on their memories and professional trajectories, using the methodology of Oral History, the author interviewed principals who worked both in the capital and in the interior of the state, this work highlights the relevance of understanding the experiences, knowledge and practices of principals.

The article by Dewes, et al (2023) investigates the trajectory of teacher Ester Troian Benvenutti in rural communities in Caxias do Sul, RS, between 1940 and 1960, based on cultural history and historical documentary analysis, the work analyzes how her representations influenced other women in the area of education in the region and how her proposals contributed to the transformation of local school culture, mediating relations between different social groups.

It is possible to note that there is an initial scarcity from the realization of this State of Knowledge, but the works comprehensively address the presence and contributions of women in Brazilian education. Figures such as Eudésia Vieira, Ana de Castro Osório, Francisca Clotilde, Heleieth Saffioti, Maria Lindomar Martins Vale, Maria Helena Vargas da Silveira, Maria Junqueira Schmidt, Nísia Floresta, Ana Maria Saul, Maria Lacerda de Moura, Elisa Scheid, Aurea Corrêa, Joanna Passos, Maria Lília Colares, Sofia and Ester Troian Benvenutti stand out. The research explores intellectual trajectories, resistance to social and political challenges, pedagogical practices, and the influence on educational history, offering contemporary perspectives, including topics such as female subjectivity, teacher training, and coping with the COVID-19 pandemic.

One can immediately observe the small number of productions found in five years. Let us see how it happens in the survey carried out in the BDTD and in the CAPES database, detailed in Chart 1.

Chart 1 - BDTD and CAPES Publications on the History of Women's Education in Brazil (2019 to 2023)

TITLE	AUTHOR	UNIVERSITY	YEAR	KIND	LOCAL
The intellectual trajectory of Eudésia Vieira: ...	GALVÍNCIO, Amanda Sousa	Federal University of Paraíba – UFPB	2019	Thesis	BDTD
Ana de Castro Osório, a transnational intellectual: ...	MACHADO, Juliana Goulart	University of Caxias do Sul – UCS	2019	Dissertation	BDTD
The pedagogical practice of Francisca Clotilde	FARIAS, Vanessa Pinto Rodrigues	Federal University of Ceará – UFC	2019	Dissertation	CAPES

in education in Aracati					
The history of the education of poor women in primary night school institutions in Uberlândia/MG (1933-1959): a space of struggle and resistance for schooling	SILVA, Carla Cristina Jacinto from	Federal University of Uberlândia Faculty of Education (FACED)	2019	Thesis	BDTD
Maria Auxiliadora Domestic School of Cuiabá: schooling women to sew, embroider and sew (1951-1965)	BARBOSA, Jane Cassia	Federal University of Mato Grosso Brazil Institute of Education (IE) UFMT CUC - Cuiabá Graduate Program in Education	2019	Dissertation	BDTD
Pedagogy of beauty in advertising speeches in the magazine A Vida Moderna: São Paulo (1907-1926)	SOUZA, Gabriel Monteiro de	Federal University of Uberlândia	2019	Dissertation	BDTD
The history of the education of poor women in primary night school institutions in Uberlândia/MG (1933-1959): a space of struggle and resistance for schooling	SILVA Carla Cristina Jacinto from	Federal University of Uberlândia	2019	Dissertation	CAPES
"Grateful mister that, whether you like it or not, is to be a housewife": women's education at the Dona Júlia Domestic School – Cuiabá-MT (1946-1949)	SILVA, Gabriella Moura da	Federal University of Mato Grosso Brazil Institute of Education (IE) UFMT CUC - Cuiabá Graduate Program in Education	2021	Dissertation	BDTD
Education and female participation in the Vargas era	FERREIRA, Marcélia Gomes	Pontifical Catholic University of Goiás – PUC Goiás	2021	Dissertation	BDTD
Unsilenced stories of teachers: ...	ROCHA, Naiara Clerics from	São Paulo State University – UNESP	2021	Thesis	BDTD
Education and representations of women through domestic life: the magazine of the home and the woman, which from hand to hand, travels through	SPINDULA, Alice Lopes	Federal University of Ouro Preto	2021	Dissertation	CAPES

Brazil from end to end (1930 to 1945)					
The Intellectual Trajectory of Heleieth Saffioti ...	SOUSA, Nilvan Lau2	State University of Ponta Grossa – UEPG	2022	Thesis	BDTD
Maria Lindomar Martins Vale: ...	MOURA, Meire Quinta de Almeida	Catholic University of Santos – UNISANTOS	2022	Dissertation	BDTD
"My times as a normalist": memories of students about the School of Family Education of Londrina in the 1960s and 1970s	BARROS, Lucila Monteiro da Silva	State University of Londrina	2022	Dissertation	BDTD
The right to school education for black women (Rio Grande do Norte, 1931-1964)	ALCÂNTARA, Paulo Basílio de	Federal University of Rio Grande do Norte	2022	Dissertation	BDTD

Source: The Authors, based on information from BDTD and CAPES (2019-2023).

The two platforms were searched for so that they could be complementary. We ignored duplicate works, and those that were not in the history of education. In total we found sixteen (16) works – four (4) theses and twelve (12) dissertations. Seven of these studies are concentrated in 2019; four in 2021; and four in 2022. No finds in 2020 or 2023. As previously discussed, there are few works that are demarcated as being in the History of Women's Education, and when considering our descriptor to be quite restricted, it is probably due to this the reduced number of finds.

The concentration in the Southeast regions (6); Midwest (4); Northeast (3); South (2), also draws attention. As well as the lack of finds in the North Region. Socorro França in 2018 draws attention to at least thirteen PPG'S and Damasceno *et al.* (2021) for eleven PPG'S in the North Region, at least thirteen graduate programs in education.

In this sense, we can observe the works individually, as is the case of the thesis by Amanda Galvíncio (2019) addresses the intellectual trajectory of Eudésia Vieira, a professor, doctor, historian and poet in Paraíba. The study argues that Eudésia Vieira played an important role as a cultural mediator of feminine and feminist causes, reconciling traditional and progressive models of women. The research is based on the works and texts of Eudésia Vieira, in addition to investigating biographies, biographical entries and academic research on her intellectual contribution, using a methodology inspired by Historical Hermeneutics.

Juliana Machado (2019) focuses on the analysis of Ana de Castro Osório's role as a cultural mediator in feminist movements, considering the international circulation of her

ideas. Ana de Castro Osório was a Portuguese intellectual, writer, journalist and feminist leader, little recognized in contemporary Brazil. The study seeks to understand how Ana de Castro Osório's contribution to feminist movements can enrich the teaching of History, especially in the context of gender. The study is based on a documentary and historical analysis.

Vanessa Farias (2019) has as its main objective to resignify the pedagogical practice of Francisca Clotilde (1862-1935), focusing on the Externato Santa Clotilde (1891-1935), a school she founded. It is important to highlight that the research uses theoretical categories such as Education, Women and Discourse, anchored in authors such as Foucault, Bakhtin and references in the History of Education. The author uses a theoretical-methodological approach, based on hemerographic and documentary sources.

Carla Silva, in her thesis, seeks to make the history of the school institutions that offered night education to women in the municipality of Uberlândia in the period from 1933 to 1959; starting from the theoretical-methodological assumptions of the New Cultural History, as its theme is the history of the education of poor women in primary night school institutions in Uberlândia/MG. The time frame begins in 1933, the year in which the first night school for girls was located in the municipality, and ends in 1959, the year of the last record of a primary night school found in the documents researched in the public archive of Uberlândia. The conclusions of the study are that these working women were made invisible in their needs as workers and not recognized as women of the house, always being mentioned in a pejorative way.

Jane Barbosa (2019) writes a dissertation on female education, offered by the Maria Auxiliadora Domestic School of Cuiabá, EDMA, between the years 1951 and 1965. It relies on alots of new cultural history such as Marc Bloch, Carlo Ginzburg and Michelle Perrot. And, it takes as conclusions that the education offered at the Maria Auxiliadora Domestic School of Cuiabá was systematized and influenced by conservative religious principles and EDMA, and that it offered training for women focused on the care of the home and family.

Souza (2019), in turn, studied advertising aimed at the female audience, which had been published in the São Paulo magazine A Vida Moderna between 1907 and 1926. It is substantiated by the contributions of Cultural History and Bakhtinian analysis. And, he came to the conclusion that advertising functioned as one of the educational instruments responsible for a "pedagogy of beauty", at two levels: body aesthetics and behavioral aesthetics. Regarding the body, beauty was characterized by white and delicate skin and youth, which was shown mainly on the face, décolleté and shoulders; In the realm of

behavior, the concept of beauty demanded from women a competitive spirit and self-determination regarding the duty to be beautiful.

The study by Carla Silva (2019) addresses the history of the education of poor women in primary night schools in Uberlândia/MG between 1933 and 1959. Using the New Cultural History, the research maps and analyzes seven institutions, the profile of the students, and the working conditions of the teachers. It is concluded that, despite social barriers and prejudices, these women resisted and transformed the school space into a common environment for both sexes, challenging the invisibility and lack of recognition of their educational needs and rights.

In Gabriela Silva's dissertation (2021), the same theme as Jane, but in another institution, addressing the female education offered at the Dona Júlia Domestic School - EDDJ, in Cuiabá, between the years 1946 and 1949, the methodology based on the analytical premises of Michel de Certeau (1982) and Paul Ricouer (2007) was used, from which they came to the conclusion that the training offered to women at EDDJ, point out that the foundation and creation of the EDDJ came from the ideas coming from women from traditional Cuiabá families, for whom domestic knowledge was the basis of learning at the institution, according to conservative religious principles, with the main purpose of training cheap and specialized female labor to work in the homes of families.

Marcélia Ferreira (2021) addresses the theme of education and female participation during the first government of Getúlio Vargas, the study focuses on the ideas of intellectuals in the 1930s, the New School Movement and the structuring of the Brazilian educational system. She investigates how education developed during the Vargas Era (1930-1945), what parameters were established for the professionalization of teachers and how the "Manifesto of the Pioneers of the New School" contributed to this, it also analyzes historically the representation and professionalization of women in education in this period, based on bibliographic and documentary research.

Naiara Rocha (2021) addresses the relationship of women and teachers with knowledge and how this relationship influences their identities and pedagogical practices. The research is based on the narratives of four teachers and explores how their relationships with knowledge shape their mobilizations to promote inclusive education. Using Bernard Charlot's theory of the relationship with knowledge, the author starts from the (auto)biographical method, making use of the narrative interview as an autobiographical narrative device; The thesis highlights the importance of teaching work in building the relationship with knowledge and in the search for an inclusive school.

Alice Spindula (2021) investigated the educational messages of the magazine "Vida Doméstica" between 1930 and 1945, focusing on morals, formal and scientific schooling. Using a methodology of documentary analysis, the research explores how the magazine, by reaching a wide audience in Brazil and internationally, propagated the idea that only well-educated women in various areas could form healthy and moral future citizens. It is concluded that "Domestic Life" played a significant role in shaping social, school, and political practices and strategies, influencing the position of women in society during the Vargas Era and World War II.

Sousa (2022) examines the intellectual trajectory of Heleieth Saffioti and her work "A Mulher na Sociedade de Classes" (1969), which represents a counter-ideology to the dominant patriarchy. Saffioti was a pioneer in the study of women and the capitalist system from a Marxist perspective . Her work analyzes women's education from the Colony to the Republic, highlighting how this contributed to social inequalities and the marginalization of women in capitalist society, employing a bibliographic methodology.

Meire Moura (2022) describes the trajectory of educator Maria Lindomar Martins Vale, seeking to give visibility to her work that goes beyond formal education. The study is a biographical and historical documentary research, which highlights how the educational act transcends the school space and contributes to the construction of the educator's identity in the Baixada Santista. It explores gender segregation in twentieth-century education, highlighting how women fought to win the right to education and professionalization as teachers.

Lucila Barros (2022) tries, in her dissertation, to make us aware of the practices of the School of Family Education of Londrina, by using interviews with the normalistas and analysis of photographs, seeking to go back to their memories. The author considers important the survey of photographs that constitutes a historiographical source and enables the understanding of the History of Women's Education in the second half of the twentieth century from the School of Family Education of Londrina, providing an overview of the History of Women's Education in the city.

As for Alcântara's dissertation (2022), it deals with the history of the education of black women over a period of 33 years (1931-1964), who studied on farms, ranches, villages and cities that are or are not the headquarters of municipalities in Rio Grande do Norte. According to the author, the history of these women's education reveals the search for schooling to overcome the poverty and illiteracy of their parents, the search for social stability for themselves and their families, allowed by the jobs and professions that characterized women's work in the period from 1931 to 1964.

For the survey in the PPG'S of Pará, we carried out the search on the Sucupira Platform, based on the parameters – PPG's of the North, of Human Sciences, Education evaluation area and we worked only with those of the state of Pará - The Graduate Program Education and Culture – PPGEDUC| UFPA; the PPEB - Graduate Program in Curriculum and Management of the Basic School | UFPA; the PPGED - Graduate Program in Education |UFPA; the PPGED - Graduate Program in Education | UEPA; and the Graduate Program in Education – PPGE| UFOPE.

Chart 3- Publications from 2019 to 2023 of graduate programs in Education in Pará (PPGED/PPGDUC|UFPA), (PPEB/UFPA), (PPGED/UEPA), (PPGE| UFOPA)[11] on the History of Women's Education

TITLE	AUTHOR	UNIVERSITY	YEAR	KIND
PPGEDUC| UFPA				
Practices, knowledge and resistance of women in the historical and cultural context during the period of rubber extraction on the island of Itanduba, municipality of Cametá/PA	FARIAS, Meurygreece Caldas	Federal University of Pará – UFPA	2019	Dissertation
It's easy to be a Christian when you live well like them": education, culture and women's engagement in Angola (1939 – 1970)	PINHEIRO, Daelem Maria Rodrigues	Federal University of Pará – UFPA	2023	Dissertation
PPGED|UFPA|Belém				
Educational practices of the congregations daughters of St. Anne and Sisters of St. Dorothea in the formation of women in Belém do Pará (1906-1927)	Silva, Tayana Helena Cunha	Federal University of Pará – UFPA	2020	Dissertation
The Congregation of the Daughters of Mary Help of Christians and Salesian female formation at the Don Bosco Institute in Belém do Pará: between education, religion and work (1935 – 1942)	CALLOU, Maria Lucirene Sousa	Federal University of Pará – UFPA	2023	Thesis
The primary school teacher in the female characters in the novelistic works of	NERY, Guthemberg Felipe Martins	Federal University of Pará – UFPA	2023	Thesis

[11] UFRA and UNIPEESPA do not have a Graduate Program in Education.

Lindanor Celina (1920-1930)				
PPEB | UFPA| Belém				
PROFESSOR MARIA ANNUNCIADA RAMOS CHAVES: contributions to the History of Brazil and to the teaching of History in the context of national-developmentalism	GOLOBOVANTE, Smile de Souza	Federal University of Pará – UFPA	2020	Dissertation
History of basic education at the women's re-education center-CRF (2006-2016)	MUNIZ, Diana Helena Alves	Federal University of Pará – UFPA	2020	Dissertation
Stories of black teachers from public schools in the municipality of Belém do Pará, from 2004 to 2014	PIMENTEL Thaís Pimenta	Federal University of Pará – UFPA	2022	Dissertation
UEPA| BETHLEHEM				
Life narratives of early childhood education teachers: teachers' memories and identities under construction	MAIA, Marcia Maria de Oliveira	University of the State of Pará - UEPA	2022	Dissertation
Miriense female education at the Aristóteles Emiliano de Castro Municipal School from 1960 to 1985	CABRAL, Rayanne Correa	University of the State of Pará - UEPA	2023	Dissertation
Monte Serrat and the desire to be: black intellectual, writer and educator from Abaetúba	TRINDADE, Joelma da Silva	University of the State of Pará - UEPA	2023	Dissertation
Writings on the education of women teachers in the periodical the school: official teaching magazine (1900-1904)	MARQUES, Natalia Priscila de Souza	University of the State of Pará - UEPA	2023	Dissertation

Source: The Authors, based on the graduate programs in force at Universities in Pará.

In Chart 3, it can be seen that, in the last five years, in the graduate programs in Education, only two works were found in PPGED/UFPA (1) and PPEB/UFPA (1) that portray the history of women's education (Silva, 2020) and the contributions of a teacher (Golobovante, 2020), since in this research other graduate programs of universities in Pará were considered, such as UEPA – University of the State of Pará, UFRA – Federal Rural University of the Amazon and UFOPA – Federal University of Western Pará).

Although the work of Meurygreece Farias (2019) is more like women's history, it highlights the knowledge constituted by these practices, when investigating the participation of riverside women in rubber extraction. Using qualitative methodology with interviews and oral history, it was concluded that these women played a crucial role in the local economy and family management. Their experiences showed resistance and female power in a sexist context. The narratives highlighted the resilience of these women in the face of the adversities of working in the rubber plantations.

The work of Daelem Pinheiro (2023) sought to understand the political action of women in the process of independence of Angola and the Methodist educational influence, especially of figures such as Deolinda Rodrigues in the anti-colonial resistances. Using qualitative methodology with analysis of historical documents and digital collections, the research was based on diaries, missionary declarations and period photographs. It was concluded that the formal education promoted by the Methodist missions provided greater educational opportunities for many Angolans, strengthening the struggle against Portuguese colonialism. Women, in particular, stood out in the resistance, highlighting the importance of education in political and social formation.

The study by Tayna Silva (2020) addresses the education of poor girls in Belém do Pará, at the beginning of the twentieth century, by the congregations of the Daughters of St. Anne and the Sisters of St. Dorothy. Using the methodology of Marc Bloch's Comparative History, the research analyzes historical documents collected in public and private archives. Initial findings indicate that these congregations contributed significantly to the formation of women, preparing them to be mothers and loyal citizens of the new Republic, while maintaining religious education as an essential pillar. These educational practices were part of the appreciation of the homeland and the promotion of civility and republican progress.

Maria Lucirene Callou (2023), in turn, in her thesis, analyzes the formation of women by the Congregation of the Daughters of Mary Help of Christians at the Don Bosco Institute in Belém do Pará between 1935 and 1942. Using the technique of Documentary Analysis and grounded by theorists such as Marc Bloch, Edward Thompson and Pierre Bourdieu, the research examines educational action and Salesian institutional culture. The conclusions indicate that the congregation implemented an educational project that reconciled primary, vocational education and festive oratory, encouraging training for work in a context where the Church associated female destiny with motherhood and marriage, demonstrating significant educational action for women's work in the city.

In Nery's study (2023), we will find an analysis of the discourses about the primary school teacher in the novels "Menina Que Vem de Itaiara" and "Eram Seis Marcados" by

Lindanor Celina, focusing on the fictional school context of Itaiara/Bragança-PA between 1920 and 1930. Using the theoretical-analytical propositions of Mikhail Bakhtin, the research treats literary works as documentary sources. The conclusions indicate that the novels present ideological and polyphonic discourses, revealing characters who sometimes represent the dominant "ideal teacher" at the time, sometimes configure themselves as transgressive "future teachers". These characters challenged current educational norms, standing out for their courage and search for autonomy.

Golobovante (2020), investigates the influence of Professor Annunciada Chaves on the History of Brazil and on the teaching of the discipline during the period of national-developmentalism. Highlighting the political and educational conjuncture between 1945 and 1964, the research analyzes the trajectory of the teacher and discusses her historiographical and teaching conceptions, especially through the work "Sugar in the History of Brazil", evidencing the relevance of the teacher in the transition of historiographical and educational approaches in the History of Brazil and in the teaching of this discipline.

About Diana Muniz (2020), her research investigated basic education at the Women's Reeducation Center (CRF) in Pará between 2006 and 2016, focusing on the changes brought about by the Educating for Freedom Project. Using a theoretical approach and documentary methodology, documents from the School of Penitentiary Administration and the CRF, such as class diaries and pedagogical records, were analyzed. The research concludes that the implementation of this project was crucial for the consolidation of basic education in prisons, evidencing significant changes in the educational trajectory of women in deprivation of liberty.

The dissertation by Taís Pimentel (2020) analyzed, through Oral History, the pedagogical strategies of black teachers in public schools in Belém do Pará between 2004 and 2014, aiming at valuing black identity. Using interviews as the main method, the investigation revealed that the black identity formation of these teachers served as resistance and social ascension. The pedagogical practices were focused on valuing black characteristics and deconstructing social stigmas, highlighting the importance of black representation in teaching. The personal experiences of the teachers influenced their educational approaches, contributing to a more just and egalitarian society.

Marcia Maia's (2022) dissertation touches on the History of Women's Education, since it investigates teacher identity in early childhood education and its relationship with pedagogical practices, based on teachers' memories. The methodology included field research with narrative interviews of three teachers from an EMEI in Belém/PA, theoretically

supported by authors such as Nóvoa, Freire and Vygotsky. A qualitative approach and content analysis were used to interpret the data collected. The results reveal reflections on the construction of teacher identity and pedagogical practice, highlighting aspects that influence the choice to work in early childhood education and the quality of education offered. It is important to note that this is not a declared HE work, but an approximate one.

The work of Rayane Cabral (2022) investigated female education at the "Aristóteles Emiliano de Castro" school in Igarapé-Miri, Pará, between 1960 and 1985, using the orality of three teachers to explore their experiences as educators. The methodology adopted Cultural History, analyzing documents, photographs and conducting oral interviews. The results reveal that the teachers resisted the authoritarianism of the time through critical and enlightening pedagogical practices, both inside and outside the school. These practices reflected the opposition to the civil-military regime, integrating itself into the opposition movement of Brazilian society during the dictatorship.

About the study by Joelma Trindade (2023), it explores the personal and professional history of Maria do Monte Serrat Carvalho Quaresma, a black woman, writer, teacher and poet from Abaetetuba, Pará. Using documentary research and oral narratives, the objective was to analyze his trajectory from 1940 to 1970, mapping knowledge and practices, and characterizing his teaching at the Basílio de Carvalho School Group. The results show how Serrat, despite inequalities and prejudices, influenced education with innovative practices and a strong connection with nature and spirituality, contributing significantly to the history of women's education.

The research by Natália Marques (2023) demonstrates the publications of normalist teachers on education in the journal "A Escola: Revista Oficial de Ensino" between 1900 and 1904, linked to the Graduate Program in Education at the University of the State of Pará. Adopting the perspective of Cultural History, texts by teachers such as Zalina Rolim, Maria Pinheiro Arthur, Claudia de Campos and Marianna Vianna were analyzed. The results show that, despite the limited space and the predominantly male context, these educators managed to publish ideas about games, child development, patriotism and solidarity, contributing to the educational debate of the time.

We would like to highlight, based on the analysis of these studies, that most of them were conducted by women. For this reason, and in an attempt to circumvent the invisibility that we women suffer when we indicate ourselves under the surname of our fathers and/or husbands, we choose to emphasize the names of the women involved, including their first and last names. We hope that this highlight serves as a claim, so that all of us, women

researchers, can be recognized in academic research and receive due credit for the efforts undertaken.

Women researchers who are dedicated to conducting studies on other women contribute to the continuity of a vital perspective, providing subsistence and recognition to the countless women who have gone through cycles of social transformation. This approach not only enriches the academic research landscape but also underscores the importance of understanding and valuing women's experiences over time.

CONCLUSIONS

The initial research on the history of women in education in the last five years reveals an unequal distribution of works, with emphasis on the CAPES journals, which present eighteen (18) studies, followed by the Theses and Dissertations Bank, with seven (7), and only two (2) in the graduate programs of UFPA, most of the studies are concentrated in the South and Southeast regions of Brazil, with lower representation in the North and Midwest regions.

The themes explored range from political participation in feminist movements to the condition of women in patriarchal society, reflecting the diversity of perspectives on female education, the predominant methodology in these works involves bibliographic, documentary and historical research, using varied sources, such as biographies, official documents and autobiographical accounts of the educators studied.

Another pertinent issue is the fact that most of the works are not presented as the history of women's education, but rather the history of institutions, religious congregations, and women's education appears in the background. This also results in the fact that in most of these studies women appear as subjects who suffer the educational act, and not as protagonists, proposers, creators, and resisters. It is certainly a question to reflect on in the subsequent production of a writing on education and women, two recognitions: to make explicit the History of Women's Education subfield and to place them in the position of active subjects.

There is a need to expand the recognition of women as historical and intellectual subjects, as well as a more in-depth investigation of the influence of gender on teacher identity, highlighting challenges and resistance faced by teachers throughout history.

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SUSTAINABLE DEVELOPMENT AND NEIGHBOURHOOD IMPACT STUDY: CONNECTIONS AND CHALLENGES

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ABSTRACT

The Neighborhood Impact Study (EIV) aims to identify in advance the possible urban impacts, positive and negative, as a result of the implementation of large-scale enterprises or activities in physical areas within the municipality. For this reason, this research aimed to

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raise scientific evidence on the advances and challenges for the use of EIV in Brazilian municipalities under the bias of Target 11.1 of the SDG. To this end, as a methodological choice, an Integrative Literature Review was developed through a qualitative approach, considered appropriate to discuss how knowledge has been built about the advances and challenges for the use of EIV and disorderly urban growth and its importance for cities, population and the necessary care for the conservation of the environment. At the conclusion of this research, it was evidenced that the EIV is a tool that, if adopted efficiently, will be able to contribute to the creation of sustainable cities, through the balance between economic growth, environmental protection and social equity. It is worth adding that the content of the research allows us to affirm that it is essential to adopt tools that contribute to the sustainability of cities and thus ensure equitable access to resources and opportunities and improve the quality of life of all residents.

Keywords: Neighborhood Impact Study. Environmental impact. City Statute. Sustainable Development Goal.

INTRODUCTION

This study is based on the idea that the process of disorderly and unplanned growth of Brazilian cities, environmental degradation and social tensions have been placing Brazilian municipalities under severe pressures on human and social development.

Thus, it is possible to find several studies in the literature that deal with disorderly urban growth, brings a common point in the approaches in part of these studies, the idea that this process consumes a lot of energy, creates inadequate infrastructures and public services, and is responsible for large carbon emissions, bringing serious environmental pollution (Mourão et al., 2019; Soeiro Vieira et al., 2022, Saleme and Micchelucci, 2023).

In this dynamic, in spite of the existence of the express constitutional provision recommended by the Federal Constitution of 1988, bringing general guidelines on the Right to the City, especially with demands related to the environment and urban issues, aiming at future well-being and ensuring that there are conditions of use for a future society that succeeds the current one (Brasil, 1988).

The national legislation that deals with the implementation of the Neighborhood Impact Study (EIV) is Law 10.257 of 2001, called the City Statute. with the objective of identifying in advance the possible urban impacts, positive and negative, as a result of the implementation of large-scale enterprises or activities in physical areas within the municipality (Brasil, 2001).

On this issue, the studies by Almeida and Calais (2021), Soeiro Vieira et al. (2022) and Saleme and Micchelucci (2023), similarly indicate the existence of exploring the obstacles, weaknesses and potentialities of the use of EIV in Brazilian municipalities and its implications in the area of environmental protection, as well as the use of EIV as an instrument for enforcing and controlling urban legislation.

As he reinforces, the greater or lesser emphasis and depth to be considered in relation to one or another impact, results from the configuration of the type and size of the enterprise, and the urban, socioeconomic and cultural context of the place. Sánchez (2006) considers that the term is used to describe local impacts in urban areas such as overload of the road system, saturation of infrastructure, microclimatic changes, increase in the frequency and intensity of floods due to soil sealing, among others.

For Silva (2022), inefficiency in urban land use is one of the problems caused by rapid urbanization. Indicator 11.3.1 of the UN Sustainable Development Goals (SDGs) is designed to test the efficiency of urban land use. However, an economically developed city is not synonymous with a sustainable city. Cities need to qualify to provide their inhabitants

with a dignified quality of life and find alternatives for economic and sustainable development.

Kronemberger (2019, p. 40), point to the idea that the 2030 Agenda is important, as a result, of covering issues and demands related to the environment, society and economy in a global way, as well as the institutional issues of Sustainable Development. It has 17 Sustainable Development Goals (SDGs), 169 targets and 232 indicators, in addition to the Declaration (vision, principles and shared commitments).

In developing these arguments, it is understood that when there is inadequate planning, the idea is glimpsed that disorderly urban growth can lead to congestion, higher crime rates, pollution, increased levels of inequality and social exclusion. On the other hand, the literature by Fabrício et al. (2019), point to the idea that there is a need to promote and implement sustainable production and consumption practices aimed at achieving one of the main challenges of contemporary times, which is Sustainable Development. Thus, Brazilian municipalities have been living with the paradox of maintaining capitalist and progressive thinking against the need to achieve development and care for the preservation of the environment for future generations.

Therefore, this study brings an interdisciplinary approach to how man relates to the environment, specifically, in relation to issues that deal with the advances and challenges for the use of EIV in Brazilian municipalities under the bias of Target 11.1 of the SDG.

Thus, this article presents an Integrative review of the literature, focusing on the need for the joint evolution of society and nature. In addition to the disorderly expansion of cities, it is understood that rapid urbanization has brought many problems and challenges, including the growing number of slum dwellers, increased air pollution, large volumes of solid waste, and insufficient or inaccessible basic services and infrastructure to the most vulnerable population, which have made cities more vulnerable to disasters.

In this context, the following guiding research question was formulated: What is the scientific evidence on the advances and challenges for the use of EIV in Brazilian municipalities under the bias of Sustainable Development?

In this scenario, the justification for carrying out this research is the importance of contributing to the construction of knowledge about the effectiveness of EIV practices in Brazil as a tool for urban planning and management, as well as identifying how the performance of this tool can contribute to the achievement of Target 11.1 of UN SDG 11. It should be added here that it is relevant to seek to highlight the advances and challenges for the use of EIV in Brazilian municipalities under the bias of Target 11.1 of the SDG, thus contributing to the construction of an understanding of the assessment of neighborhood

impacts and their importance for cities, population and the necessary care for the conservation of the environment.

Therefore, the objective of this article is to gather scientific evidence on the advances and challenges for the use of EIV in Brazilian municipalities from the perspective of Sustainable Development.

METHODOLOGY

This is an Integrative Literature Review carried out through a qualitative approach, considered appropriate to discuss how knowledge has been built through related evidence on the advances and challenges for the use of EIV in Brazilian municipalities under the bias of Goal 11 of the SDG.

Thus, during the development of the study, six stages will be followed (Figure 1), as recommended by Mendes, Silveira and Galvão (2008): a) Identify the guiding question; b) To raise the inclusion and exclusion criteria and literature search sampling; c) Collect data; d) Critically analyze the chosen researches; e) Discuss the results and f) Synthesize and present the review.

Figure 1 – Flowchart of the stages of the Integrative Literature Review



Source: Mendes, Silveira and Galvão (2008)

The online databases were consulted, from December 2023 to January 2024: Scientific Electronic Library Online (SCIELO), Web of Science Platforms, Scopus and Google Scholar, using the following keywords for the search: "Neighborhood Impact Study",

"Sustainable Development Goal 11", "Urban Management" and "Preservation of the Environment", in Portuguese, published in the period between 2019 and 2024. 2023, with Qualis B1 to A1.

The exclusion criteria were: productions with incomplete or repeated texts and publications that are outside the established time frame. To identify issues that are related to the advances and challenges for the use of EIV in Brazilian municipalities under the bias of Goal 11 of the SDG, with the help of the Iramuteq software, the most significant words that appear most in the abstracts of the selected works.

On this issue, Souza et al. (2020), state that the use of Iramuteq in the analysis of interview data can occur in different ways. In this study, we focused on the "Word Cloud" analysis, which according to Alves et al. (2022, p. 10), "[...] This type of analysis projects words structured in the form of a cloud, with different sizes, with the largest being those that have a certain importance, as they are repeated more often in the textual corpus."

With the chosen articles, each article was read thoroughly and in its entirety, in order to critically analyze the content of the material and reflect on the forms of approaches that the studies brought in their data. All publications, without exception, went through this sieve in which it was possible to list the main conclusions found by the researched literature on the subject.

Subsequently, the findings found in the analyzed contents were described in categories of analysis, so that it was possible to provide subsidies in the answer to the guiding question of the research. Thus, the data were analyzed through Content Analysis, which is "a set of communication analysis techniques, which uses systematic and objective procedures to describe the content of messages" (Franco, 2020).

In addition, the content of the analyzed articles was maintained in its originality, that is, these articles were not limited to distorting at any time the ideas defended by the authors chosen in this Integrative Literature Review. As for the risks of the research, it was evident the possibility of the occurrence of possible similarities in the analyses and the discussion carried out, which can be characterized as plagiarism, so the author was concerned with giving due credit to the authors who contributed to the research. In order to prevent this from occurring, we sought to respect the provisions of Law No. 9,610/1998, which deals with Copyright in Brazil (Brasil, 1988), as well as the Regulatory Standard of the Brazilian Association of Technical Standards (ABNT) No. 10520/2023, recently updated, which deals with Citations in documents.

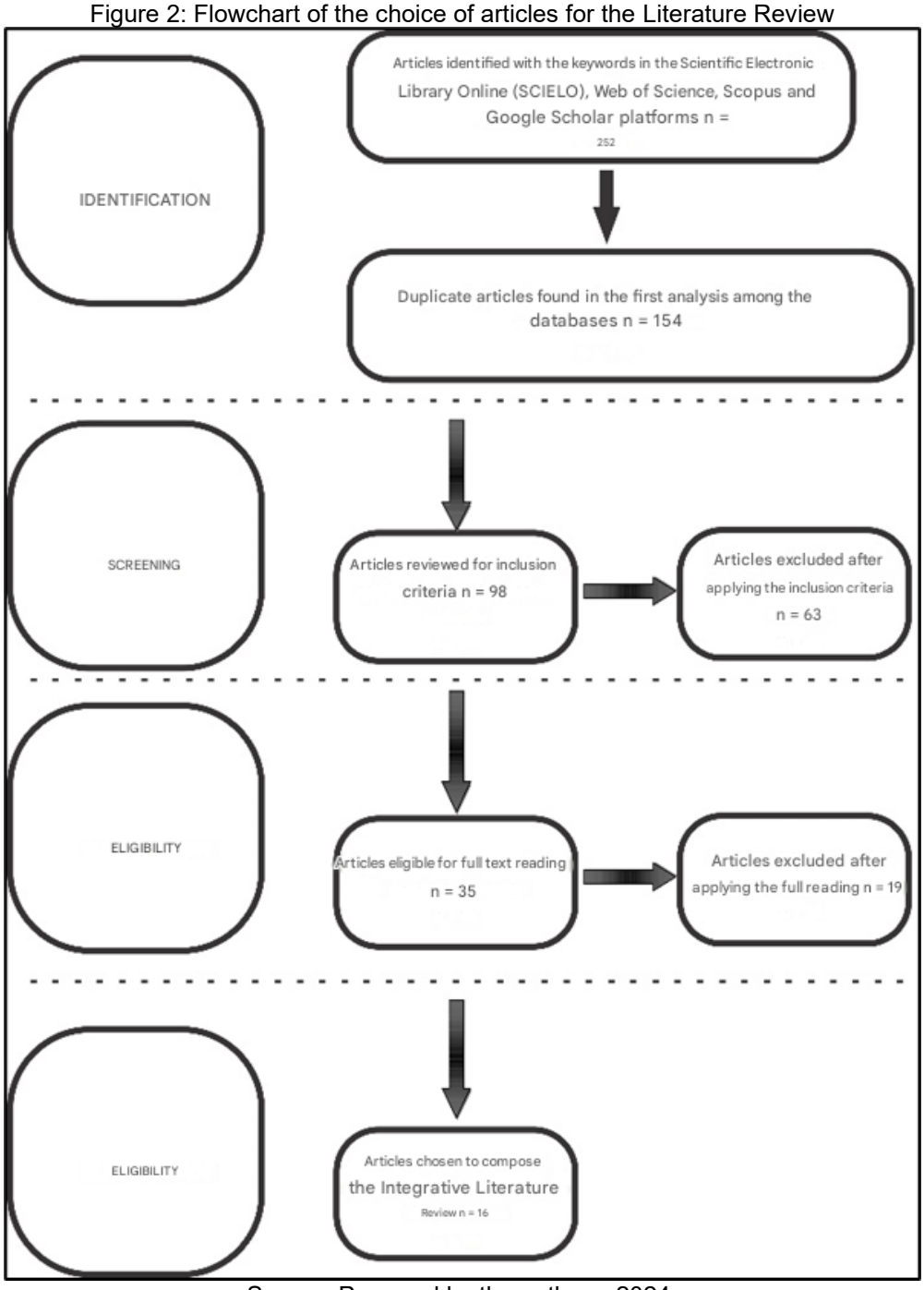
RESULTS

Preliminarily, 252 articles were found for the initial screening in the Scientific Electronic Library Online (SCIELO), Web of Science, Scopus and Google Scholar databases, of which 154 were excluded, based on the criterion of the adequacy of the title to the investigated theme and the exclusion of duplicate occurrences. After the first refinement, abstracts of 98 studies were read in order to verify whether the content of the articles was adequate for the present research, as well as the methodologies developed in these articles, for this reason, resulted in the exclusion of 63 articles that were inappropriate to the theme proposed for this investigation.

Thus, in a new filtering with the terms "Neighborhood Impact Study" AND "Urban Management" and "Neighborhood Impact Study" AND "Environmental Preservation" and "Neighborhood Impact Study" AND "Sustainable Development Goal", and the reading of the 35 texts in full, analyzing each article individually and applying the inclusion factors and eligibility criteria were made, filtering that resulted in the exclusion of 19 articles, reduced to 16 articles, which managed to fit the inclusion criteria, which were read in full and included in this study. The final sample consisted of 18 articles included in the present review (Figure 2).

After individually analyzing the information contained in the research chosen for this study, chart 1 was created to demonstratively illustrate the information compiled from the analyzed articles, which are: Authors/year; research title, database, Qualis of the article and objective.

Figure 2: Flowchart of the choice of articles for the Literature Review



Source: Prepared by the authors, 2024.

Chart 1 – Articles chosen for Integrative Review in the period from 2018 to 2023

Authors/Year	Job title	Database	Qualis	Objective
Braga (2018)	Transparency and social control in the rules on Neighborhood Impact Study in the urban agglomeration of Piracicaba-SP	Geographical Studies: Electronic Journal of Geography	B1	To evaluate the Master Plans, and related urban standards, of the 23 municipalities of the Urban Agglomeration of Piracicaba-SP, regarding aspects related to transparency and social control in the process of analysis and approval of Neighborhood Impact Studies

Almeida Coutinho (2019)	Environmental public policies and the statute of the city: urban development in a democratic state and the rule of law	Revista Argumentum-Argumentum Journal of Law	B1	To analyze how the environmental issue and environmental policies were dealt with by the City Statute.
Peres and Cassian (2019)	The Neighborhood Impact Study (EIV) in the South and Southeast regions of Brazil: advances and challenges to urban environmental management	city. Brazilian Journal of Urban Management	A1	Present a methodological roadmap for improving the regulation and elaboration of EIVs.
Silva (2020)	Legal analysis of the neighborhood impact study as a mechanism to promote sustainable development in the municipality of Manaus/AM	Route	A3	To evaluate the importance of the Neighborhood Impact Study for the construction of a balanced urban environment, a challenge that opposes the public interest and the private interest, the application of public order norms and the social use of property, in order to have a sustainable development of cities
Sant'anna (2020)	Neighborhood Impact Study: the city's profile	City Law Journal	A1	To examine one of the instruments of urban policy - the (EIV) and its insertion in the profile of the city, which is constituted by corpus, but also by animus
Inguaggiato, Stanganini and Melanda (2021))	The Neighborhood Impact Study as a tool for Urban Management in Medium-Sized Municipalities in São Paulo (100 thousand to 400 thousand inhabitants)	city. Brazilian Journal of Urban Management	A1	To survey the legislation on EIV in the pre-established municipalities, through a bibliographic and legislative review on the subject
Almeida, Calais and Lopes (2021)	(Im)possibilities of the neighborhood impact study as an instrument of the right to the city in Belo Horizonte	City Law Journal	A1	To observe to what extent such an instrument contributes to a more democratic management of the urban space of Belo Horizonte, thus contributing to the right to the city being a reality
Miranda *et al.* (2021)	Analysis of the demand for Neighborhood Impact Studies in Goiânia, GO	Baru Magazine	A1	To evaluate the demand for Neighborhood Impact Studies (EIV) in Goiânia, GO.
Scopel *et al.* (2021)	Neighborhood Impact Study: Procedures for approval in the Municipality of Serra/ES	Ifes Science Magazine	B1	To present through schematic models: the history of the legislation that deals with the EIV, the flow of the process, the agents involved, and to analyze the necessary procedures for the approval of the EIV in the municipality of Serra/ES

Vieira, Couto and Bello (2022)	The (in)effectiveness of the instruments of the neighborhood impact study and environmental impact study in the metropolitan region of Belém (PA)	City Law Journal	A1	To identify the degree of social effectiveness (effectiveness) of the instruments of previous neighborhood impact and environmental impact studies (EIV and EIA) by the municipalities that make up the Metropolitan Region of Belém (RMB)
Medeiros, Kos in Fauth (2022)	The concept of neighborhood in Brazilian urban legislation and its application in Neighborhood Impact Studies (EIV) in Florianópolis/SC	city. Brazilian Journal of Urban Management	A1	To demonstrate, based on research in concrete cases, how the neighborhood has been delimited in the first five years of application of the instrument in the city of Florianópolis/SC.
Silva e Marson (2022)	The relevance of the neighborhood impact study: Conjunto Vera Cruz in Goiânia, Goiás, Brazil	Research, Society and Development	A3	To demonstrate the relevance of the Neighborhood Impact Study for residential projects, case study of the Nelson Mandela Residential in the Vera Cruz Complex in Goiânia, Goiás, Brazil.
Santos Junior and Vasconcelos (2023)	Impacts caused by polarization: a study on the University Center of Goiatuba-Unicerrado.	Research, Society and Development	A3	Check if there is commuting, traffic on public roads and use of the institution's facilities and if these are sufficient to ensure the minimum comfort to the students who travel to it and if there is any influence on the people who are installed in its vicinity
Saleme and Micchelucci (2023)	Convenience of imposing neighborhood impact studies and compensatory, mitigating and remunerative measures	City Law Journal	A1	Discuss the use of the neighborhood impact study (EIV) as an instrument for the implementation and control of impactful activities and enterprises and how urban legislation does so in the face of the economic conveniences generated by public or private enterprises

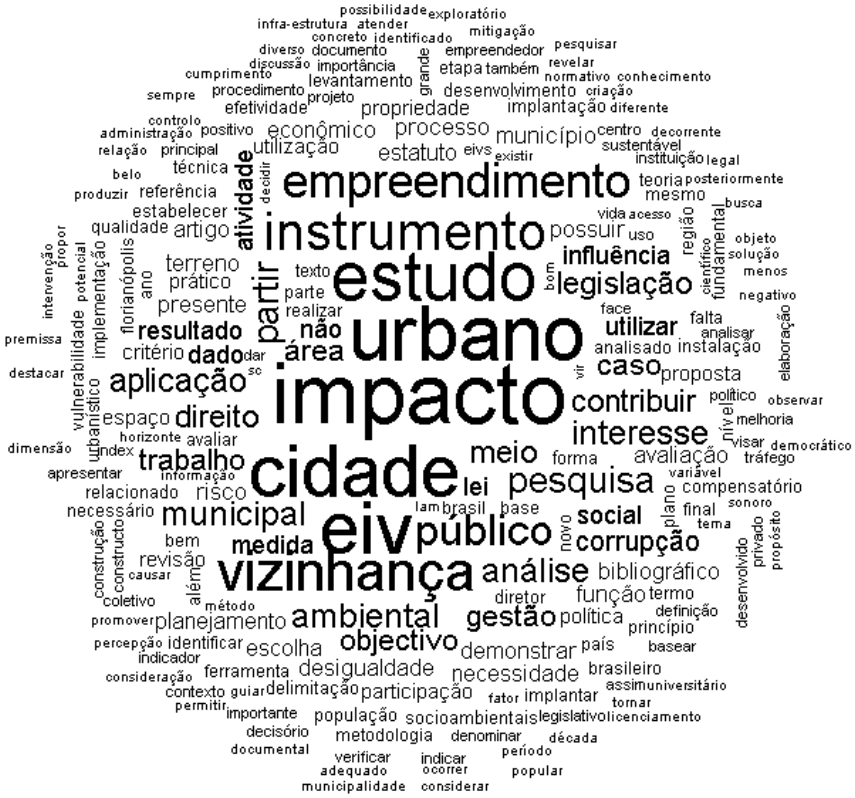
Source: Prepared by the author, 2024

In an illustrative way, figure 3 presents a word cloud, in order to demonstrate the main terms that are present in the objective of each article chosen to be analyzed. It was possible to observe the existence of words that are longer than the others, that is, the longer the word, the more frequent it is in the analyzed texts.

Figure 3 also demonstrates the active form and recurrence with more than five times in all the texts analyzed, being interrelated with the researched theme: Impact (44), Urban (39), EIV (37), City (37), Neighborhood (34) and Instrument (20), among others. Thus, the

following category of analysis was established: The EIV as an instrument for sustainable urban management and planning in Brazilian municipalities.

Figure 3: Word Clouds



Source: Prepared by auror, 2024

DISCUSSION

In this category of analysis, in general. evidence was found that the EIV has been used as one of the instruments of the Urban Policy in all Brazilian municipalities, as well as has been identifying possible demands and challenges to be faced by the Public Administration of the municipalities, in order to make the urban environment more habitable, fair and sustainable for the future.

Based on this understanding, the research of Vieira, Couto and Bello (2022), Saleme and Micchelucci (2023) and Polizel and Montaño (2023), brings a common point in their approaches, the fact that there is a pressing need to break the paradigm in the urban planning of municipalities, control of the use and occupation of land and space, in the sense of contemplating in an interdisciplinary way the planning of cities and the achievement of the Sustainable Development Goals.

In this dynamic, Almeida, Calais and Lopes (2021), warn of the need to meet all the demands of the municipality without compromising the ability of future generations to meet their own social needs and effects on health, cultural heritage, education, transportation,

among others, that is, the studies show that the use of the EIV presents itself as an alternative to operationalize efforts and indicate mitigating measures in critical areas of suffering possible impacts on the neighborhood where the projects will be implemented and ensure sustainability and guarantee of well-being to its inhabitants.

Likewise, Braga (2018) states that there is a character of transparency and social control of urban policy when using the EIV, as this tool is capable of encouraging environmental preservation, reducing urban conflicts and increasing the quality of life of residents. In this same dynamic, the lack of planning that should be required by the municipality, ends up causing a serious problem to society because it does not know the current and future problems generated by the implementation of residential developments. In this way, it notes the importance of the EIV for the application of both private and public residential developments, which aims to propose the improvement of the quality of life of society

It was also evidenced that there is a relationship between the EIV and the promotion of sustainability, Silva (2020) showed in his research that the environmental dimension used in the processes developed during the implementation of the EIV, is based on the principle that urban planning should take into account cultural spaces and explicitly aim to promote quality of life in the urban environment and sustainability.

Regarding environmental issues, it was evidenced in the research Fernandes de Medeiros, Kos and Fauth (2022), that there are concerns about climate change and are present in urban policies and the social function of urban property, in the implementation of the EIV by the municipality, aimed at meeting future environmental demands according to the collective good and the possible implications of the decisions made in the present.

Therefore, it is understood that the municipality that uses the EIV in its processes will have greater chances of building more harmonious, attractive and safe urban spaces, also offering services and facilities to meet all the basic needs of citizens, such as the social right to housing for all. Additionally, it can be said that the EIV is capable of intervening in the built environment in the search for positive effects directly aimed at the urban issue, that is, who and where are those susceptible to being harmed in cities and the development of cultural and historical spaces and the variety of alternative modes of mobility and accessibility for the three dimensions of sustainable development: Economic, Social and Environmental.

CONCLUSION

At the conclusion of this research, it was evidenced that the EIV is a tool that, if adopted efficiently, will be able to contribute to the creation of sustainable cities, through the balance between economic growth, environmental protection and social equity. It is worth adding that the content of the research allows us to affirm that it is essential to adopt tools that contribute to the sustainability of cities and thus ensure equitable access to resources and opportunities and improve the quality of life of all residents.

Another inference that is made in the contents found in the analyzed research is the fact that when talking about sustainable urban development, the EIV can be cited as a tool capable of prioritizing long-term planning and innovative solutions to face the challenges of rapid urbanization and climate change currently underway with great speed.

It was possible to verify in the content of the analyzed research that there is an emerging consensus on the need for urban planning of cities and the achievement of the Sustainable Development Goals, which should interact with each other and in all processes aimed at the rapid growth of cities and sustainable urban development.

In general, the content of the analyzed articles points to the idea that the use of the EIV by municipalities can serve as a strategy to guide cities towards sustainability and facilitate an urban planning process based on positive visions and accessibility for the three dimensions of sustainable development: Economic, Social and Environmental.

Finally, it was evident that current trends suggest that this urban expansion will cause direct impacts on the environment and its indirect impacts will also increase, over time and space. Therefore, the EIV presents itself as an efficient tool of contemporary urbanization, presenting a series of contributions to face the immense challenges to achieve global sustainability, including the conservation of biodiversity, more harmonious, attractive, safe urban spaces and human well-being.

Numerous efforts exist to establish priorities and actions to promote sustainability in urban development. Here, it was evidenced that the EIV can contribute to the objectives of the 2030 Agenda for Sustainable Development, in particular Sustainable Development Goal 11 on inclusion, security, resilient and sustainable cities.

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GENERATION OF SCREENAGERS AND EDUCATION: CHALLENGES AND POSSIBILITIES

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ABSTRACT

The present work is the result of a bibliographic research, in reliable sources, to respond to the objective of analyzing the challenges and possibilities that education faces today, when facing a generation immersed in the digital world. Screenagers, as they are called, need to be educated, develop social, emotional and also cognitive skills and abilities. How can the school organize itself to serve these young people? The paper is developed in subtitles that help to understand the relationship of this generation with the school universe: how their school career takes place and what are the biggest challenges for teachers and schools, always anchored in studies already carried out by authors such as Kenski, Moran, Camargo and Daros, among others. By way of conclusion, the school needs to develop a flexible and student-centered approach, embracing technology as a tool, but keeping the focus on students' social, emotional, and cognitive skills.

Keywords: Screenagers. Technologies. Education.

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INTRODUCTION

The present work aims to show some challenges and possibilities arising from current education, in a world in which people are born immersed in new technologies and use them for almost everything in their lives, generating a greater distance between the way they learn and the way their teachers learned and are able to teach.

All this social revolution reaches the school and forces them, their systems and their teachers to change their concepts and rethink the way of doing education. Young people who arrive at school already standing out for their technological skills need to be educated and learn to build knowledge from this immersion in technologies. That is the challenge!

The work was divided into sections for a better understanding, the first being a reflection on the generation of *screenagers* and education, dialoguing with the ideas of Moran, Kenski and Veríssimo, the impacts on education are seen. In the second part, we sought the foundation in Moran to observe the relationship of *screenagers* with the educational universe, with its impacts and possibilities, in order to find a balance. Thirdly, the digital generation and its school path were emphasized, using the studies of Camargo & Daros to support the ideas on this theme. Finally, as a fourth item, we sought to understand the challenges for teachers and schools when faced with the *screenagers* generation, resorting again to Kenski's ideas to support this important topic.

This bibliographic research does not intend to account for the entire theme treated, but opens a parenthesis for reflection on the theme that is so necessary for those who do education, whether face-to-face or at a distance. Knowing the target audience, knowing how they learn, what they like and how they relate, is a need that subsidizes pedagogical practices and can generate many other more and more in-depth works, since technological advancement is a constant that only expands.

GENERATION OF *SCREENAGERS* AND EDUCATION

In contemporary society, we observe a generation of young people who were born and are developing in an environment saturated with electronic devices and technology. This generation, according to Matta (2012), called *screenagers* and *teenager*, which can be translated as "screen teenager", is characterized by constant experience in the digital world and frequent connection to screens. They are digital natives, they flow naturally in the midst of *smartphones, tablets*, computers and *video games*. Technology is an intrinsic part of their lives, shaping the way they learn, communicate, and interact with the world. They were born and raised amid the accelerated advancement of technology and are constantly immersed in the digital world. Paraphrasing Veríssimo (2011), contemporary youth is

redefining the way we interact, register and relate to each other; His nimble fingers on keyboards are diving into a world of endless information and we are following.

However, it is essential to reflect on the impact of this *screenager* generation on education. It must be recognized that technology is a powerful instrument, capable of expanding the possibilities of teaching and learning, but it is only a tool. In terms of knowledge construction, it is not the technology that counts, but the way people use it. Education needs to adapt to this reality and incorporate technologies into its pedagogical practices. It is necessary to go beyond simply banning or restricting the use of electronic devices in the classroom, it is necessary to have a good pedagogical proposal, good planning and diversified strategies so that knowledge is integrated into the life and work of young people.

It is essential that education not only focuses on using technology as a substitute for traditional methods, but also provides an innovative approach, integrating digital skills with cognitive, emotional, and social skills. As Moran (2015) says, it is up to the school and educators to understand and integrate these technologies into the educational process in order to enhance the skills and abilities of these young people who live immersed in the digital world.

Technology can be a powerful resource to engage and motivate learners, allowing them to explore content in an interactive and collaborative way. It also opens doors for the personalization of teaching, adapting to the different rhythms and learning styles of students. According to Kenski (2016), through personalization, we can create adaptable learning environments that value individualities and allow each student to follow their path towards knowledge.

The generation of *screenagers* presents unique challenges to education, but it also offers exciting opportunities. Technology should be used as an ally in the training of young people, preparing them for the challenges and opportunities of the digital world. By adopting an educational approach that promotes creativity, collaboration, and digital responsibility, young people are given the opportunity to become critical, ethical, and active citizens in contemporary society.

Education for the *screenager* generation needs to be tailored to their specific characteristics and needs, as they possess advanced technological skills and are accustomed to receiving information quickly and visually stimulating. Therefore, traditional education based on conventional didactic methods no longer meets the desires of this generation.

To make the most of the educational potential of the *screenagers* generation, it is essential to utilize technology as an effective pedagogical tool. This involves not only providing access to digital devices and resources, but also incorporating innovative teaching approaches that promote student engagement and active interaction with technology.

On the other hand, educators must address issues related to excessive use of screens and addiction to electronic devices. It is important to teach young people time management skills, promote balance between the digital and real worlds, and encourage the conscious use of technology as a tool for learning and personal growth. Moran (2017) clarifies that it is essential to educate young people, from an early age, about the importance of dosing the time and attention dedicated to screens, in order to preserve mental health, promoting social experiences and cultivating a critical look at the information that surrounds them virtually.

RELATIONSHIP OF *SCREENAGERS* WITH THE EDUCATIONAL UNIVERSE - POSSIBILITIES AND IMPACTS

The relationship of the students of the *screenagers* generation with the educational universe is complex and multifaceted. These young people have grown up in a world saturated with technology, where the presence of digital resources is constant and ubiquitous. This reality has possibilities and influences felt in education.

Technology provides these young people with unprecedented access to diverse information and knowledge. Through internet-connected devices, they can explore an immersion in educational resources, research, elaborate, and share ideas with ease. These possibilities offer a unique opportunity to broaden your horizons and acquire knowledge faster and more efficiently.

In addition, the *screenagers* generation has advanced technological skills and these characteristics can be leveraged to promote a more engaging and interactive educational environment. Innovative teaching methodologies, such as the use of apps, educational games, virtual reality, and online learning platforms, arouse students' interest and encourage active participation in the learning process.

However, the relationship of students from the *screenagers* generation with the educational universe also presents challenges. Constant exposure to screens and unlimited access to technology can lead to distractions, lack of concentration, and over-dependence. It is essential to find a healthy balance between the use of technology, as an educational tool, and the need to disconnect, reflect and interact with the real world.

Therefore, it is essential that educators understand the needs, interests and abilities of students of the *screenagers* generation and adapt their pedagogical approaches, incorporating technology strategically and consciously, taking advantage of the possibilities but also understanding the potential problems, provides an enriching educational experience. Still paraphrasing Moran (2017), technology enhances teaching, breaks space barriers, stimulates creativity and expands the possibilities of learning. It is necessary to accept this innovation and explore its full potential to transform the way we teach and learn, preparing young people for the challenges of the 21st century.

Ultimately, the relationship of students from the *screenagers* generation with the educational universe requires a balanced approach, which values both technological skills and social, emotional and cognitive skills. Through this intelligent integration of technology into the educational context, a new generation of students can be formed that are able to adapt, learn, and thrive in a connected world.

THE DIGITAL GENERATION AND ITS SCHOOL PATH

The school path of the digital generation is marked by a deep interaction with technology, which significantly influences their way of learning and relating to knowledge. These young people use the internet as an inexhaustible source of learning, providing access to different cultural perspectives and points of view. They seek and share knowledge, collaborate with peers and professors, create projects, and expand their skills. Digital tools allow for the personalization of learning, adapting to the individual needs of each student and providing a more engaging and relevant experience.

However, the school path of the digital generation also faces challenges. The rapid evolution of technology requires a constant update of teaching and learning methods, teachers need to keep up with changes and seek pedagogical strategies that effectively integrate technology into the school curriculum. It is necessary to balance the use of technology with the promotion of social, emotional and cognitive skills. The development of competencies such as critical thinking, problem-solving, collaboration, and communication cannot be neglected in favor of the exclusive use of digital devices.

Teachers play a fundamental role in this school journey of the digital generation. They are the facilitators of knowledge construction, assisting students in navigating an ever-changing digital world. Their ability to adapt to the needs of students and efficiently integrate technology into the educational process is essential to the success of these young people.

In the school path of the digital generation, technology plays a fundamental role in the way they acquire knowledge and interaction with educational content. Reflecting with Camargo & Daros (2021), it is through digital learning platforms, educational apps, interactive resources, augmented reality, virtual simulations, and online collaboration that students have access to a diverse range of information and can explore different learning approaches that suit their individual needs and interests. Thus, teachers can take advantage of this universe to actively involve students in the learning process, exploring concepts in a practical way and developing skills such as critical thinking, problem-solving, and collaboration.

However, it is important to recognize that the digital generation also faces challenges in their school path, the ability to discern relevant information and develop critical thinking in a digitally overloaded world becomes a crucial skill to be developed. In this context, educators play a key role in guiding and supporting students of the *screenagers* generation in their school career. They must take on the challenge of integrating technology meaningfully, providing guidance on responsible use, promoting critical thinking, and empowering students to become conscious digital citizens.

CHALLENGES FOR TEACHERS AND SCHOOLS

Teachers and schools face long-lasting challenges when dealing with the *screenagers* generation, made up of students who grow up immersed in technology and others who do not have access to it. One of the main challenges is to engage them in the classroom. These young people are used to constant and immediate stimuli from technology, which makes passive, traditional learning less appealing to them. Teachers need to adopt more interactive, engaging, and personalized teaching methods, using digital resources and technology to arouse students' interest and promote active participation, also engaging those who are not digital natives.

Kenski (2016) understands that teachers face enormous difficulties when dealing with young people immersed in electronic devices and screens, needing to develop essential skills and abilities beyond the digital world. Teachers and schools need to face the challenge of balancing the use of technology in the classroom, setting boundaries and ensuring that students use it productively and responsibly, avoiding distractions and over-dependence.

Training teachers for the effective use of technology is also a necessity. The rapid evolution of technology requires teachers to be up-to-date and aware of the latest digital trends and tools. Educators need professional development opportunities and ongoing

support to explore new pedagogical approaches and meaningfully integrate a technology into their teaching practices.

In addition, teachers need to prepare themselves to teach research skills, evaluation of information sources, critical thinking, and problem-solving related to the use of technology, in addition to helping students develop essential digital skills to navigate safely and consciously in the digital world.

FINAL CONSIDERATIONS

The objective of showing some challenges and possibilities arising from education in a world in which people are already immersed in new technologies was fulfilled in the studies carried out through bibliographic research it was observed that the generation of *screenagers* presents unique challenges and opportunities for education.

Harnessing the potential of technology as an educational tool, adapting it to the teaching methods and characteristics of this generation, and promoting the conscious and balanced use of screens are crucial aspects to ensure an effective and meaningful education for these young people, enabling them to become successful citizens in an ever-evolving world.

In short, the challenges for teachers and schools when dealing with the screenager generation is to develop a flexible, adaptable, and student-centered approach, embracing technology as a powerful educational tool, but at the same time, keeping the focus on developing students' social, emotional, and cognitive skills.

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PROJECT-BASED LEARNING AND THE CHALLENGES OF THE 21ST CENTURY

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ABSTRACT

The work addresses the need to train proactive individuals and protagonists of their own life, career and goals, in the face of the current scenario of society and the world. To this end, it proposes a new way of teaching that integrates various media, the curriculum and pedagogical practice, based on the Constructivist perspective, aiming to strengthen the student's protagonism and form critical and participatory citizens, capable of solving problems in collaboration with their peers. The importance of active learning methodologies is highlighted, such as Project-Based Learning (ABProj.), which places the student at the center of the educational process, encouraging their active participation, critical reflection and resolution of real problems. A ABProj. It allows the integration of different disciplines in a project, enhancing the student's knowledge and developing skills such as teamwork, critical thinking, time management and articulation of different contents. The profile of the teacher who teaches through projects must be able to work in a team, listen to and accept divergent opinions, manage their actions and attitudes, and articulate knowledge with colleagues from different areas to solve problems collaboratively.

Keywords: Active methodologies. Project-based learning. Collaboration. Teamwork.

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INTRODUCTION

The need to replace the old vision of static and safe knowledge with a changeable knowledge, which adapts to changes and has the flexibility to reinvent itself and adapt to different contexts and unpredictability, means that education also needs to change its way of creating knowledge, using methodologies that make the student a more flexible being, active, thinking and who knows how to relate to their colleagues in a collaborative way, acquiring subsidies to continue learning throughout life.

The globalized world full of new technologies will also require professionals capable of being creative, critical but also humanistic and concerned with social and environmental issues that will guarantee life on earth and the possibility of peaceful coexistence between people of different creeds, races and nationalities.

Traditional education no longer encompasses the infinity of skills and abilities that the modern citizen needs to have to remain active and productive in the labor market, for this reason the school needs to change its way of doing education, so that it can meet the demands of society, changing the theoretical character for a more dynamic and active conception of doing education.

From this perspective, we present this study on active methodologies, more precisely on project-based learning as a way to involve students in an action in which the various knowledges can be used to answer everyday questions, together with a team that works collaboratively, critically and consciously, forming the citizen aware of his role as a transformer of society.

The objective of this work is to reflect on project-based learning as a lever for meaningful learning, understanding the challenges to be faced by educators to put this methodology into practice in the school model that is currently presented, and the profile necessary for the teacher to carry it out successfully.

The methodology is built on the bibliographic research of the idea of renowned authors who have already made considerations about project-based learning, seeking to conceptualize and characterize it, in addition to a reflection on the challenges of the teacher in conducting this methodology and the profile of the same in the face of the innovations that this practice requires.

PROJECT-BASED LEARNING AND ITS IMPORTANCE FOR MEANINGFUL LEARNING

PROJECT-BASED LEARNING (ABPROJ.): CONCEPT AND CHARACTERISTICS

The current moment that the world and society as a whole are going through, demands people who are proactive and protagonists of their lives, their careers, and their goals and dreams. Thus, education needs to form the individual who is able to adapt to the new desires of today's life, capable of performing the multiple roles that he will need to perform throughout life, as well as knowing how to live and collaborate with his peers, whether at school, at work or in society.

In order to develop a new way of teaching, which integrates the various media, the curriculum and the pedagogical practice in a Constructivist perspective, combined with the need to strengthen the student's protagonism and design an education that delivers to society critical and participatory citizens, capable of solving problems in collaboration with other people, have made education theorists formulate several theses and studies to solve these issues.

For Becker (2012), constructivist pedagogy has shifted the focus from the teaching process to "mediation", which occurs in the interaction between the learner and the object of study. In this approach, both hereditary factors, curriculum, culture and people in the circle of coexistence interact in learning. Certainly, when changing the focus of learning, it is necessary to change the methodologies and the curriculum design of schools, so that they can handle this new demand.

This active form of learning, better known as "active methodology" provides greater participation of the student in the educational process, favoring greater criticality and reflection on what he is doing, always linking his studies to the problems of the reality that surrounds him, even consciously intervening in this reality. For Dewey (2002), the use of social problems for the student to solve as a team is the most coherent way of learning, because education should work with the experience of real experiences, instead of simply transmitting abstract themes to students.

Thinking about an educational methodology that is active also requires that education systems and schools think about the use of new technologies, a critical approach to content selection, the best way to work as a team, cooperation, interaction and the responsibility of the student in the face of the active construction of their knowledge. The student's protagonism is essential for him to enhance his school performance and be able to develop learning that enables him to experience citizenship.

In recent years, many active methodologies have been used in order to develop competencies, skills and attitudes that are consistent with the autonomy required by

companies and the market. All these skills must be acquired in the school, which has increasingly sought to implement methodologies that facilitate students to develop, always seeking to meet the demands of the globalized world, which seeks proficient, creative people who know how to relate and work as a team.

As a way of placing the student at the center of the learning process in school practice, based on the National Common Curriculum Base (BNCC), Project-Based Learning (ABProj) has been widely used, this active methodology leads the student in the search for solutions to problems of their reality and experience, usually grouped in teams that study all possible content to try to find solutions that solve the problem. This methodology is a comprehensive pedagogical strategy, as it includes several other methodologies and technologies in the way of seeking knowledge and achieving objectives.

A ABProj. it is very easy to integrate different knowledge from multiple disciplines in the same project, which enhances the student's knowledge, as he observes that a problem cannot be solved in just one discipline, but needs knowledge from several areas to be solved, which facilitates the understanding that knowledge is not fragmented or divided, but that each area of knowledge has its contribution to the solution of that problem.

The profile of the student who studies through projects needs to be a person capable of working well in a team, of knowing how to listen and accept divergent opinions, thinking critically with their peers in order to find the best solution through their active participation in the learning process. This student still needs to know how to control time, manage his actions and attitudes and know how to relate different contents in the same project, always articulating the theory with the reality he wants to transform.

These skills and abilities are trained and acquired also in the development of the proposal, because in addition to finding solutions to the problem in question, the student also develops his potential. Ruthes & Cunha (2008) state that project-based learning is active and collaborative, as it emphasizes teamwork and action while developing skills and acquiring knowledge. At the moment when a student is reading, discussing, giving his opinion and deciding, he is at the same time building his autonomy and forming himself as a social and cultural subject and developing his citizenship.

For Abrantes (1995) the main characteristics of a work with a project are:

- Intentional action: students work around solving a real problem, which gives meaning to every study carried out.
- The responsibility and autonomy of the students: by working as a team, the students are responsible for the choices made throughout the project. Cooperation between them is essential to the final result.

- The reality: Students will engage in a real problem, the solution of which may benefit them and their socio-cultural context.
- Problem solving: The central objective of the project is to solve or propose resolutions to a problem that requires action to solve.
- Realization in phases: Choice of the objective, formulation of questions, planning, execution, evaluation and dissemination of results.

The project, as a work methodology at school, transforms the act of studying, which was previously solitary and individual, into a group experience with cooperation, sharing, research, debate, change of mind and construction of knowledge and skills useful for life and for the community. The use of new technologies for research and investigation also provides another skill to students. Knowledge can be multiplied through the search for solutions to the problem by learning to use new sources of information, developing in a scientific and technological way.

THE CHALLENGES OF TEACHERS TO IMPLEMENT ABPROJ

The teacher working in this context of new technologies and active methodologies needs to be prepared to encourage their students to develop investigative activities, to raise hypotheses and seek to answer them through research and scientific experiment, building knowledge that mobilizes them to actively participate in the society in which they live, if possible, modifying it for the better, while collaborating with their colleagues in a reflective and critical way. All these issues are necessary and require a professional who has these skills and abilities, in addition to working in a school that provides them with the necessary means to achieve their goals.

Some issues, however, are fundamental for the educator to be able to truly be this master of active methodologies, and do a job that really generates effective learning results in the school where he teaches. The first and most important challenge that the teacher needs to overcome comes from his initial training, often based on the traditional way of teaching, which will not help him at all when using an active methodology, especially if the didactics studied and experienced in the years of training were based on traditionalism. Breaking paradigms and breaking with the model of classes in which he was trained becomes a great challenge for the teacher.

Another obstacle that may hinder the application of ABProj. by the teacher, it is due to the rigidity of planning by specific areas, which makes it difficult for colleagues from one area of knowledge to relate and plan with colleagues from other areas, causing the

articulation between disciplines and knowledge to be truncated. The division of areas and disciplines, which are often worked with different coordinators, on different days and with different approaches, makes it very difficult to work that intends to take a global approach to a given problem or phenomenon.

The rigidity of the annual syllabus of the disciplines and all the contents that are planned to be worked on in a given grade, do not always give the teacher the opportunity to build projects with their students, because sometimes the project leads to learning other than the foreseen ones, and schools, families and educational systems demand from the teacher that those planned contents be worked on in full, forcing an abbreviation of projects or a greater difficulty in leaving students free to seek diversified solutions. Prado (2003) reflects that not all the contents determined for a grade can be contemplated in the context of a project, which leads to the teacher needing other strategies for students to learn some concepts.

External evaluations, with the accountability of schools and teachers for the results, are often a cause of concern for educators who seek in the best possible way, to work on the knowledge provided in the reference matrix of these evaluations, trying to develop the matrix of competencies for which they will be charged at the time of the results, a situation that can facilitate the use of active methodologies to achieve these results, but it can also be a limitation of work with projects, often preventing the flexibility of time for the natural development of the study. Paraphrasing Amaro (2013), external evaluations can have a direct impact on the professional autonomy of teachers and on the control of pedagogical actions, often limiting creativity and reducing the possibility of integrating work with projects.

With the advent of the media and the consequent use in the school, the teacher needs to be qualified to work as an incentive for his students to seek knowledge autonomously, but the times and spaces of the classes, the way they are organized in 50-minute schedules, sometimes make it difficult to work with projects and with the media, if they go beyond class time or the use of technological means. Often, teachers are not familiar with all the possibilities they can obtain through these valuable mechanisms and end up not using them in their classes. Prado (2003) considers that in order to work with ABProj. From the perspective of integration between the various media, it is necessary to interrelate concepts and principles, which, without proper mastery, can weaken the initiative to improve the teacher's learning and practice.

THE TEACHER OF THE ABPROJ ACTIVE METHODOLOGY

The profile of the teacher to work with ABProj. it must be that organizer, planner, encourager, intervener, reflective, open to dialogue, partner in research, the one who thinks about making his classes more active and also who opens himself to cooperative work with his teaching colleagues, realizing that the curricular components are a complex whole and that knowledge is not fragmented, but permeates the other areas and knowledge. This professional needs to be aware of the social and environmental relevance that a good project has and the change it can mean in the lives of their students.

A major change in the role of the educator who proposes to work based on constructivist theories and through active methodologies, such as ABproj. It is to stop being the transmitter of knowledge and become that partner of the student in the search for knowledge that best meets the objectives of the project, for this, the media are of fundamental importance. In addition to seeking knowledge, the teacher needs to facilitate dialogue among his students, motivate the group dynamics while also evaluating each intellectual and behavioral step taken by the group members in carrying out the project.

Teamwork is also an educational reality that needs to be discussed with the pedagogical team in order to facilitate holistic learning for students and that is effective in analytically responding to the problem to be solved, identifying the objectives and privileged contents in the execution of the project. Working with projects requires continuous pedagogical training based on an interdisciplinary philosophy, so that the educator can offer what he experiences, and carry out activities with his students, which he himself carries out with his peers.

Fernandes, Flores & Lima (2012. p.234) say about the profile of the ABProj actor professor. "teamwork, curricular coordination and articulation, sharing of ideas and experiences, joint decision-making are some aspects that participation in projects presupposes in terms of teaching work", the pedagogical experience of individual and solitary work, does not apply to the new model of methodology that needs the various areas of knowledge to explain a project or phenomenon so that students can build global concepts, and no longer divided into watertight processes.

The educator who wants to build meaningful learning, capable of changing attitudes, behaviors and values of his students, needs to contemplate the teaching and learning process as an opportunity for educational objectives, methodologies, content selection and evaluation to be tools for their intervention and social participation, ensuring that the human dimensions, social and political can be developed in the process.

FINAL CONSIDERATIONS

The conclusion that is reached at the end of all the readings and reflections about the changes that education needs to go through to keep up with the great development that today's society is going through, both in technological aspects and in political, scientific and economic paradigms, go through the adoption of a teaching practice that makes the student the protagonist of his knowledge, hence the study of active methodologies and among them the ABProj.

Working with projects requires a structural change in the school, in planning, in the division of tasks, in procedures and in evaluation, which must adapt to the way of working in which the student will stop being passive to be a protagonist in decision-making, organization, research and at all times assume responsibility for the search for knowledge and for what he can do from what he has learned to benefit his life, your school or your community, always acting in cooperation with your team.

The role of the teacher is also reconstructed from the use of active methodologies, as he is no longer the master to be the tutor, that partner who is together in each phase of the project, encouraging, researching, stimulating dialogue and understanding of the team, always evaluating the step-by-step of the activities, while at the same time needing to talk to colleagues from other areas to organize the conditions that best provide holistic learning.

The theme is engaging and very necessary, opening up a range of possibilities for deepening this methodology, which can be increased with the use of new technologies and encouragement for teachers to seek constant training, to be open to changes that enhance their work of building an education that prepares for full citizenship.

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USE OF MICROREACTORS FOR DIABETES DRUG SYNTHESIS

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ABSTRACT

The fraction of the world population affected by type 2 diabetes mellitus and its trend of significant increase in the coming decades strongly stimulates improvements in the synthesis of drugs for glycemic control. The transposition of batch production to continuous processes in microreactors allows for reduced synthesis time and better throughput. In this paper, four microreactor designs were proposed—labyrinth, leaf, hive, and hive serpentine—to enable drug synthesis in a single microreactor with a volume greater than 1 mL. The mixing quality of the prototypes was evaluated by simulating their residence time distributions (DTR) using computational fluid dynamics (CFD). The RTDs were raised in response to the step of a methylene blue tracer and maintaining a spatial time of 20 min. In the leaf, honeycomb and serpentine designs with honeycomb, there was the formation of preferential paths for flow, evidenced by the structure of the velocity field and the average residence time of less than 20 min. Their fluid dynamic behaviors were hybrids between the ideal models of a battered flow reactor and a perfectly stirred mixing tank. The labyrinth design has a pressure drop seven times higher than the others because it allocates all the fluid in a single extensive channel, but it promoted mixing of the currents with the greatest homogeneity in the available volume and with a deviation of 0.36 % between the mean residence time and the spatial time, being the most promising design for the synthesis of drugs among those proposed.

Keywords: Glitazones. Microfluidics. Mixture. Simulation.

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INTRODUCTION

Diabetes mellitus is a metabolic syndrome that affects about 10.5% of the world's population between the ages of 20 and 79 — 537 million people, 17 million of whom are Brazilians. In 2021, 6.7 million people died from diabetes (one death every 5 seconds) (IDF, 2021). It is estimated that more than 90% of diabetics have type 2 diabetes mellitus, which is caused by insulin resistance (MEIRING et al., 2022). The treatment of these cases consists of the use of drugs to control blood glucose levels, such as drugs of the sulfonylurea, biguanide and glitazone classes (KUMAR; NANJAN, 2010).

Considering the portion of the population affected by type 2 diabetes mellitus, it is relevant to seek ways to optimize the production of drugs for its treatment and reduce the final cost of new generation molecules with greater metabolic efficiency, democratizing access to the drug.

For the formation of these drugs and their intermediates, the pharmaceutical industry, in general, uses the batch process, in which drugs are produced in batches from the raw material, ensuring reaction control and the quantity of the resulting material. However, although it is widely used, batch production has some disadvantages: long reaction time and long interval between batches, which often results in variability in products, drugs with less than 100% of the active complex, in addition to having high production costs and reducing the plant's production capacity. (TAXWEILER; PERES, 2020)

In view of these negative points, there is a promising alternative for pharmaceutical industries: the implementation of microreactors, equipment composed of connected microchannels, typically smaller than 1 mm, within which the components of a chemical process interact in small volume, bringing together and maximizing the interaction between these components. (COLTRO et al., 2007; FACCHIN; PASQUINI, 1998; TAXWEILER; PERES, 2020; WATTS; WILES, 2012). It is worth mentioning that drugs with advanced molecular structure, such as Oseltamivir, Celecoxib, SC-560 and Dolutegravir, are already synthesized in microreactors by the pharmaceutical industry, demonstrating the feasibility of application. (SILVA et al., 2019).

In this sense, the use of microreactors can be a more economical and safer solution for the pharmaceutical industry, since these devices can operate in a laminar regime without affecting the quality of the mixture, due to their small dimensions and large contact area, allowing greater control over the reaction (PERES et al., 2019; BUGAY, C.A. et al., 2024). In addition, microreactors produce in less time and space, providing ease of handling, safety and a reduced environmental impact in case of explosions or toxic leaks (MACHADO et al., 2014).

However, the implementation of microreactors in the pharmaceutical industry faces obstacles, such as high costs for installation and adaptation, in addition to the need for technical specialization to operate the system, which is more complex (BUGAY, C.A. et al., 2024). It is worth noting that the design of the microreactor channels influences the performance of the reaction due to the formation of secondary flows that affect the mixing quality of the equipment (YI et al., 2014). The computational fluid dynamics (CFD) technique simulates flow inside a piece of equipment and allows optimizing its geometry to maximize mixing before the production of physical prototypes (JIANG et al. 2022).

Therefore, in order to propose innovations and optimization in the production process of drugs for diabetes, this paper aims to develop prototypes of microreactors using the simulation-based design approach. In particular, it is desired to:

a) Develop microreactor designs that promote adequate mixing in the reaction medium and thus favor the aforementioned synthesis;
b) Evaluate the influence of channel geometry on the velocity field via computational fluid dynamics (CFD) simulations;
c) Characterize the quality of the mixture in the prototypes proposed by the simulation of the residence time distribution (DTR);
d) Identify possible detractors of the microreactor efficiency, such as dead zones, and compare them with ideal flow models.

METHODOLOGY

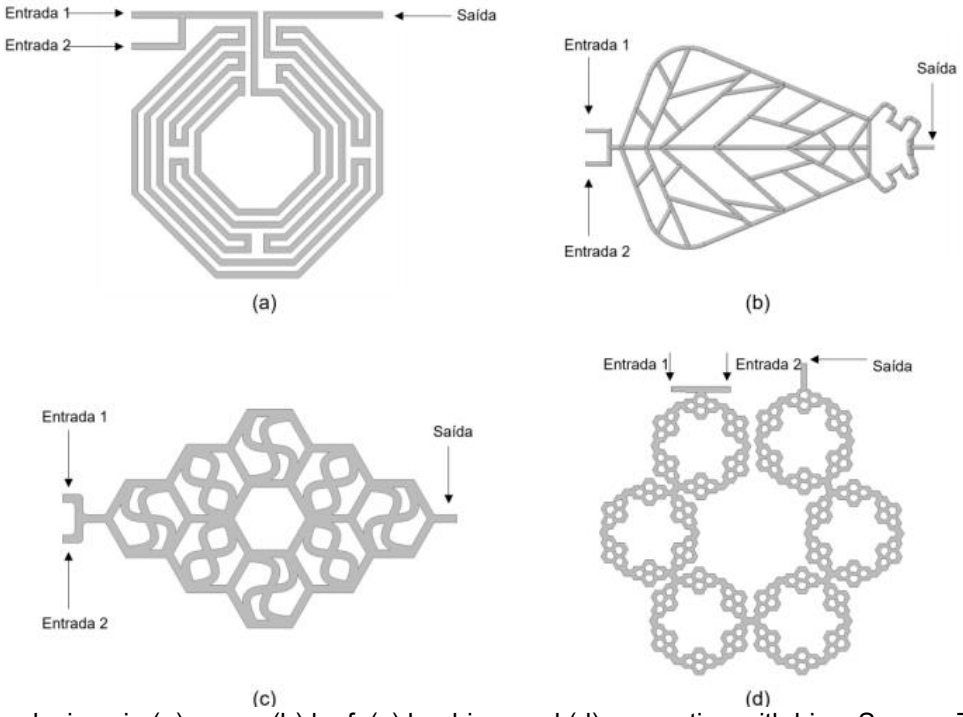
Silva et al. (2019) compared the synthesis of (Z)-5-benzylidene-2,4-thiazolidinadione, a drug derived from the glitazone class, in batch and continuous processes. In the first case, the authors obtained optimal reaction yield after 8 h of process. Transposing to a continuous process with two microreactors of 1.0 mL each associated in series, similar yields were obtained for a residence time of 20 min, a 96 % reduction in process time.

To facilitate the synthesis described above, four microreactor designs with a volume greater than 2.0 mL were proposed so that the reaction can be conducted in a single equipment. Figure 1 illustrates the virtual prototypes developed. The labyrinth design consists of a single channel arranged in a combination of traditional serpentine and spiral geometries, with the goal of increasing the surface area occupied by the channel compared to the total surface of the prototype's support plate. The leaf design mimics the sap-conducting vessels in plants by separating the runoff into several internal channels to mix the reactants. The hive design is an extension of the strategy of Jiang et al. (2014) to

maintain the uniformity of the reaction medium and thus increase mixing within the channels.

Finally, the hive serpentine design consists of six hives in series to match the residence time achieved by a serpentine structure with the blending quality expected for the hive arrangement. All prototypes have three-dimensional channels with a cross-section of 2 mm edge, except for the sheet design, whose cross-section is circular with a diameter of 2 mm. There are two fluid inlets to facilitate the feeding of distinct reagents and an outlet at the end of the channels.

Figure 1 - Proposals for microreactor designs for diabetes drug synthesis



Structure of the designs in (a) maze, (b) leaf, (c) beehive, and (d) serpentine with hive. Source: The authors (2024)

The flow in the developed prototypes was investigated at Autodesk® CFD 2023. First, the velocity field for water flow at 25 °C (density of 998 kg/m3, dynamic viscosity of 0.001 Pa·s) was solved in the proposed geometries. The feed flow rate of each prototype was adjusted according to its volume so that the space time[8] was 20 min for comparison with the serial microreactor system adopted by Silva et al. (2019). The Reynolds number in all cases was less than 3, corresponding to the laminar regime. The outlet of the channels was considered open to the atmosphere (zero relative pressure). Table 1 indicates the operating conditions on each prototype.

[8] Space time is the ratio of the prototype volume to the total feed throughput. It is equal to the average residence time for ideal reactor systems (FOGLER, 2022).

Table 1 - Boundary conditions in the simulation of prototype feeds

Prototype	Flow rate in each feed (uL/min)	Maximum Reynolds Number
Maze	118,2	1,97
Leaf	90,8	1,95
Beehive	71,7	1,2
Beehive streamer	139,5	2,32

Source: The authors (2024)

As a method of solving, the software solves the Navier-Stokes equation [Eq. (1)] through the finite volume method.

$$\frac{\partial(\rho u_i)}{\partial t} + \frac{\partial(\rho u_i u_j)}{\partial x_j} = -\frac{\partial P}{\partial x_i} + \mu \frac{\partial^2 u_i}{\partial x_j^2} \qquad (1)$$

To evaluate the mixture in the proposed microreactors, the residence time distribution (DTR) for each of them was simulated using a step-shaped injection. An inert tracer with the same water transport properties and diffusivity Di = 1.0 · 10^(-10) 〖m〗^2 /s was added, equivalent to that of methylene blue in water (GUPTA et al., 2004). In one of the prototype inlets, pure water was fed, while in the other, a pure tracer stream was fed with the same flow rate as the other inlet.

The tracer concentration at the output of the prototypes was monitored over 3600 s and was obtained by solving their transient mass balance:

$$\frac{\partial(\rho x_A)}{\partial t} + \frac{\partial(\rho u_i x_A)}{\partial x_j} = -\frac{\partial}{\partial x_i}\left(\rho D_A \frac{\partial x_A}{\partial x_j}\right) \qquad (2)$$

The instantaneous concentration curves of the tracer at the exit, C(t), were simulated with a time step of 1 s and considering that the prototypes were initially filled only with water. Its raw data allowed the calculation of the cumulative distribution curves F(t) and the distribution of residence times E(t), defined by Fogler (2022) as:

$$F(t) = \frac{C\,(t)}{C_0} \qquad (3)$$

$$E(t) = \frac{C(t)}{\int_0^\infty C(t)\,dt} = \frac{d\,F(t)}{dt} \qquad (4)$$

As it is a distribution of probabilities, the DTR can be characterized by its momenta, among which the most relevant for the analysis of chemical reactors are the mean residence time (tm) and the variance of the mean residence time (σ2):

$$t_m = \int_0^\infty t\, E(t)\, dt \qquad (5)$$

$$\sigma^2 = \int_0^\infty (t - t_m)^2\, E(t)\, dt \qquad (6)$$

The RTD of a reactor depends on its volume. To analyze reactors with different volumes, the DTR can be dimensionalized using spatial time (τ) and a dimensionless time θ as proposed in Eq. (7):

$$\theta = \frac{t}{\tau}\ ; E(\theta) = \tau\, E(t) \qquad (7)$$

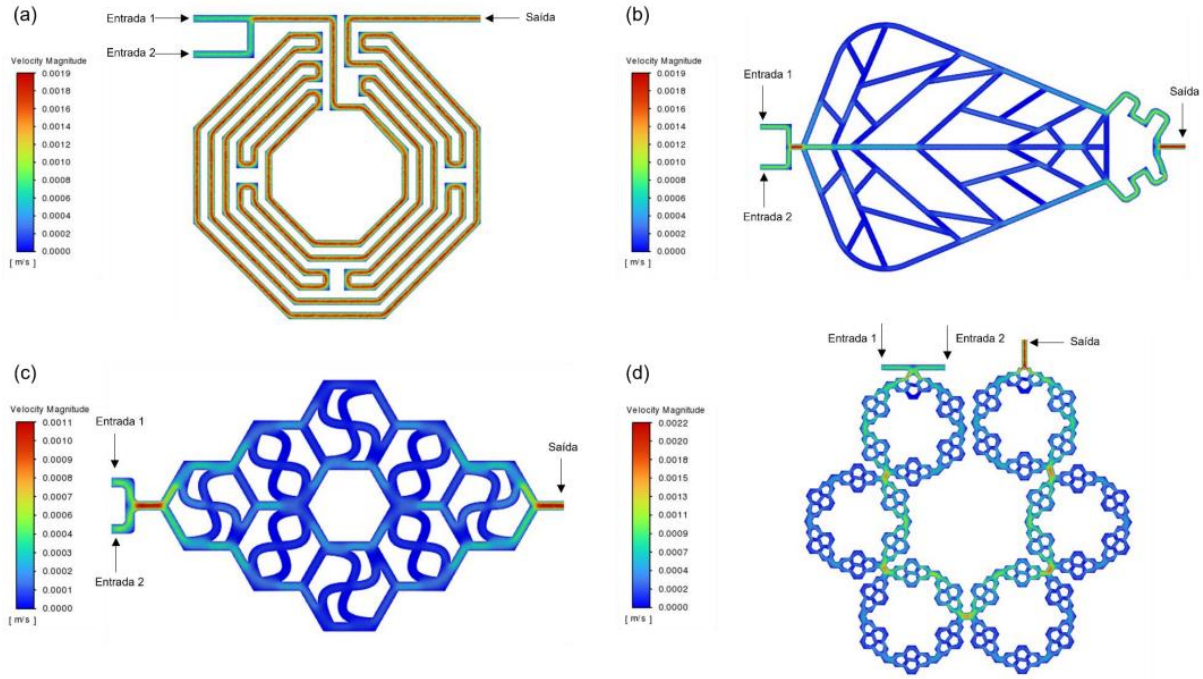
RESULTS AND DISCUSSIONS

The structure of the velocity field in a microreactor influences the quality of the mixture inside. Although there is a 94% variation between the minimum and maximum values of average speed in the prototypes – which occurred for the beehive and serpentine with hive designs, respectively – the Reynolds number has the same order of magnitude in all prototypes. Thus the similarity of the fluid phenomena is guaranteed

Figure 2 compares the distribution of velocities in the central plane of the developed prototypes. The labyrinth design showed higher speeds because it concentrated all the flow in a single channel, with an average value of 1.6 mm/s. In its curved sections, the formation of dead zones was noticed, regions of fluid stagnation, near the outer corners of the curves. This fact occurred due to the balance between the inertial force and the centrifugal force on the fluid when passing through the curves: most of it follows the curvilinear trajectory, but a small portion in the outer parts formed small recirculation zones that do not interact with the other regions. The extent of the dead zones, however, was small and did not affect the mixing capacity of the prototype, as indicated by its DTR (Figure 6).

In the other prototypes, the division of the feeds into subchannels led to the reduction of the average speed in the channels to the range of 0.3 mm/s to 0.9 mm/s. In the leaf and honeycomb designs, the flow exhibited a symmetrical distribution with respect to the central axis of the prototypes due to its geometric symmetry. The leaf design provided greater homogeneity of speeds compared to the honeycomb and serpentine designs with honeycomb. The average speed in the honeycomb design was the lowest compared to the others due to the fact that its volume was on average 36% lower than that of the other prototypes.

Figure 2 - Distribution of speeds in the developed prototypes



Designs in (a) labyrinth, (b) leaf, (c) beehive, and (d) streamer with beehive. Source: The authors (2024)

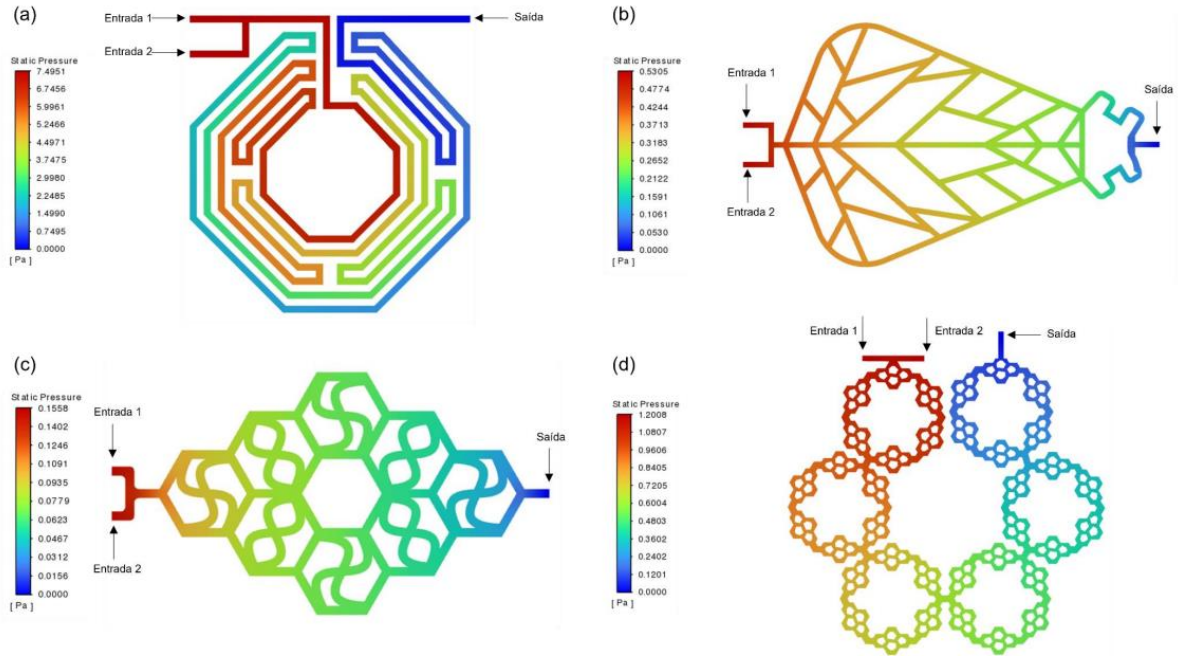
There was formation of preferential paths in the honeycomb and serpentine with honeycomb designs, with greater extension in the latter. In the beehive prototype, the fluid accumulated in the external channels and in the central hive, with an average speed twice as high as in the other sections. In the prototype of a coil with a honeycomb, there is a concentration of flow in the internal parts of the second to fourth coil of the series, with speeds between two and three times higher than in the external part. The preferred path in such a prototype may be due to the geometry of the feeding channels, which come together directly inside the first hive (in the others, the feeds mix before the main channels).

The structure of the velocity field affected the distribution of pressures in the prototypes, as shown in Figure 3. The direction of the flow in a single channel in the labyrinth design led to a pressure variation of seven to forty-nine times greater than in the others, an effect similar to that observed with the single-channel and segmented channel

microreactors proposed by An et al. (2012) for methane combustion. The leaf and honeycomb designs were the ones that require the least pumping power. In this aspect, the behavior of the honeycomb coil design proved to be a combination of the others: the pressure suffered small variations within each hive and is more significant from one hive to another, as in the labyrinth design (whose structure is a serpentine channel), but the pressure drop between the inlets and the outlet is closer to the segmented channel designs.

The mixing quality of the prototypes can be evaluated qualitatively by the steady-state tracer distribution, a condition reached after 3600 s in the DTR test. Because the flow rates of the tracer and water feeds were the same, the fluid can be considered perfectly mixed to tracer mass fraction of 50%.

Figure 3 — Map of pressures in developed prototypes



Designs in (a) labyrinth, (b) leaf, (c) beehive, and (d) streamer with beehive. Source: The authors (2024)

Figure 4 shows that the labyrinth design was the one that best promoted tracer mixing, because the distance traveled by the fluid for the mass fraction of this species to reach 50 % was the smallest among the proposed prototypes. The honeycomb coil design exhibited poor mixing quality, a trend expected by the preferential flow of fluid in the internal parts: more than half of the volume of this prototype did not effectively contribute to mixing the feed streams. A change in the arrangement of the feeding channels could improve the use of the external parts of the hives and improve the mixing of the prototype.

The leaf and honeycomb designs showed very similar mixing trends, which are evidenced by the overlap of their DTR curves seen in Figure 5. There was a low tendency to mix in these prototypes, but with better use of the internal volume compared to the coil

design with honeycomb. The figure also indicates that the labyrinth design behaved closer to the ideal Impistonate Flow Reactor (PFR) model.

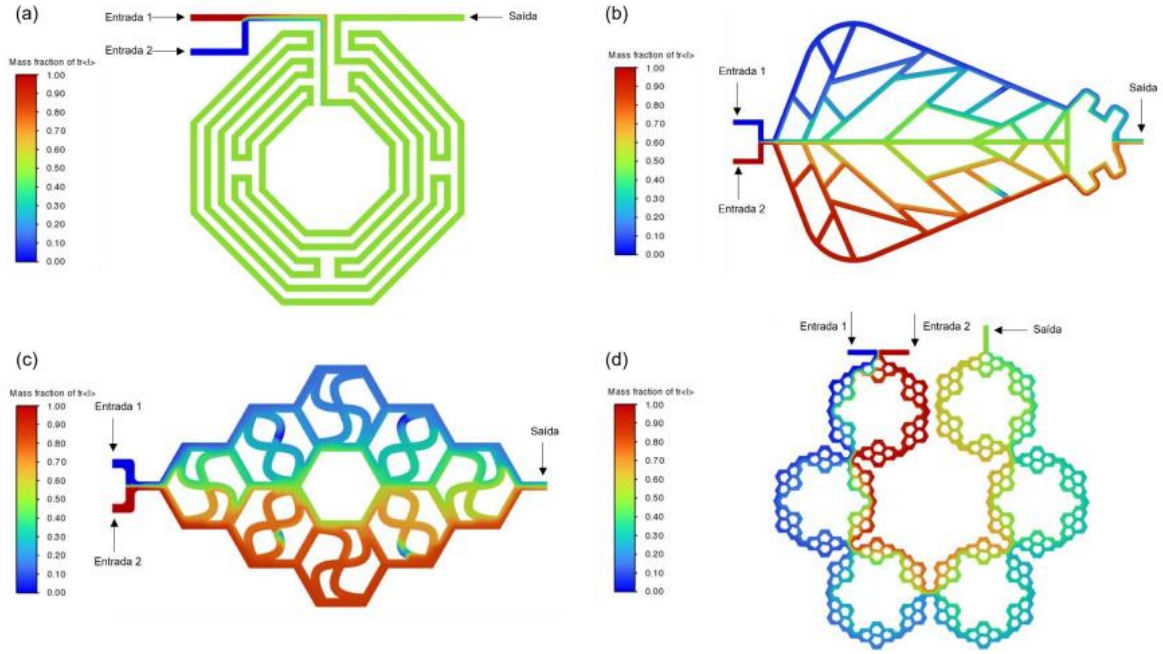
The comparison of prototypes to ideal flow models can be made quantitatively by the moments of their DTRs summarized in Table 2. It confirms the proximity between the flow in the labyrinth design and an ideal PFR: the mean residence time is 0.36 % higher than the spatial time and the standard deviation corresponds to 5.9 % of the mean residence time, indicating low dispersion.

Table 2 - Moments of the distribution of residence times of the developed prototypes

Parameter	Maze	Leaf	Beehive	Beehive streamer
Average residence time, t_m (min)	20,1	18,7	19,3	17,9
Standard deviation of mean time, σ (min)	1,2	5	5,9	5,4
Mean time variance, σ2 (min2)	1,4	25,2	34,8	29,3
Razão σ / t_m (%)	5,9	26,8	30,6	30,2
Deviation between t_m and τ (%)	0,36	6,9	3,7	12

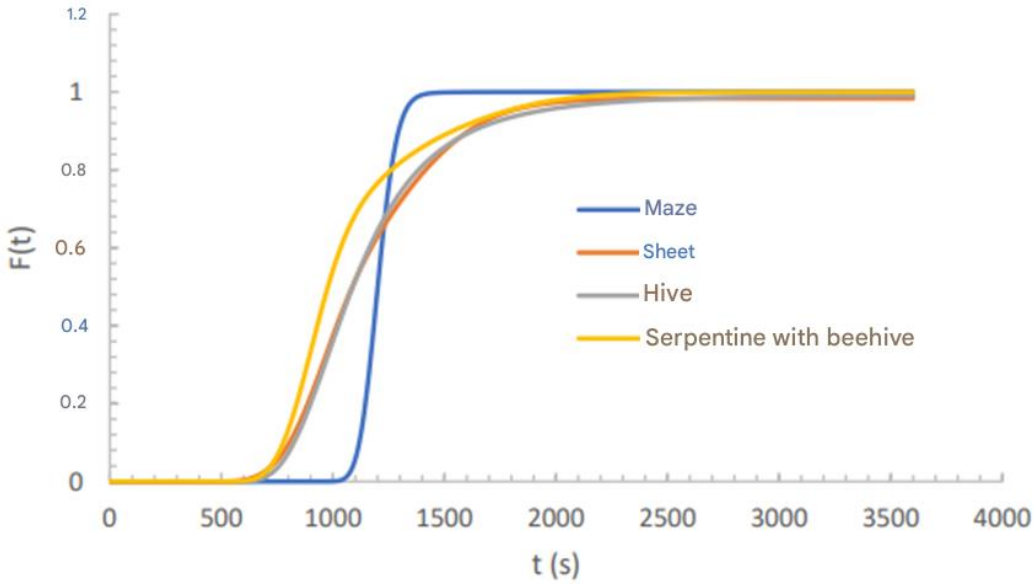
Source: The authors (2024)

Figure 4 - Mixing trends in the developed prototypes



Steady-state tracer distribution in the designs in (a) maze, (b) leaf, (c) hive, and (d) serpentine with cholemia.
Source: The authors (2024)

Figure 5 - Response to the tracer step in one of the feeds in the simulated prototypes



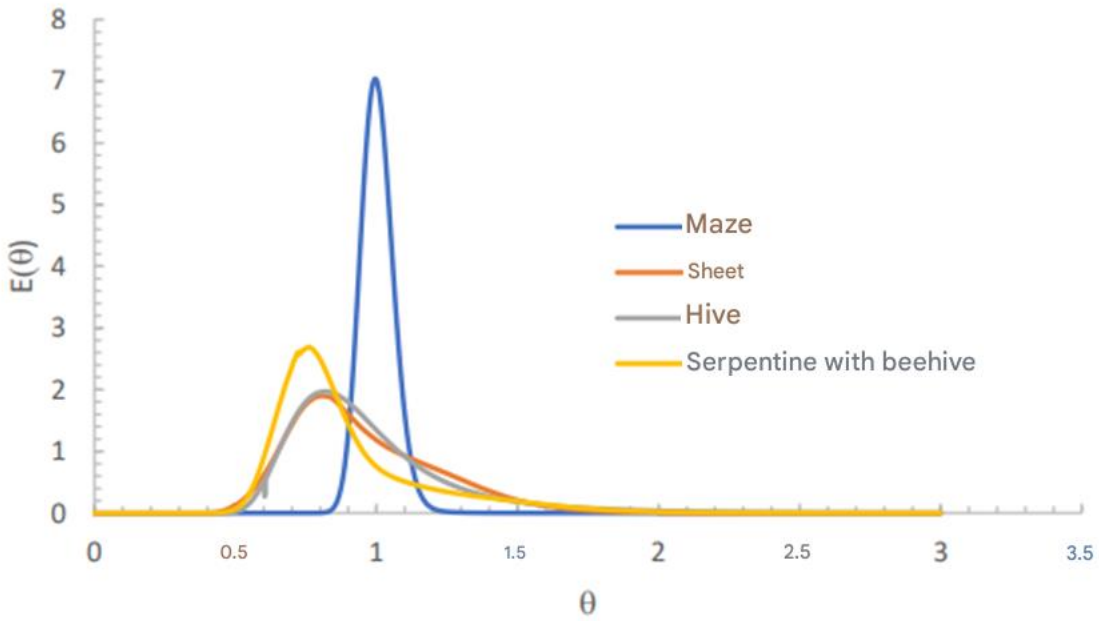
Source: The authors (2024)

The other prototypes had hybrid behavior between an ideal PFR and a perfect mixing tank (CSTR), since their DTRs exhibited elongated tails and shifted peaks from the tracer injection instant (Figure 5). The fact that their mean residence times are lower than the spatial time (ratio between the volume of the prototype and the total feed flow) evidences the existence of preferential flow paths that were predicted by the simulation of the steady-state velocity field.

CONCLUSION

Four prototypes of microreactors were proposed to enable the synthesis of diabetes drugs in a single equipment with a space time of 20 min. The labyrinth design proved to be the most promising. It optimized the plate volume occupied by the channels compared to a traditional coil design and provided the best mixing quality. The pumping power required in this prototype, however, was about seven times greater than that of the others due to the transport of the fluid in a single extensive channel. In the other proposed designs, there was the formation of preferential paths due to the dispersion of the flow in subchannels and evidenced by the average residence time shorter than the spatial time.

Figure 6 - Dimensionless residence time distribution for the proposed prototypes



Source: The authors (2024)

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BUSINESS INTELLIGENCE AS AN INTEGRATION TOOL FOR FAULT DETECTION OF THE BOARD ASSEMBLY PROCESS

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ABSTRACT

The plate assembly process in the company in question has a stipulated goal of 2000 plates per day, and 10% of this production has failures in the process, bringing a compromise to the goals defined by management. In view of this problem, the present study aims to implement an intelligent system for identifying and correcting failures in the process of board assembly, based on Business Intelligence, aiming at the evolution of Industry 4.0 practices. The methodology was based on Process Mapping, Analysis of Requirements for Implementation of the Integrated System. The integrated system allowed communication with other systems in the production process more quickly and effectively, bringing the most assertive information possible for the performance of usability and data security. The implementation of an intelligent system for detecting and correcting failures in the board assembly process, with the support of Business Intelligence tools, represented a significant step towards the evolution of Industry 4.0 practices.

Keywords: Process improvement. Integrated system. Optimization. Industry 4.0.

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INTRODUCTION

Currently, there is a certain industrial competitiveness in which it requires companies to be able to produce in the most efficient way, in the shortest time, and with the highest quality (Javaid, 2022). Losses at any stage in production processes can make any production line unfeasible and waiting for failures to occur to be able to intervene, it may be too late to maintain the viability of the production process (Dos Santos et al, 2022).

The plate assembly process currently in the company in question has a stipulated goal of 2000 plates per day, and 10% of this production has failures in the process, bringing a compromise to the goals defined by management. In view of the above, the decision-making process through managers, who are challenged to make increasingly accurate and assertive decisions, of which many decisions need to be made in a short period of time.

Considering the high competitiveness scenarios to which companies are inserted, associated with the need for managers to be precise and assertive in their decisions, along with the large volume of data and the emergence of new technologies that enable the generation of information, this work aims to propose the use of Big Data and AI as a tool to support decision making.

Industry 4.0, characterized by the integration of digital technologies and advanced automation, has been revolutionizing the industrial environment and transforming the way products are manufactured and processes are managed. This new production paradigm, also known as the Fourth Industrial Revolution, is based on a set of emerging technologies, such as the Internet of Things (IoT), Big Data, Artificial Intelligence (AI), and *Business Intelligence* (BI), which together make it possible to create intelligent and connected systems.

One of the biggest challenges faced by industries, especially those operating with complex processes, such as the assembly of electronic boards, is the identification and correction of failures. Board assembly is a delicate and precise process that involves placing and soldering electronic components onto a printed circuit board (PCB). In this context, failures can occur at various stages of the process, resulting in defective products and high costs of rework and material waste. In addition, the rapid evolution of technology demands that these industries maintain a high level of quality control, ensuring that the final products meet the standards required by the market.

Given these demands, there is a need for an integrated and intelligent monitoring system, which is capable of automatically detecting, analyzing and correcting failures, improving the quality and efficiency of the board assembly process. This system must be guided by real-time data and capable of presenting clear insights for decision-making,

which is facilitated by the application of Business Intelligence tools. *Business Intelligence* offers a range of functionalities that allow continuous monitoring and analysis of data in a structured way, transforming raw information into key indicators that can be used to improve the quality of the process and reduce the number of failures.

LITERATURE REVIEW

EVOLUTION OF INDUSTRY 4.0 AND ITS IMPACTS ON MANUFACTURING

Industry 4.0 is the term that designates the transformation movements within industries that are seeking new technologies at various levels to increase the quality of their products, increasing the productivity of the entire business.

The Fourth Industrial Revolution is a milestone in history, following the other three that came before: the 1st revolution, with the steam engine and the mechanical loom, then the second revolution, with electricity and mass production. Finally, the third industrial revolution, after World War II, with the arrival of the first computers.

Industry 4.0 has come to transform business management, systems and machinery that did not exist before, allowing the creation of new business models and boosting the economy, as well as making activities more efficient and practical, based on the use of applications.

Tiwar (2021) argues that Industry 4.0 is the integration of business processes, manufacturing, and actors involved in the company's value chain. For the integration between business processes and manufacturing to occur perfectly, it is necessary to make use of manufacturing execution systems and integrated management systems, in addition to the help of cyber-physical systems, which identify, locate, track, monitor and optimize production processes through advanced connectivity collecting information in real time. In addition, companies handle a lot of raw data that needs to be analyzed and transformed into useful information to support the production process.

The automated processes in this sector of Industry 4.0 are standardized, making them safer and faster, since information can be transmitted virtually, thus also being able to customize software and systems for companies, adapting to the needs of that segment. This allows for better results and higher quality products.

According to Gentner (2016), to implement Industry 4.0, IT projects need great communication and goal setting. In addition, it is important to start by executing small things, because then the losses are smaller, but the confidence in the project is maintained.

The optimization of resources and the reduction of errors provides the organization of processes, collaborating with the reduction of waste of raw materials, resources, time

and allocation of people, as well as the reduction of errors and rework is another objective of industry 4.0. Through real-time measurements and systems, there is greater predictability in case of failures, anticipating maintenance in the process of assembling electronic boards and thus reducing expenses.

The Fourth Industrial Revolution, or Industry 4.0, is based on digitalization and intelligent manufacturing with the help of physical cybernetic systems or also called cyber-physical systems (GENTNER, 2016). With this advent, production systems migrated from the classical model to the self-organizing cybernetic physical production system, allowing mass customization and flexibility in the amount of production (ROJKO, 2017).

Industry 4.0 was the consequence of what had already been started in the 3rd Industrial Revolution. With a wave of widespread digitization in the 1970s, the perfect scenario was created for the introduction of the use of smart objects today (MÜLLER, BULIGA, and VOIGT, 2018).

All the changes that have occurred since the seventeenth century with the first industrial revolution have been driven by the growing need for improvements to meet customer demands. It was necessary for industries to have a high speed of adaptation, change management and adaptability to provide the market with everything it needed (BINNER, 2014).

In this way, Industry 4.0 is directly affecting companies and the way they deal with the labor market, their employees and customers. Therefore, the next topic deals better with the nuances of this topic.

BIG DATA AND ARTIFICIAL INTELLIGENCE

The use of artificial intelligence (AI) in technical diagnostic processes is an area of great interest and relevance to the industry, as it involves the application of advanced computing techniques to detect, identify, and correct complex faults, anomalies, or deviations. industrial systems. Artificial intelligence can help professionals in the sector make more accurate, faster, and more efficient diagnoses, reducing costs, risks, and the negative impact of failures.

Artificial Intelligence (AI) allows computer applications to mimic human intelligence and can solve problems, make predictions, and present solutions.

Nascimento (2020) explains that Big Data contributes to storing the massive amount of data generated by the Internet of Things (IoT), which is produced in real time. This technology brings challenges to information technology companies such as where to store

data securely and easily accessed, in addition, how to process such data so that it can be transformed into information aimed at intelligent decision-making?

Big Data can be understood in two different ways. The first identifies them as a technology that stores a massive amount of data and information. The second strand, on the other hand, understands Big Data as the amount of data present on the internet (Ribeiro, 2014).

The term BD is not new, since the 1980s some problems of large volume of data already existed, such as data from the human genome and particle physics. However, in recent years the topic has become increasingly popular in the 4.0 sector and many other sectors, as existing techniques are becoming more mature for dealing with BD and deriving value from it (LU Yang, 2021).

Applying Computer Vision in the industry can be the guarantee of more assertive and optimized results. This is one of the areas of Artificial Intelligence in greater evidence today, being a field of study that seeks to reproduce the human ability to see, that is, to see and understand what is being seen. These solutions need equipment to capture images and powerful processors that can handle the data and Artificial Intelligence algorithms. In this way, they are able to detect objects, people, facial expressions, and actions (De Andrade, et al., 2023).

Currently in Grohmann's (2021) conception, Computer Vision has been used as a basis for innovations in various areas, from games to autonomous cars. In the industrial scenario, in particular, there are many applications of these techniques that can bring high gains related to automation of production lines, repeatability, speed, precision, safety, and ergonomics in various processes. With the reduction of costs, increase in production capacity and improvement of quality, industrial productivity contributes directly to the profitability of companies. They can achieve higher profit margins, reinvest in innovation and expansion, and even lower prices to gain larger market shares.

Finally, the integration of Artificial Intelligence into engineering is only in its early stages, with the potential to completely transform the field. As we explore new applications and develop innovative technologies, AI will continue to be a driving force behind the advancement of engineering.

BUSINESS INTELLIGENCE NOT INDUSTRIAL CONTEXT

Due to the inconstancy and dynamism of information, it is verified how necessary it is for the use of BI to be closely linked to the company's strategies, after all, any poorly stipulated requirement at the beginning can lead to even greater problems in the future.

The link between intellectual capital and the efficient use of technological tools can be seen as a key component for the organization to achieve its expectations.

Through the grouping of data, it becomes possible to generate intelligent information, which in turn will be polished and transformed into knowledge.

In this way, knowledge management is an immense benefit that is intrinsic to BI, as it adds several possibilities such as: a broad notion of the market position that the organization faces, better evaluation of the competitive strategies that need to be executed, among others.

Two initial proposals that proved to be very relevant for the progress of BI as a support for business management were the decentralization of access to information and the expansion of operational autonomy for managers. In addition to not overloading the IT team, the decision-makers themselves could have greater independence and perform their metric analyses, study reports, and propose strategies without major technological mishaps.

Sampaio (2023) clarifies that when the project is well executed, if before it consumed 90% of the time preparing reports, with BI it is plausible to perform the same work 10% of the time, which causes a considerable improvement in the analysis capacity.

METHODOLOGY

RESEARCH AREA

The present research was carried out in a company located in the city of Manaus, Amazonas (Brazil), which designs and manufactures boards for notebooks. The specific location of the research was in a DIMM insertion line of components that has the printed circuit board as the final product, whose research center took place in a line of automatic insertion of components called Surface Mount Technology - SMT, where the need to create proposals so that the process always occurred in compliance were evidenced. The possible failure modes were the key piece of the study, in which, once the steps are completed, the process will reach the metrics established by the company.

METHODS

a) Mapping of the Board Assembly Process:

This observation made it possible to structure an applied methodology that analyzes the possible causes of failures. Also in the methodology, it was possible to quantify the risks of these potential failures listed and thus prioritize prevention actions.

- Identification of Steps: The process has been divided into specific phases such as solder application, SMD component positioning, reflow soldering, and quality

inspection. In each of these stages, key performance indicators (KPIs) were defined that allowed monitoring quality and efficiency, such as defect rate and execution time.

- Risk Analysis: Using the Failure Modes and Effects Analysis (FMEA) method, the most common failures, possible impacts on the process, and preventive actions to mitigate them were identified.
- Definition of Monitoring Parameters: Based on the mapping and risk analysis, the parameters for continuous monitoring were defined, such as welding temperature, correct positioning of the components and uniformity of the weld. These parameters were monitored in real time to prevent deviations and automatically correct failures when possible.

b) Analysis of Requirements for Implementation of the Integrated System

Defining the requirements of an effective *Business Intelligence* (BI) system depends on a detailed analysis of the needs of the board assembly process and the objectives of Industry 4.0. This system integrated data from various sources and presented insights and reports that aided in decision-making.

- Identify key stakeholders: These include end users, customers, consumers, and other stakeholders.
- Gathering requirements from stakeholders: Gathering information about the features, limitations, and desired objectives.
- Choice of *Business Intelligence Tools*: With the requirements established, the BI tool was identified as the most suitable. Tools like Power BI that offer advanced functionality for real-time monitoring and analysis.
- System Architecture Specification: The design of this complex structure requires an engineering mindset, although it can be one of the most creative and rewarding IT architectures you can create. In a large organization, a BI solution architecture might consist of:
- Data sources
- Data ingestion
- Big Data/Data Preparation
- Data Warehouse
- BI Semantic Models

The evaluation of the effectiveness of the system was carried out through the results achieved with the implementation of Big Data and AI in fast communications and readings with more accuracy and positive results, with a reduction in failures and costs. The use of the PDCA cycle has ensured effective control and continuous improvements. These technologies are key for industries to become more competitive in the era of industry 4.0.

The implementation of an integrated *Business Intelligence* system for detecting failures in the board assembly process allows real-time control and monitoring, essential for continuous improvement and to achieve high levels of digital maturity. Based on the materials and methods described, the system will be able to transform data into valuable insights, enabling quick and accurate actions to reduce errors and optimize production.

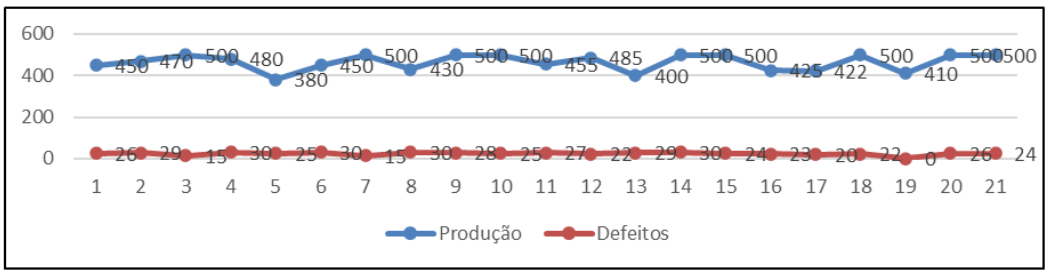
RESULTS AND DISCUSSIONS

MAP THE PRINTED CIRCUIT BOARD ASSEMBLY PROCESS

Carrying out the mapping in the process provided a comprehensive view of its entire structure, allowing the identification and analysis of critical points. This result was achieved through the execution of the mappings required during the chronoanalysis (Fig1)

Figure 1. Chronoanalysis of the process

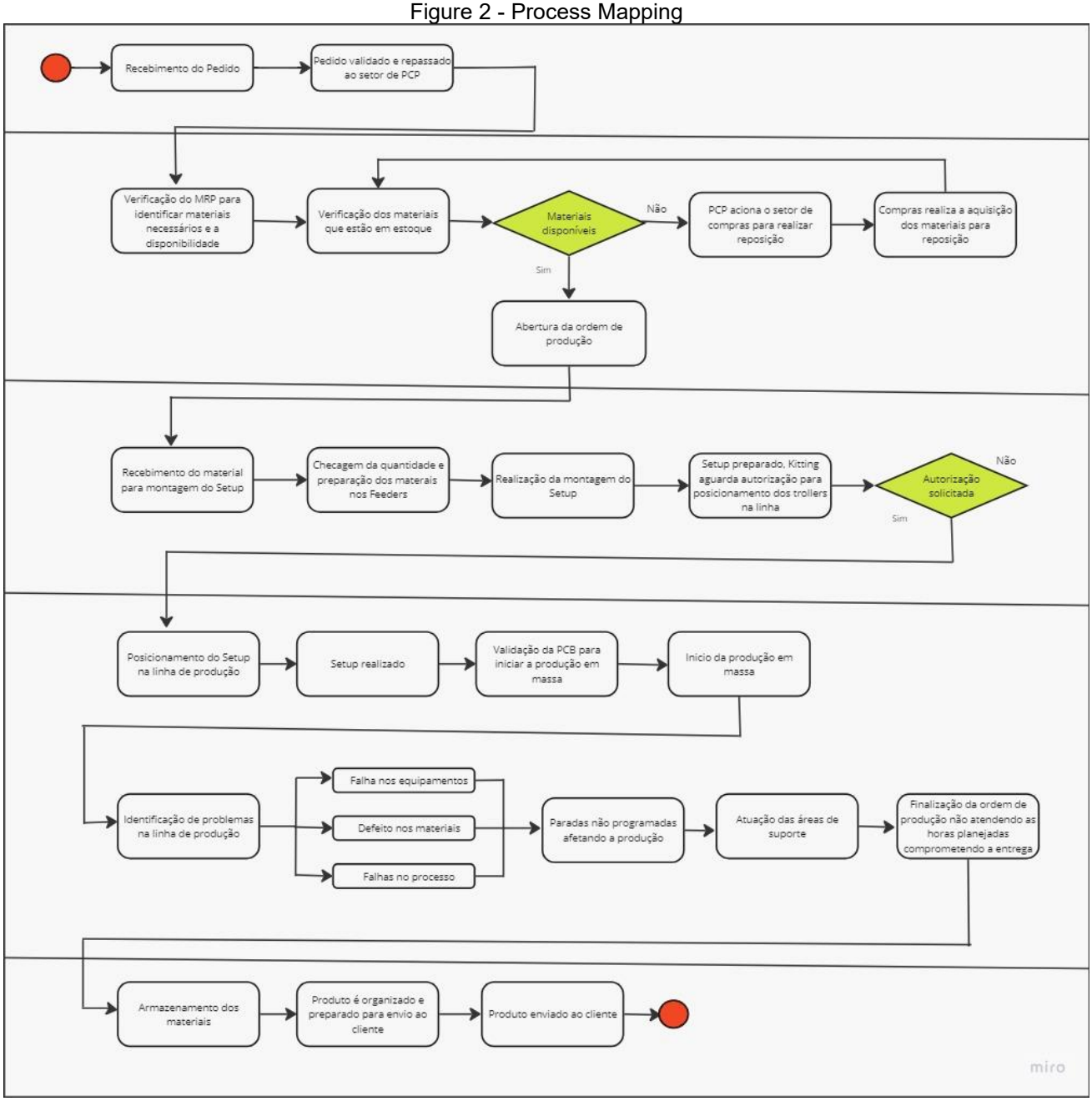
Produção mês	Planejado x Produzido											Média Eficiência		5%			Média Produção diaria			465	
10500	3	4	5	6	7	10	11	12	13	14	17	18	19	20	21	24	25	26	27	28	31
Meta Produção	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Produção	450	470	500	480	380	450	500	430	500	500	455	485	400	500	500	425	422	500	410	500	500
Defeitos	26	29	15	30	25	30	15	30	28	25	27	22	29	30	24	23	20	22	0	26	24
Eficiência	6%	6%	3%	6%	7%	7%	3%	7%	6%	5%	6%	5%	7%	6%	5%	5%	5%	4%	0%	5%	5%



Source: Authors, (2024).

With the data collected, it was defined to chronoanalyze the failures in the production process to generate improvements in productivity and efficiency of the process and allow an effective action plan.

Figure 2 - Process Mapping



Source: Authors, (2024).

ANALYZE THE REQUIREMENTS NECESSARY FOR THE IMPLEMENTATION OF AN INTEGRATED MONITORING SYSTEM

The necessary requirements that were evidenced in the mapping for the monitoring system led to the analysis of:

1. Average Time to Produce a Board
2. Number of slabs produced per hour
3. Percentage of defective plates
4. Unplanned downtime

Automated Optical Inspection (AOI) has been able to identify a wide range of defects on printed circuit boards and electronic components. Defects detected by AOI machines included:

1. Insufficient or over-solder
2. Short circuit between two solder joints
3. Component Displacement
4. Component Lifting
5. Inverted component
6. Tombed component
7. Missing Component

Ferreira (2021), recognizes that the growth of the electronics industry has led to an increased need for validation and testing methods on more efficient printed circuit boards (PCB). The author describes a prototype of a visual inspection system that made it possible to detect errors that occur during the process of solder paste deposition, and this system allowed to speed up the inspection stage in the production line.

In a production per day totaling 8 hours with a production of 500 plates, 30 faulty plates were found that were directed to repair, as shown in table 1

Table 1. Number of failures detected per hours worked

Number of hours per day	Number of boards produced per day	Number of faulty plates per day	%
8	500	30	6%

Source: Authors, (2024).

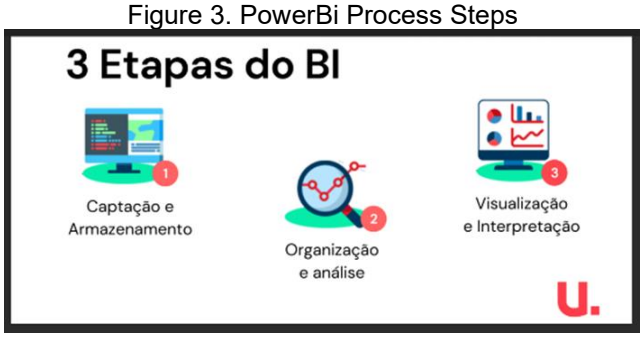
For Mendes et al, (2024), in a similar study showed that the integrated system created using vibration sensors, artificial intelligence techniques with supervised learning, and a dataset for classifying possible defects allowed the generation of alerts and recommendations for corrective actions to avoid failures and unplanned stops, contributing to the reduction of maintenance costs, increased productivity.

INTEGRATE REAL-TIME DATA COLLECTION SYSTEMS AND TOOLS TO CONTINUOUSLY MONITOR ASSEMBLY STEPS

This system allowed real-time monitoring of all process steps, from the application of the solder paste to the inspection and testing of the finished products. The main steps for implementing the process control system included: Establishing clear goals and objectives

for production, as well as defining a system of continuous feedback and process improvements. (Figure 3)

Figure 3. PowerBi Process Steps



Source: Authors, (2024).

The implementation of the integrated system was essential to ensure efficiency in the production of SMT welding. Giffoni (2024) reports in his research that the integration of methodologies and systems allows for a more fluid and efficient production, with a reduction in defects, rework and waste of materials, evidencing a substantial optimization in both quality and operational efficiency.

EVALUATE THE EFFECTIVENESS OF ACTION PLANS GENERATED BY BI TOOLS, WITH A FOCUS ON ACHIEVING THE INDUSTRY 4.0 MATURITY LEVEL IN TRANSPARENCY AND PREDICTABILITY

Standardization and optimization of solder parameters are key to ensuring quality and efficiency in SMT soldering production. This included selecting the correct type of solder paste, adjusting the temperature of the reflow oven, and controlling the printing speed of the solder paste. Some tips for optimizing welding parameters include:

- Select the appropriate solder paste based on the required physical and chemical properties
- Control the printing speed of the solder paste to ensure even and consistent distribution

Quality inspection and testing are key to ensuring efficiency in SMT welding production. This involved visual and automatic inspection of the boards after each step of the process, as well as conducting functional and electrical tests of the finished products. Some tips for improving quality inspection and testing include:

- Utilize automated optical inspection (AOI) equipment to identify defects and faults

- Implement visual and manual inspection procedures to complement automated inspection
- Establish clear and strict acceptance criteria to ensure the quality of finished products

The training and qualification of operators is key to ensuring efficiency in SMT welding production. This included training in welding techniques, handling equipment, and understanding quality standards and process requirements. Some strategies to improve operator training and upskilling include:

- Establish a continuous and comprehensive training program for all operators
- Develop specific training materials for each step of the SMT soldering process
- Promote open communication and knowledge sharing among team members
- Implement an evaluation and feedback system to monitor operator performance and identify areas for improvement

Preventive and corrective maintenance of equipment is essential to ensure efficiency in SMT welding production. This included regularly inspecting equipment, making necessary adjustments and repairs, and replacing worn or damaged components. Some tips for improving equipment maintenance include:

- Establish a preventative maintenance schedule for all SMT welding equipment
- Monitor equipment performance and identify potential issues before they become critical
- Train operators to identify signs of wear or fault on equipment and report any issues

Continuous process improvement is key to ensuring efficiency in SMT welding production. This involves analyzing production data and identifying areas for improvement, as well as implementing solutions and adjustments to the process. Some strategies to promote continuous process improvement include:

- Establish a culture of continuous improvement within the organization
- Utilize data analysis and statistical tools to identify patterns and trends in production data
- Implement improvement projects focused on specific areas of the SMT welding process
- Promote collaboration among team members and encourage everyone's participation in process improvement

Process management in SMT welding is crucial to ensure efficiency in production and product quality. By implementing a process control system, standardizing and optimizing welding parameters, conducting quality inspection and testing, training operators, performing preventive and corrective maintenance of equipment, and promoting continuous process improvement, it is possible to ensure efficiency in SMT welding production and achieve high-quality results.

The integrated system allowed communication with other systems in the production process in a faster and more effective way, bringing the most assertive information possible for the performance of usability and data security. With the integration of real-time data collection tools for continuous monitoring of assembly stages and generation of management reports, it allowed to provide benefits in improved time reduction, increased productivity, and with the early detection of failures in real time.

The reports to the management will be issued more accurately and in real time for each analysis made in the process process of the plates. With the performance indicators, it was possible to identify the percentages of gains in the production process and increased productivity.

The implementation of the new integrated system allowed the increase in the capacity to identify and take actions for each failure found in the plate assembly process, it is also worth mentioning that the gains were also in quality, as the analysis and readings of the plates were 100% automatic, and no longer depended on the employee's decision to approve or disapprove the product, After the implementation of the new system, it was possible to identify the vision of the gains:

- Reduction of failures due to early identification of deviations in the process
- Increased operational efficiency by providing real-time information to managers and teams
- Better decision-making based on accurate and up-to-date reports
- Tighter standardization and control of assembly steps
- Reduced rework and non-compliance rates
- Improvement in the final quality of the products delivered to the customer (measured by VLRR indicator - Vendor Line Reject Line)
- More assertive planning, reducing the risk of delays or failures in the project
- Increased visibility into operations and their bottlenecks
- Ability to predict scenarios and propose proactive solutions

CONCLUSION

The analysis of a specific board assembly process was successfully carried out after the implementation of the integrated system in question, in the context of the industrial sector. Considering that the model was developed with a focus on the specific problems and objectives of the company, it will be relevant to evaluate its applicability in other companies in the same production segment, which may present different challenges, goals, products and manufacturing requirements.

It is suggested that the model created be applied in other areas, in order to see its applicability, which can serve as a generic guide, or if it is necessary to reformulate the model more complete. Another suggestion for future work is an analysis, promoting suggestions for an effective and dynamic relational process between Test and Production Engineering, because during the preparation of the case study, it was possible to perceive that such Engineering complements each other and makes the practice of *Business Intelligence* full, when tuned.

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INTERDISCIPLINARITY IN SECONDARY EDUCATION AND PHILOSOPHY TEACHING

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ABSTRACT

Interdisciplinarity in philosophy teaching has gained prominence as an essential pedagogical approach for promoting critical and integral education. Interdisciplinary teaching is one of the possibilities that can provide productivity and is suited to contemporary educational needs. The aim of this article was to conceptualize interdisciplinarity and analyse it within the school context, especially in secondary education. The methodology applied was documentary analysis, with a bibliographic survey of scientific articles, present in the thesis bank of the Coordination for the Improvement of Higher Education Personnel (Capes), in the Scientific Electronic Library Online (SciELO), literature that deals with the theme and in annals of scientific events in education, based on the study by Fazenda (2024); Lück (2013); Ramos; Freitas and Pierson (2013) and the BNCC. Finally, it can be concluded that interdisciplinary work in secondary education and philosophy teaching, when carried out clearly and coherently, effectively provides an integral education for students.

Keywords: High School. Philosophy. Interdisciplinarity.

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INTRODUCTION

Inserting interdisciplinary practice in the school routine is considered one of the challenges for education, at the same time that it contemplates the construction of knowledge by the subject based on its relationship with the context in which it lives.

Interdisciplinarity has been consolidated as one of the fundamental pillars for the construction of pedagogical practices that respond to the challenges of contemporary education. Its essence lies in the articulation between different areas of knowledge, promoting an integrated and contextualized view of reality. In the school context, especially in High School, interdisciplinarity presents itself as a necessary tool to overcome the fragmentation of knowledge, contributing to the formation of critical, reflective students prepared for the challenges of society.

The National Common Curriculum Base (BNCC), a normative document that guides Brazilian education, reinforces the importance of interdisciplinary practices by providing general competencies that deactivate the connection between different disciplines, promoting useful learning. This approach is corroborated by authors such as Fazenda (2024), who defends interdisciplinarity as a movement that transcends disciplinary boundaries in search of integration, and Lück (2013), who highlights its applicability for the integral education of the student. In addition, Ramos; Freitas and Pierson (2013) emphasize the need for dialogue between areas of knowledge for the development of a more contextualized and relevant education.

For Freire (2011), interdisciplinarity contemplates a methodological process of knowledge construction by the subject based on his relationship with the context in which he lives, with his reality and the culture that surrounds him. From this concept, the following research problem arises: How is interdisciplinarity present in the school context and especially in High School? Aiming to conceptualize interdisciplinarity, and analyze it within the school context and especially in High School.

In view of this perspective, this investigation is considered relevant since it aims to contribute to academic discussions about the difficulties and possible alternatives of interdisciplinary work in High School (EM).

METHODOLOGY

In the context of research, the careful choice of methods is an essential resource. Each study requires the definition of an appropriate method, which guides the results and allows a coherent interpretation of the proposed objectives (Chemin, 2020). For this investigation, it was decided to integrate different methods, evolving to their effectiveness.

As for the approach to the problem, the research developed predominantly a qualitative character. The option for qualitative research took into account the aspect of flexibility in analyzing how literary production has been addressing the importance of interdisciplinary work in the school context, especially in high school. In this sense, this research was carried out in an exploratory, descriptive and documentary way because what was intended was to provide greater familiarity with the problem, based on bibliographic surveys, legislation. This exploratory character was given considering that it is a research with less rigidity in planning (Gil, 2008), which is relevant in qualitative research.

CONCEPTUALIZING INTERDISCIPLINARITY

The word interdisciplinarity appears in the mid-60s and appears as a criticism of the fragmentation of disciplines (Thiesen, 2008). Since discipline is nothing more than a way of organizing, of delimiting, academic contents, with the support of a set of didactic and methodological procedures for teaching and evaluation of learning, that is, it is a division of knowledge into different disciplines that are directed in isolated fields of knowledge in a compartmentalized view of the sciences.

Thus, interdisciplinarity emerges as a proposal for interaction between knowledge from different disciplines or areas of knowledge so that people can understand reality and face problems through a globalizing vision.

In Brazil, discussions about interdisciplinarity began to gain space from the 70's onwards, and it can be understood, in the educational field, as an alternative to overcome the fragmentation of teaching, with a view to the integration of learning and knowledge. In the same decade, several scholars presented proposals for meanings of interdisciplinarity, according to levels of interaction, cooperation or coordination between disciplines (Thiesen, 2008).

Interdisciplinarity is not contrary to disciplinarity, it takes place in the disciplinary context, it presupposes the relationship/interaction/dialogue between disciplines, in an uninterrupted relationship between the objects of knowledge. For Brasil (1999) the function of interdisciplinarity:

> It does not dilute the disciplines, on the contrary, it maintains its individuality. But it integrates the disciplines based on the understanding of the multiple causes or factors that intervene in reality and works with all the languages necessary for the constitution of knowledge, communication and negotiation of meanings and systematic recording of results. (Brasil, 1999, p. 89).

For Lück (2013):

> Interdisciplinarity is the process that involves the integration and engagement of educators, in a joint work, of interaction of the disciplines of the school curriculum with each other and with reality, in order to overcome the fragmentation of teaching, aiming at the integral formation of students, so that they can critically exercise citizenship, through a global view of the world and be able to face complex problems, broad and global of the current reality (Lück, 2013, p. 64).

Thus, for interdisciplinarity to occur, it is not a matter of eliminating the disciplines, but of making them communicative with each other. According to Brasil (2018), the curricular reorganization in areas of knowledge aims to facilitate the development of contents, from a perspective of interdisciplinarity and contextualization.

Medrado and Lima (2015) states that:

> The foundation of the interdisciplinary conception is in itself a problem, because it is not a matter of grouping ideas or knowledge, it is not a matter of merging them, it is not a matter of a formula or recipe to be followed, there are no examples, it is not, above all, a matter of grouping the parts so meticulously and scientifically torn apart by the knowledge of modernity through a method. Interdisciplinarity should be thought of primarily as a dialogue of knowledge, as a unique theoretical construction in each of its applications; there is not only one truth, there is no uniform conception of the world, and any attempt to homogenize the being and its ideals would carry with it irrationality (Medrado and Lima, p. 120, 2025).

It is perceived that the interdisciplinary proposal is to establish connections of complementarity, interconnections and passages between knowledge. The curriculum should include learning strategies that enable the student to live in society, productive activity and subjective experiences, aiming at integration. Jean Piaget (1994) attributes other terms correlated to interdisciplinarity:

> a) Multidisciplinarity: The lower level of integration. It occurs when, in order to solve a problem, information and help are sought in various disciplines, without such interaction contributing to modify or enrich them.
> b) Interdisciplinarity: Second level of association between disciplines, in which cooperation between various disciplines provokes real exchanges; that is, there is true reciprocity in exchanges and, consequently, mutual enrichment.
> c) Transdisciplinarity: It is the highest stage of integration. It is the construction of a total system, without solid boundaries between the disciplines (Piaget, 1994, p. 33-34).

Piaget's citation presents a classification that reflects the different levels of interaction between the disciplines in the educational and scientific context, highlighting the increasing complexity in each approach. Multidisciplinarity, located at the most basic level, is characterized by the juxtaposition of disciplines that, although they contribute to the analysis of a problem, remain isolated in terms of content and method, not generating transformations in the areas involved. Interdisciplinarity, in turn, increases the degree of integration by promoting effective exchange between disciplines, resulting in collaborative interactions and mutual enrichment of the areas involved. This model implies active

cooperation that goes beyond the simple sharing of information, generating advances in both knowledge and pedagogical practices. At the apex of this classification, transdisciplinarity proposes a holistic and integrated approach, going beyond the traditional boundaries of disciplines to build a unified knowledge system. At this level, disciplines converge to address complex problems in a systemic way, reflecting a broader understanding of reality.

Thus, Piaget highlights the importance of each level of integration in the advancement of scientific and educational knowledge, with transdisciplinarity being an ideal goal for the construction of more comprehensive and interconnected knowledge, while interdisciplinarity represents a viable and essential practice for contemporary educational contexts.

It can be seen that these conceptualizations show the importance of the association of disciplines, some more or less accentuated. However, it is known that school disciplines have different purposes, objects and modalities of application than scientific disciplines (Lenoir, 2008).

School interdisciplinarity understood as an alternative to overcome the fragmentation of teaching indicates the need for a transformation in the predominant teaching in schools, so it is required from teachers attitudes committed to education and the strengthening of interdisciplinary practices.

Thus, education must be by nature interdisciplinary practice in the sense of integration and articulation of the epistemological universe, in the sense of replacing the fragmented form of knowledge and reality for a search for a unitary conception of the human being and understanding of the world, given its complexity.

Therefore, interdisciplinarity deals with the dissemination of knowledge and ranges from dialogue to the integration or overcoming of limits between disciplines, to the process that must lead from the multiple to the one (Fazenda, 2024). In this sense, for interdisciplinarity to occur, it is necessary to eliminate the barriers between disciplines and also between people, because the interdisciplinary educator who builds knowledge with his students; it goes from being a mere transmitter of information to a mediator of knowledge and a guide in the production of knowledge.

In view of this, the student becomes active in his learning process. In an interdisciplinary classroom, the teacher's authority and student autonomy are conquered and everyone realizes each other and becomes partners. In this sense, interdisciplinarity is a process of living, discovering, uniting and freedom to know (Fazenda, 2002).

Interdisciplinarity is materialized by the educator's attitude towards knowledge, in the opportunity to reorganize knowledge in the global understanding of reality. The interdisciplinary teacher has a special taste for knowing and researching, a differentiated commitment to his students, a boldness to work on new techniques and teaching procedures, analyzing and dosing them conveniently.

The professional who seeks interdisciplinary work fights for a better education, who resists and fights against accommodation and faces various obstacles in his daily life, but does not lose the joy and satisfaction in teaching. He is, therefore, a teacher who is always "dissatisfied" with what he does, always seeking the new in his actions (Fazenda, 2024).

INTERDISCIPLINARY WORK IN HIGH SCHOOL: PERSPECTIVES AND ACTIONS

To better understand interdisciplinary work in EM, figure 1 demonstrates a situation that characterizes the need for a dialogue between disciplines:

Fig.1: Need for interdisciplinary teaching



Source: Fusion of course contents. Available at: https://educascience.wordpress.com/2014/08/26/interdisciplinaridade-futuro-da-educacao/:. Accessed on: 05 Dec. 2024.

The figure shows the issue of the difference between systematized knowledge and the student's needs. One tendency to interpret the process of disciplining with a view to overcoming the fragmentation and compartmentalization of knowledge is to consider that the scientific discipline, the academic discipline and the school discipline have different constitutions and fulfill different social purposes.

Lück (2013) reinforces the failure of the fragmentation of knowledge:

> Fragmentation has broken with the link of simplicity and the growing complexification of reality has been established, making man unprepared to face

> global problems that require from him not only an education oriented to the globalizing vision of reality and a continuous attitude of learning to learn (Lück, 2013, p.14).

It is possible to interpret that, in the traditional model of school that aims at a propaedeutic education, school subjects adopt as a reference the knowledge produced by science, which often seeks the truth in and for itself and, in this self-centered conceptual universe, school knowledge is disconnected from the realities that science itself helps to build.

Denying the student's right to interconnected contents would therefore mean denying him the right to a socially organized life. In the history of education, when improvements in the teaching and learning processes are sought with a view to a better understanding of reality and cultural content, the issue of curricular integration has been posed as a possibility thought from different educational and pedagogical assumptions (Japiassu, 1976).

An interdisciplinary curriculum organizes knowledge and develops the teaching-learning process in such a way that concepts are apprehended as a system of relations of a concrete totality that is intended to be explained/understood (Santos, 2007).

This conception understands that, in school, it is the curricular components that are responsible for allowing the apprehension of knowledge already constructed in its conceptual and historical specificity; that is, as the most particular determinations of phenomena, related to each other.

Thinking about interdisciplinarity in EM, as a prerogative for the production and organization of school knowledge, is the reconstitution of totality through the relationship between concepts originated from different cutouts of reality, that is, from the various fields of science represented in disciplines. It aims to enable the understanding of the meaning of the concepts, reasons and methods by which one can know the real and appropriate it, in its potential, for the human being. In addition to grounding the educational purpose in the elaboration of the curriculum, this principle guides the selection and ordering of teaching contents.

Interdisciplinarity is not something artificial, but a necessity, as Frigotto states; Ciavatta and Ramos (2005):

> Interdisciplinary work presents itself as an imperative necessity for the simple reason that the part that we isolate or extract from the original context of the real in order to be effectively explained, that is, to reveal on the plane of thought and knowledge the determinations that thus constitute it, as a part, has to be made explicit in the integrity of the characteristics and qualities of the totality. It is precisely in the exercise of responding to this need that interdisciplinary work presents itself

> as a crucial problem, both in the production of knowledge and in the educational and teaching processes (Frigotto; Ciavatta; Ramos, 2005, p. 33).

Both interdisciplinarity and contextualization must be based on the epistemological foundation of the relationship between part and totality in the production of science and in the educational process. Interdisciplinarity becomes a strategy for the analysis of social reality by students based on systematized knowledge.

AN INTERDISCIPLINARY CURRICULUM IN HIGH SCHOOL

Fazenda (2024) defines what an interdisciplinary classroom would be:

> In an interdisciplinary classroom, the obligation is alternated by satisfaction; arrogance, by humility; loneliness, through cooperation; specialization, by generality; the homogeneous group, by the heterogeneous one; reproduction, through the production of knowledge. [...] In an interdisciplinary classroom, everyone perceives each other and gradually becomes partners and, in it, interdisciplinarity can be learned and can be taught, which presupposes an act of perceiving oneself interdisciplinary. [...] Another characteristic observed is that the interdisciplinary project sometimes arises from one who has already developed the interdisciplinary attitude and is contaminated by others and by the group. [...] To carry out an interdisciplinary project, there is a need for an initial project that is sufficiently clear, coherent and detailed, so that the people involved in it feel the desire to be part of it (Fazenda, 2024, p. 86-87).

As soon as the need to put interdisciplinarity into practice in the classroom and especially in High School is perceived, Ramos; Freitas and Pierson (2013) show in their chart an action plan for the creation of an interdisciplinary curriculum:

Chart 1: Collective elaboration of the Interdisciplinary Curriculum Proposal

Moment of elaboration	Result of the elaboration
1. Problematize the production process, fact or phenomenon in multiple perspectives: technological, economic, historical, environmental, social, cultural, etc.	Set of questions that serve the selection of contents; that is, the selection of knowledge necessary to solve the problem.
2. To explain fundamental theories and concepts for the understanding of the object(s) studied in the multiple perspectives in which it was problematized.	Integrated selection of teaching contents. Theories and concepts explained here constitute the necessary knowledge to solve the problematization and, thus, structure the selected teaching contents.
3. Locate the theories and concepts explained in the respective fields of science (areas of knowledge, scientific disciplines).	Thus, the epistemological root is identified of this knowledge, so that the curricular components acquire meaning and purpose in the curriculum instead of reproducing the guidelines of textbooks or textbooks.
4. Identify relationships between these theories and concepts and others in the same field (disciplinarity).	Expansion and complementation of the teaching contents selected from the problematization, considering that the real learning of a concept — that is, in a non-pragmatic or only instrumental way — implies apprehending it in relation to other concepts that give epistemological unity to a scientific field.

5. Identify relationships with other concepts from different fields (interdisciplinarity).	Indication of interdisciplinary approaches necessary to explain the problem in its entirety.

Source: Ramos; Freitas and Pierson (2013, p. 37)

It is understood that the assumptions for the construction of the curricular proposal include, in addition to the pedagogical planning itself, also the dimensions of the organization of school work, democratic management, the election of leaders, the autonomy of the school and the participation of the community.

Some facilitating elements must be used for interdisciplinarity to happen in the classroom, one of them is the pedagogical project/proposal, which must have efficient communication; institutional support; a monitoring and evaluation of the project; the existence of a favorable environment for labor relations; and a competence and legitimacy of those who defend the ideas; A theoretical framework that makes it easier to find the main concepts and structure of the project.

Interdisciplinarity, then, is essential, within a school context, so that the dismemberment of the procedures used by it occurs in a satisfactory way. Thus, interdisciplinary work must be planned in advance so that there is not simply a clash between the disciplines that will develop the work together. Therefore, in addition to prior communication between the teachers of the different subjects, the structure of the school must also offer conditions for the proposal to be effectively put into practice.

> When putting into practice an interdisciplinary teaching project, there must be extensive research by the teacher on the different areas with which the chosen productions will relate, in order to anticipate specific situations in which specialized knowledge will be needed.

INTERDISCIPLINARITY AND THE BNCC

The BNCC, by proposing a competency-based training, starts from the principle that knowledge should not be compartmentalized, but rather articulated in order to promote meaningful learning. According to Lück (2013), interdisciplinarity favors the integration between different areas, expanding the understanding of issues about reality in a more comprehensive and complex way. This perspective is essential to meet the ten general competencies of basic education described in the BNCC, such as critical thinking, problem solving, and argumentation.

Interdisciplinarity is also aligned with the proposal of high school training itineraries, which allow students to deepen their studies in areas of greater interest, integrating knowledge and applying it in concrete situations. In this sense, Ramos (2013) states that interdisciplinarity emerges as a strategy to overcome the fragmentation of the curriculum

and foster meaningful learning. Thus, the BNCC stands out for encouraging pedagogical projects and practices that dialogue between different disciplines, breaking with the traditional teaching model.

AREAS OF KNOWLEDGE AND INTERDISCIPLINARITY

Languages and their technologies

The area of Languages and their Technologies is a privileged field for interdisciplinary work, as it covers disciplines such as Portuguese Language and its literatures, Arts, Physical Education and English Language. These disciplines dialogue with each other by addressing topics such as communication, cultural expression, and the development of language skills. According to Antunes (2017), language teaching must go beyond mere grammatical decoding, effectively integrating itself into practices. The BNCC reinforces this integration by proposing the development of skills related to critical reading, textual production and interpretation of different languages.

Applied human and social sciences

Interdisciplinarity is essential in the area of Applied Human and Social Sciences, which includes disciplines such as History, Geography, Philosophy and Sociology. This area seeks to understand social and cultural phenomena in their complexity, requiring an integrated approach. Morin (2018) argues that knowledge must be articulated, connecting the parts to the whole so that we can understand the human condition in its entirety. The BNCC encourages work with cross-cutting themes, such as citizenship, cultural diversity, and human rights, promoting an interdisciplinary look at contemporary issues.

Natural sciences

In the area of Natural Sciences, interdisciplinarity is expressed in the connection between Physics, Chemistry and Biology, in addition to its dialogue with other areas of knowledge. Solving problems related to sustainability, health, and technology requires the integration of specific knowledge from these disciplines. According to Delizoicov and Angotti (2018), scientific literacy presupposes the articulation of different areas to understand natural and social phenomena. This approach allows students to analyze complex situations and propose innovative solutions.

Mathematics and its technologies

Mathematics, often seen as an isolated area, also benefits from interdisciplinarity, especially when applied to real problems in conjunction with other areas. The BNCC emphasizes the importance of skills such as mathematical modeling, data interpretation, and problem solving, which require articulation with Natural Sciences, Languages, and Human Sciences. According to D'Ambrosio (2007), ethnomathematics shows how mathematical knowledge is present in different cultural contexts and can be integrated into other areas in a significant way.

CHALLENGES AND POSSIBILITIES

Despite the potentialities, the implementation of interdisciplinarity faces significant challenges, such as teacher training, resistance to changes in the traditional curriculum, and the lack of integrated pedagogical materials. However, initiatives such as interdisciplinary projects, the use of digital technologies, and the continuing education of teachers can contribute to overcoming these obstacles.

CONCLUSION

It was proven through this study that interdisciplinarity is characterized by instrumentality and that planning time, courage to innovate, enthusiasm, leadership and flexibility are factors that make interdisciplinary practice effective. It also points out the need for projects that dialogue and interrelate the contents, as well as an effective methodology, and educational support.

There is great richness and complexity in interdisciplinary work in EM, which represents an alternative capable of bringing together the disciplines in the same educational project, constituting for those who experience it a transformation of the pedagogical experience.

Interdisciplinarity, as proposed by the BNCC, represents a promising path for the construction of a High School more connected to the demands of the contemporary world. By articulating the areas of knowledge, it enables the formation of students who are more prepared to deal with the complexity of reality. However, it is necessary to face the structural and pedagogical challenges for this approach to become an effective practice in schools. Thus, the relevance of interdisciplinarity as a guiding principle for education in the twenty-first century is reaffirmed.

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MANAGEMENT OF PULMONARY PARACOCCIDIOIDOMYCOSIS: AN INTEGRATIVE REVIEW

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ABSTRACT

The present study aims to describe the clinical management of pulmonary paracoccidioidomycosis through the literature. The study used as a method the integrative literature review, carried out via the Virtual Health Library (VHL), and through a search in the Medline, Pubmed and Scielo (Scientific Electronic Library Online) databases using the descriptors "Paracoccidioidomycosis", "Diagnosis". For the evaluation of the research problem and its stratification, the PVO strategy was used, and the following strategy was formulated, which can be seen in Chart 1. The aforementioned strategy allowed the following guiding question to be formulated: What is the importance of diagnosing and treating pulmonary paracoccidioidomycosis (PCM)? The standard diagnosis of PCM is visualization in clinical specimens by direct examination or histopathology of characteristic cells with multiple buttons in biological fluids or fungal isolation. As the choice of the drug to be used depends on the clinical form of the disease, clinical follow-up of the patients being treated is necessary and, if it is necessary to adjust the dose of the drug, side effects may also arise, making it necessary to switch to another drug. Finally, even with clinical improvement throughout the treatment, it is necessary to monitor the patient accurately to avoid recurrence of the disease. Fungal diseases in general and especially paracoccidiodomycosis are a public health problem in Latin America.

Keywords: Paracoccidioidomycosis. Fungal Diseases. Diagnosis. Antifungal treatment.

INTRODUCTION

Paracoccidiodomycosis (PCM) is a deep, systemic and progressive mycosis caused by a dimorphic fungus, Paracoccidioides brasiliensis. In infected animal tissue, naturally or experimentally, it presents itself in a spherical form, with a thick refringent membrane, which gives the cell the appearance of a double contour. In culture, using routine media such as Sabouraud's medium, it grows in filamentous form. In special media, it takes on the yeast-like form, presenting as round, budding cells. Dimorphism is reversible, and can change from yeast-like to filamentous and vice versa (Hahn *et al.*, 2022).

This mycosis is endemic in Latin America, with a higher prevalence in Brazil, Venezuela, and Colombia. In Brazil, the states of São Paulo, Rio de Janeiro, Minas Gerais, Paraná, Rio Grande do Sul, Goiás, and Mato Grosso do Sul contribute with the largest casuistry. In the chronic form, it most often affects males. This fact is attributed to the protection conferred by estrogens on adult women (Peçanha-Pietrobom *et al.*, 2023).

Contagion does not occur in the inter-human form. Possibly, the fungus, in saprofitism in soil or vegetables, reaches man directly. The main gateway of P. brasiliensis into the human body is the inhalation of the fungus through the lungs. There are well-documented reports about the cutaneous port of entry. The frequency with which lesions in the digestive tract have been demonstrated also makes one think of the possible acquisition of mycosis by ingestion of the fungus. However, it sometimes occurs in people who have a weakened immune system (due to another disorder or the use of drugs that suppress the immune system) (Thompson *et al.*, 2021).

There are basically two clinical forms: paracoccidioidomycosis-infection, represented by infected individuals who have progressed to spontaneous cure or who harbor P. brasiliensis in latency, both groups with a positive paracoccidioidin test, and paracoccidioidomycosis-disease, which comprises individuals who manifest the clinical and pathological aspects of the infection (Giusiano, 2021).

Active disease is a systemic infection whose classic triad is lesions of the oropharyngeal mucosa, lymph nodes, and lungs. Infected lymph nodes become swollen and may secrete pus that erupts through the skin, although it causes little pain. The most commonly affected lymph nodes are those in the neck and armpits. The liver and spleen can enlarge sometimes causing abdominal pain. Sometimes the symptoms last for a long period, but the infection is rarely fatal. PCM usually involves all organs and systems and has a tendency to spread, resulting in a wide variety of clinical manifestations (Hahn *et al.*, 2022).

Some people with paracoccidioidomycosis develop a chronic lung disorder that causes scar tissue formation (fibrosis) and widespread lung damage (emphysema). When paracoccidioidomycosis occurs in people younger than 30 years of age or in people with HIV infection or AIDS, the infection is more aggressive. It spreads widely, including to the bone marrow and other organs. People have a fever and lose weight. The lymph nodes, liver, and spleen increase in size and anemia arises (Thompson *et al*., 2021).

The present study aims to describe the clinical management of pulmonary paracoccidioidomycosis through the literature.

METHODOLOGY

The present study used as a method the integrative literature review, which according to Galvão (2012), is a construction of a broad analysis of the literature with pre-defined steps, carried out via the Virtual Health Library (VHL), and through a search in the Medline, Pubmed and Scielo (Scientific Electronic Library Online) databases using the crossings of the descriptors "Paracoccidioidomycosis", "Diagnosis". For the evaluation of the research problem and its stratification, the PVO strategy (Population/Problem, Variable/Results and Outcomes/Outcomes) was used, and the following strategy was formulated, which can be seen in Chart 1. The aforementioned strategy allowed the following guiding question to be formulated: What is the importance of diagnosing and treating pulmonary paracoccidioidomycosis? Based on the guiding question, Boolean operators were used to systematize the searches with the following scheme: Paracoccidioidomycosis AND Diagnosis.

Table 1. Research problem stratification following PVO strategy for research formulation.

P Population	People with pulmonary Paracoccidioidomycosis.
V Variables	Pathophysiology and diagnosis.
O Outcomes	Importance of carrying out diagnosis and treatment.

Source: Prepared by the authors.

The following inclusion criteria were used for the selection of articles: articles written in English; published in the last 10 years and that address the diagnosis of pulmonary Paracoccidioidomycosis. With regard to the exclusion criteria, articles that distanced themselves from the central theme of this review and studies that did not present full abstracts in the searched databases were dispensed with.

After the pre-reading and selective reading of the texts, 10 articles were selected (Chart 2), in which an interpretative reading was carried out in order to answer the research

question of this review.

RESULTS AND DISCUSSIONS

From the searches carried out in the databases, a total of 340 articles were found after using the inclusion and exclusion criteria, with a total of 13 articles being selected, 3 in Scielo, 1 in Medline and 9 in Pubmed.

Chart 1 describes the distribution of the articles used according to author/year, title, objective and results.

Chart 2 - Distribution of articles according to author/year, title, objective and results

AUTHOR/YEAR	TITLE	OBJECTIVE	RESULTS
COCIO & MARTINEZ, 2021	*Serological diagnosis of paracoccidioidomycosis using a Paracoccidioides spp. 5lcança5al antigen and the counterimmunoelectrophoresis method.*	To evaluate the Paracoccidioides ID antigen reagent in sera from PCM cases and patients with other diseases	All active PCM sera (n=24) were reactive using counterimmunoelectrophoresis (sensitivity = 100%), including 11 cases of infection by P. brasiliensis sensu stricto and one by P. americana. The commercial antigen showed satisfactory performance and may contribute to the dissemination of the use of serological tests for the diagnosis of PCM.
BRITO *et al.*, 2022	Paracoccidioidomycosis screening diagnosis by FTIR spectroscopy and multivariate analysis	To evaluate a novel strategy for the diagnosis of PCM using blood serum FTIR spectra from 20 PCM patients and 20 healthy subjects.	FTIR spectroscopy and machine learning applied to the analysis of human blood serum samples have shown great potential for the diagnosis of PCM, being a fast and inexpensive alternative to be implemented as a screening technique.
SILVA *et al.*, 2016	Advances and challenges in paracoccidioidomycosis serology caused by Paracoccidioides species complex: an update	To review advances in paracoccidioidomycosis serology in recent years.	The use of gp43 has become restricted because it has recently been discovered that this marker is not identified in infections caused by Paracoccidioides *lutzii*. Therefore, it is necessary to identify new antigens in both species or specific antigens for *P. lutzii to decrease the morbidity and/or mortality associated with PCM*
GIUSIANO, 2021	The Trojan Horse Model in *Paracoccidioides*: A Fantastic Pathway to Survive Infecting Human Cells	It comprises a literature review of the spectrum of tools and mechanisms exhibited by *Paracoccidioides* to overcome phagocytosis, discusses the Trojan horse model and the immunological context in proven models or the possibility that *Paracoccidioides* applies this tool for dissemination to other tissues.	The Trojan mechanism represents an impressive demonstration of the admirable adaptability of the yeast-like pathogenic form of *Paracoccidioides* to harsh conditions, as an accidental fact in the life cycle of this environmental fungus that tries to survive after inhalation.

HAHN *et al*.2022	Paracoccidioidomycosis: Current Status and Future Trends.	It provides a comprehensive and critical overview of immunopathology, laboratory diagnosis, clinical aspects, and current treatment of PCM, highlighting current issues in patient identification, treatment, and follow-up in light of recent taxonomic developments of *Paracoccidioides species* .	Classic PCM diagnostics benefit from culture-based, biochemical, and immunological direct microscopy assays in a general microbiology laboratory practice, providing a generic identification of agents.
HAHN *et al*.2019	*Clinical and epidemiological features of paracoccidioidomycosis due to Paracoccidioides lutzii*	To describe the clinical manifestations of 34 patients with PCM caused by *P. lutzii*, treated over 5 years (2011–2017) at a referral service for systemic mycoses in Mato Grosso, Brazil,	The results of this descriptive study showed no significant clinical or epidemiological differences that could be attributed to the P species. *lutzii.* Regarding cardiovascular mortality, there was marginal significance for premature menopause after considering the follow-up intervals.
MACHADO *et al*., 2022	*Pulmonary and cerebral paracoccidioidomycosis.*	Describe a case of pulmonary and cerebral Paracoccidioidomycosis	The main findings of pulmonary computed tomography in PCM are ground-glass opacities, consolidations, nodules, masses, cavitations, and fibrotic lesions, often in combination. An inverted halo sign was observed in approximately 10% of patients with active infection. On T1- and T2-weighted magnetic resonance imaging, cerebral PCM shows variable hypo- or hyperintense signs with annular impregnation after contrast injection and perilesional edema. Imaging is essential for differential diagnosis and to direct initial patient care
PEÇANHA-PIETROBOM *et al*., 2023	Diagnosis and Treatment of Pulmonary Coccidioidomycosis and Paracoccidioidomycosis	Critical view of the strategies for diagnosis and clinical treatment of BC and PCM.	Learning to recognize their main epidemiological aspects and clinical manifestations is essential for clinicians to be able to include them in the differential diagnosis of lung diseases and avoid late diagnosis.
PEÇANHA *et al*., 2016	Amphotericin B lipid complex in the treatment of severe paracoccidioidomycosis: a case series	To report the experience of a series of patients treated with ABLC	Almost all patients were male (27/28; 96%). The mean age of the patients was 44.7 ± 15.7 years and the median age was 48.5 years (range 4 to 69 years). Most patients came from rural areas (64.3%). Chronic lung disease was present in 14 patients (50%), the acute form in 5 patients (18%), and the chronic disseminated form in 9 patients (32%). Cure was achieved in all 28 patients (100%) using ABLC.

SHIKANAI-YASUDA *et al*., 2017	Brazilian guidelines for the clinical management of paracoccidioidomycosis.	Update the first Brazilian consensus on paracoccidioidomycosis, providing evidence-based recommendations for the management of patients at the bedside. This consensus summarizes etiological, ecoepidemiological, molecular epidemiological, and immunopathological data, with emphasis on clinical, microbiological, and serological diagnosis and management of clinical forms and sequelae, as well as in patients with comorbidities and immunosuppression.	Discussion of outpatient treatments, severe forms of disease, prevalence of disease among special populations, and resource-scarce settings, a brief review of prevention and control measures, current challenges, and recommendations.
SANTOS *et al*., 2020	Medication association and immunomodulation: An approach in fungal diseases and in particular in the treatment of paracoccidioidomycosis	To present and analyze recently suggested strategies for the treatment of fungi of medical interest, in particular for PCM, such as the use of combinations of protein fractions or killed microorganisms, such as vaccine antigens, and cellular immunotherapy.	New therapeutic alternatives, such as lipids, vitamins, synthetic or natural products, as well as the use of low-level LASER therapy (LLLT) to modulate the host immune response, increasing the efficiency of existing treatments for mycoses of medical interest and in particular for PCM.
RAMOS *et al*., 2020	Thinking in paracoccidioidomycosis: a delayed diagnosis of a neglected tropical disease, case report and review of clinical reports and eco-epidemiologic data from Colombia since the 2000	To report a case of a patient with Chronic Multifocal Paracoccidioidomycosis with long-standing symptoms and a late diagnosis caused by several barriers to 7cancer	Lip biopsy with silver methenamine staining revealed small and large sprouting yeasts that resemble a "sailor's wheel", confirming Chronic Multifocal Paracoccidioidomycosis. He was successfully treated, but subsequently lost follow-up.
THOMPSON *et al*., 2021	Global guideline for the diagnosis and management of the endemic mycoses: an initiative of the European Confederation of Medical Mycology in cooperation with the International Society for Human and Animal Mycology	Provide up-to-date consensus and practical guidance in clinical decision-making, involving physicians and scientists involved in various aspects of clinical management.	In vitro susceptibility tests and their correlation with clinical response will also need to be further evaluated. Because many diagnostics require the expertise of specialized reference laboratories, improvements in this area would be a welcome step forward and could reduce the time to diagnosis and initiation of treatment.

Source: Prepared by the authors.

Paracoccidioidomycosis can manifest acutely/subacutely in young patients or chronically, especially in adults. The chronic form is more frequent and has an age of 30 to 60 years due to the prolonged incubation period, with multifocal involvement, especially

respiratory and mucocutaneous involvement. Given its heterogeneous nature, this disease is considered a "great imitator" and can be a diagnostic challenge in areas of low endemicity (Ramos *et al*., 2020).

Various diagnostic tests, such as microbiological, immunological, histopathological, and molecular tests can be performed for the diagnosis of PCM. Standard diagnostic methods for PCM are based on microscopic visualization of typical yeast cells by direct mycological or histopathological examinations. This requires the collection of non-blood samples, some of which are difficult to access, such as biopsies of the larynx, lungs, adrenals, lymph nodes, and central nervous system. In addition, the microbiological diagnosis depends on the isolation of the fungus in the crop, whose growth can take a few weeks (de Brito *et al*., 2022).

Serological tests are widely used in the presumptive diagnosis and also in the follow-up of cases of paracoccidioidomycosis (PCM). Currently, double immunodiffusion on agar gel is the most frequently used method to detect serum antibodies to Paracoccidioides spp. Counterimmunoelectrophoresis is an alternative technique to show precipitating antibodies in agarose gel, with higher sensitivity than double immunodiffusion for serological diagnosis of PCM, despite its more restricted use. Detection of anti-Paracoccidioides spp. antibodies in patients' serum requires extraction of the fungal antigen, which must show adequate reactivity to the selected serological test. This antigen must be reactive with antibodies from patients infected with any of the species of the P. brasiliensis and P. lutzii complex, in addition to having low reactivity with sera from other fungal infections (Cocio *et al*., 2021).

Chest X-rays, complete blood count and erythrocyte sedimentation rate (ESR), biochemical tests of the liver (ALT, alkaline phosphatase), evaluation of renal and metabolic function (serum creatinine, Na, K) are also used as possible forms of diagnosis. Imaging tests, such as ultrasound, computed tomography, magnetic resonance imaging (MRI), and scintigraphic mapping, should be performed only when there is clinical suspicion or laboratory results suggestive of organ involvement that cannot be evaluated by physical examination alone (Shikanai-Yasuda *et al*., 2017; Fabris E *et al*., 2014).

The main findings of pulmonary computed tomography in PCM are ground-glass opacities, consolidations, nodules, masses, cavitations, and fibrotic lesions, often in combination. An inverted halo sign was observed in approximately 10% of patients with active infection. On T1- and T2-weighted magnetic resonance imaging, cerebral PCM shows variable hypo- or hyperintense signs with annular impregnation after contrast injection and perilesional edema. Imaging evaluation is essential for differential diagnosis and to direct initial patient care (Machado *et al*., 2022).

The differential diagnosis of mucocutaneous involvement includes other tropical diseases such as mucocutaneous leishmaniasis, sporotrichosis and histoplasmosis; other conditions such as squamous cell carcinoma, T/Nk cell non-Hodgkin's lymphoma, tuberculosis and vasculitis should be considered; in order to reach the clinical diagnosis, the physician can be guided if there is a concomitant presence of mucocutaneous lesions and adenopathies forming a triad of symptoms characteristic of this disease (Ramos *et al*., 2020).

The standard diagnosis of PCM is visualization in clinical specimens by direct examination or histopathology of characteristic cells with multiple buttons in biological fluids or fungal isolation. However, the difficulty of demonstrating the etiological agent of PCM in different clinical specimens, together with the fact that the mycelial growth phase is very slow and confirmation through the reversion of the yeast to the mycelia form is necessary, since it is a dimorphic fungus, makes the use of serological techniques a good option for the diagnosis of PCM (Silva *et al*., 2016; Hahn *et al*., 2019).

The treatment of choice for PCM is itraconazole at a dose of 200 mg per day, and it has been widely used in the treatment of mild and moderate forms of PCM with high efficacy and safety rates. Therefore, currently, this triazole is the treatment of choice for patients with mild to moderate forms of PCM. The duration of treatment can vary from 9 to 18 months, with a mean duration of 12 months, and the patient should always be evaluated by clinical, immunological and radiological criteria. Although co-trimoxazole is fungistatic and requires a longer treatment duration than itraconazole, co-trimoxazole is the second treatment option for patients with mild to moderate forms of PCM. The advantages of co-trimoxazole include wide availability in the public health system in Brazil. Cotrimoxazole intravenous solution may be used in patients with digestive disorders and/or who do not absorb oral medication well. Co-trimoxazole can also be used in contraindications to itraconazole, or in cases of suspected treatment failure or concomitant treatment for tuberculosis (Shikanai-Yasuda *et al*., 2017; Hahn *et al*., 2022).

For severe and disseminated forms of PCM, amphotericin B in deoxycholate or lipid formulation (liposomal or lipid complex) is indicated for use. The recommended induction dose of conventional amphotericin B is 0.5-0.7mg/kg/day, with a maximum of 50mg/day. Lipid formulations should be prescribed in doses of 3 to 5mg/kg/day. The duration of treatment depends on the clinical stability of the patient and amphotericin B should be administered for the shortest possible time (on average 2 to 4 weeks). Transition to oral medication during the consolidation phase should occur after clinical stabilization, once oral absorption of the drug has been confirmed (Peçanha *et al*., 2016).

As the choice of the drug to be used depends on the clinical form of the disease, it is necessary to follow up the patients who are being treated and, if necessary, adjust the dose of the drug, side effects may also arise, making it necessary to switch to another drug. Finally, even with clinical improvement throughout the treatment, it is essential to monitor the patient accurately to avoid recurrences of the disease. The use of the term "definitive cure" in patients with PCM cannot be applied because treatment does not totally eradicate P. brasiliensis. The treatment aims to reduce the number of fungal cells and allow the recovery of cellular immunity. Therefore, the use of drugs that stimulate the immune system can help reduce treatment time and reduce the challenges encountered in the treatment of these mycoses (Santos *et al*., 2020).

PCM can be considered a neglected disease, as the notification of new cases is not mandatory and there are no treatment policies implemented, requiring early and accurate diagnosis for the prescription of appropriate treatment and prevention of aggravation, death and sequelae.

CONCLUSION

Fungal diseases in general and especially paracoccidiodomycosis are a public health problem in Latin America. One of the important measures that would help to identify the real extent of PCM in these endemic areas, particularly in Brazil, is the compulsory notification of this disease to health authorities, as is required with tuberculosis and AIDS, and the creation of national notification registries via access to medicines. The standard criterion for the diagnosis of PCM is to demonstrate the presence of the fungus as multiple cells sprouting in clinical or tissue specimens. However, serological tests and imaging exams such as CT, MRI and X-rays also play an important role in the diagnosis and evaluation of the disease, in addition to this, the treatment employed depends on the clinical form of the disease and the patient's follow-up should be done in order to adjust and mitigate any side effects that arise, thus avoiding recurrences of the disease.

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PERIPHERAL'STATE RESPONSIBILITY UNDER GLOBALIZATION VS SOCIAL EXCLUSION AND SUSTAINABILITY: A CHALLENGE FOR MEXICO AND LATIN AMERICA IN CURRENT CENTURY

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ABSTRACT

The majority of peripheral (and emerging) economies such as Mexico and other countries in Latin America and some other in peripheral regions around the world have undergone during the last four decades, socioeconomic, political, and environmental woes triggered not only by recurrent international financial crises in world markets, but also stemming from their long-time structural social, economic, and political problems such as unemployment, poverty, malnutrition, margination, income maldistribution, corruption and some unexpected temporary phenomenon such as the pandemic, which have entailed and inflicted a huge unprecedented social and economic costs both to peripheral but also developed economies, along to a host of externalities, producing social and environmental costs vis-a-vis the advent of globalization and trade liberalization and the concomitant increase of international trade between Mexico and the rest of the world, particularly between Mexico and its trade partners, under UMSCA treaty, namely, United States, and Canada.
Under this context, it is worth mentioning the lack of a long-term strategy from most peripheral economies to not overlooking their States' responsibility to promote long-term strategies aiming at curtailing the historically unbalanced growth pattern they have observed through time such as growing unemployment, income maldistribution, and notoriously, unsustainable handling of their natural resources along with other externalities. This article aims to highlight the fact that under today's current global context, it comes out manifest a clear lack of long-term commitment from their States to implement strategies aiming to balance the binomial economic growth well-being under a sustainable framework in most peripheral economies, among manifold factors and particularly the pervasive presence and influence of international hegemonic institutions such as the World Bank, IMF in major economies, in Latin America and elsewhere throughout the periphery which has undermined the efforts of democratic governments to shift the current neoliberal-oriented-policies to maximize profit-at-all-cost strategies which have undermined population's social wellbeing and sustainability prevailing throughout the periphery by another alternative one, a more socially inclusive and sustainably oriented strategy. One committed to paralleling fostering, economic growth and the people's well-being in a country. Such a model currently prevails in some advanced socially inclusive economies (Scandinavian countries, Switzerland, Canada, etc.), versus the situation faced by the majority of peripheral economies, as in Latin America, including Mexico, during the last decades. The bottom line of this article is to disclose some underlying factors and circumstances that have prevented a reorientation of the prevailing neoliberal strategies in peripheral economies, namely, those socioeconomic factors and political circumstances under which an emerging economy such as Mexico is currently successfully implementing a socially inclusive and sustainable strategy far from the so-called Washington Consensus, vid, Hurt, Stephen R.(May 27, 2020).

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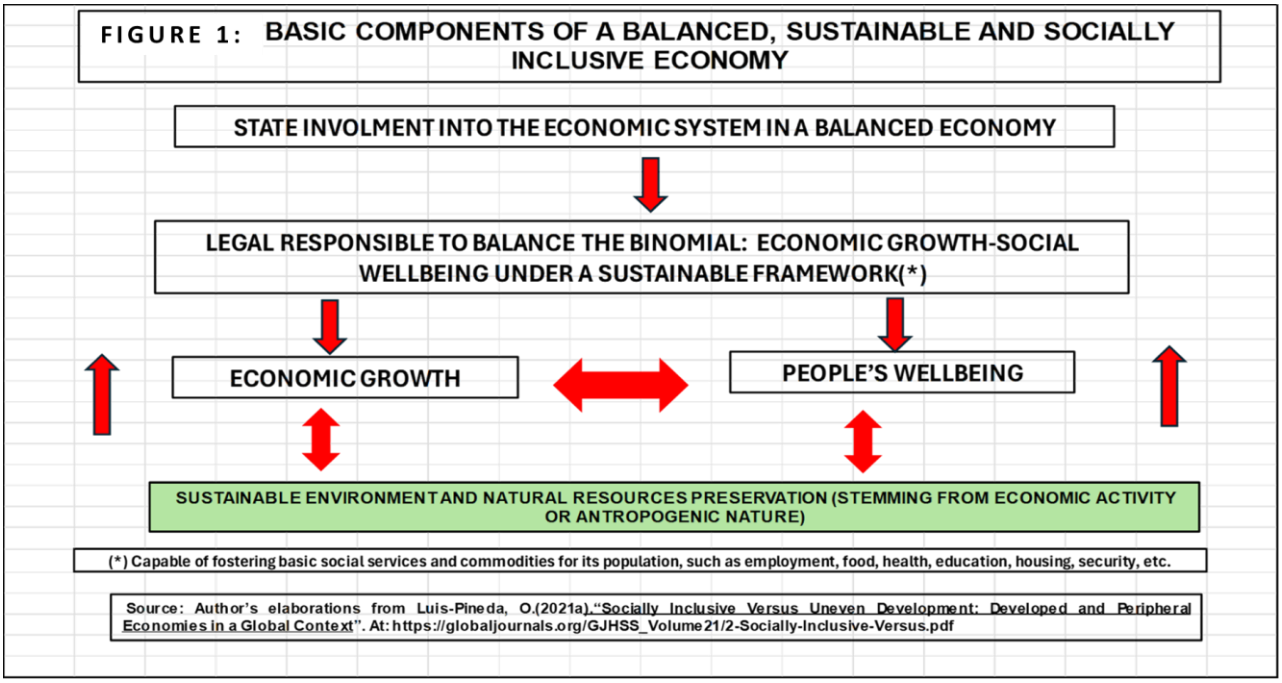
Keywords: Globalized state. Social inclusion. Sustainable economic development. Unbalanced economic growth. Socioeconomic and environmental externalities.

INTRODUCTION

THE ROLE OF THE STATE TO ACHIEVE A SOCIALLY INCLUSIVE AND SUSTAINABLE DEVELOPMENT IN PERIPHERAL AND DEVELOPED ECONOMIES

To fully understand the role and relevance of the State in balancing economic growth and social inclusion in any country under today's global context we need to review the concept of a balanced versus unbalanced economy. To ease the visualization of the complexity of the concepts involved in our discussion, we deem it pertinent to summarize them into a graphical scheme such as **Figure 1** which appears below:



The above illustration suggests that the attainment of a balance in the binomial economic growth and social well-being under a sustainable environment entails the economic stewardship of the State, as the country's legal guarantor and responsible par excellence, to promote, through pertinent and sound policies, the equilibrium among the above highlighted three fundamental elements: **economic growth** (economic system), **social well-being** (social inclusion and social interests), and a **sustainable environment** (natural wealth preservation) in addition to the fact that in a balanced economy, the State should be **capable** of fostering the generation of the basic social satisfiers that the country's population requires, whether developed or peripheral, such as **employment, food, health, housing, education, and social security**.

A State under a socially inclusive balanced economy does not overlook emphasize investment in science and technology (% GDP), and social spending (% GDP), and keeps through time, a moderate Gini coefficient or income distribution within the country to deter

wealth polarization or income maldistribution at domestic level, such as those levels prevailing in most advanced market-oriented countries with balanced economies, under today global context, namely Sweden, Norway, Denmark and so on.

Although the above figure represents a clear oversimplification of reality and the phenomenon behind the unbalanced versus balanced types of development in today's peripheral and industrialized countries, It poses a dramatic reality prevailing nowadays between both groups of countries under our current global context. These findings come from an analysis of the author ("socially inclusive versus uneven development between development countries and peripheral economies") based upon pertinent indicators stemming from an empirical sample of both sets of economies taken from international sources, such as the World Bank, CEPAL, IMF, ECLAC, OECD, etc., from the period 1980-2020, **vid, Luis-Pineda, O.(2021a).**

Under this context, for instance in America, it is evident that only Canada fits into the above-referred prototype. Although Mexico is on the right path so far, it still needs to fit in this category as we shall see later on. Albeit clear expectation exists that this will occur in the coming years, given its recent trend, provided it continues the prevalence and persistence of the current economic strategy which parallelling emphasizes growth and social well-being under a sustainable environment. Something that might occur or take place in the medium or long term, as long as the current strategy prevails in the 0foreseeable future featuring strong social support and involvement of the State in the economic system and its stewardship to guarantee a better balance in the binomial growth versus social well-being under a sustainable framework for the coming years.

However, the aforementioned desirable status for a country altogether entails a strong involvement of the State and people's demands and economic agents in the process of formulation and implementation of a country's most desirable economic path that may best fit its social interests versus the economic sector's under a sustainable framework as recently pinpointed by **I.M.D. Little, vid, Little, I.M.D.(October, 2022).**

Unfortunately, regarding the case of the rest of Latin America, similar to most peripheral countries, including high-growth emerging economies, like those belonging to the **BRICS** group, do not fit into this category either. As previously mentioned, only countries such as the Scandinavian countries, Switzerland, and other economies in the European Union meet these conditions. Countries featuring "welfare economies" where the State plays a linchpin role in formulating the country's economic route or path, characterized by having mature democratic regimes where there exists strong social participation and awareness to enable people to participate in designing the best economic growth path

which best fit the country's interests not only to all economic agents but also to population's social demands, vid, **Luis-Pineda, O.(2021b).**

THE ROLE OF THE MODERN STATE: DEVELOPED VERSUS PERIPHERAL ECONOMICS: EMPIRICAL EVIDENCE

ECONOMIC GROWTH AND R&D EMPHASIS

To fully understand the role and relevance of the State's involvement in both developed and peripheral economics we present below **Table 1.0**, containing economic indicators (**GDP**, **per capita,** and **Research and Development expenditure (R&D%GDP)** from a sample of major world economies and peripheral (emerging) countries, with statistical data stemming from international institutions such as the World Bank, OECD, CEPAL, etc.

TABLE 1.0

ECON.OVERVIEW. PERIPHERAL vs DEVELOP. SELEC.COUNTRIES(1980-2022)

PAIS	GDP(Bill$USdls)		Per Capita(US$dls)		R&D(%GDP)	
	1980	2022	1980	2022	1980	2022
MEXICO	205.1	1,420.0	2,958	11,497	0.2	0.3
USA	12,597.7	25,460.0	12,598	76,398	2.4	3.5
CANADA	273.9	2,140.0	11,135	55,343	0.4	1.9
GERMANY	950.3	4,070.0	10,170	48,397	2.1	3.1
U.K.	564.9	3,070.0	10,032	45,850	1.1*	1.7
JAPAN	1,105.0	4,230.0	9,465	33,319	2.1*	3.3
SWITZERLAND	223.7	818.4	18,832	59,458	2.1	3.2
SWEDEN	142.1	579.9	17,000	56,299	3.3	3.3
NORWAY	64.4	593.3	11,230	108,798	2.5	2.1
POLAND	659.8	688.2	17,312	18,073	0.7	1.2
SPAIN	232.8	1,415.0	13,415	29,715	0.8	1.2
CHINA	191.2	17,960.0	195	12,720	0.6	2.4
INDIA	186.3	3,390.0	267	2,389	0.6	0.7
BRAZIL	235.0	1,920.0	1,940	9,049	0.8	1.2
ARGENTINA	77.0	632.3	2,738	13,636	0.4	0.6
COLOMBIA	33.4	345.3	1,204	5,509	0.3	0.2
CHILE	29.0	302.2	2,577	6,064	0.5	0.4
GUATEMALA	7.9	95.2	1,082	5,332	0.0	0.0

*Closest historical available data

Sources:

OCDE: http://stats.oecd.org/Index.aspx?datasetcode=SOCX_AGG

CEPAL: http://websie.eclac.cl/sisgen/ConsultaIntegrada.asp?idAplicacion=1&idTema=6&idioma=

NATIONMASTER: http://www.nationmaster.com/graph/eco_dis_of_fam_inc_gin_ind-distribution-family-income-gini-index

CIA FACTBOOK :https://www.cia.gov/library/publications/the-world-factbook/index.html

COMMENTARY ON TABLE 1.0: ECONOMIC GROWTH VS R&D(%GDP)

The above data shows that both developed and peripheral, experienced economic growth, in terms of their GDP and per capita, during the last more than four decades **1980-2022,** despite manifesting disparity among them throughout the period, and regarding R&D developed countries show a clearer emphasis on this subject than emerging or peripheral ones. For instance, aside from **Mexico** only **China, India, and Brazil,** three current members of the **BRICS** group clearly emphasize this vital investment due to the imperative to achieve greater competitivity in the global market. All the remaining peripheral or

emerging economies remain lagged or even backward as in the cases of **Colombia, Chile,** and **Guatemala,** just to mention some examples.

In short, in the face of the market liberalization, which corresponds to the period of our analysis, the earlier results show that although both groups experienced growth in their GDP and per capita, but not in R&D, since meanwhile, developed economies manifest a clear upward trend to upgrade this sort of investment, peripherals on the contrary, observe a chiaroscuro outlook on this matter during the same period. This means in other words, a lack of interest or concern from their governments on this subject.

ECONOMIC GROWTH VS KEY SOCIAL INDICATORS' EMPHASIS

To better understand the behavior of growth versus social emphasis on two of the above set of countries considered in the previous table, we now add two key social indicators to this table, namely the **Net Social Public Expenditure (% GDP)**, and the **Gini Coefficient** and as it is reported in **Table 2.0** below:

TABLE 2.0

SOCIAL OVERVIEW. PERIPHERAL vs DEVELOP. SELEC.COUNTRIES(1980-2022)

PAIS	GDP(Bill$USdls)		Per Capita(US$dls)		SOC.EXP(% GDP)		GINI		R&D(% GDP)	
	1980	2022	1980	2022	1980	2022	1980	2022	1980	2022
MEXICO	205.1	1,420.0	2,958	11,497	10.9	18.4	51.9	45.4	0.2	0.3
USA	12,597.7	25,460.0	12,598	76,398	20.5	19.3	41.2	41.4	2.4	3.5
CANADA	273.9	2,140.0	11,135	55,343	17.5	17.5	33.7	33.7	0.4	1.9
GERMANY	950.3	4,070.0	10,170	48,397	25.4	25.4	30.6	30.6	2.1	3.1
U.K.	564.9	3,070.0	10,032	45,850	23.1	23.1	35.1	35.1	1.1*	1.7
JAPAN	1,105.0	4,230.0	9,465	33,319	22.3	22.3	32.9	32.9	2.1*	3.3
SWITZERLAND	223.7	818.4	18,832	59,458	26.7	26.7	29.6	29.6	2.1	3.2
SWEDEN	142.1	579.9	17,000	56,299	28.4	28.4	27.0	27.0	3.3	3.3
NORWAY	64.4	593.3	11,230	108,798	27.3	27.3	25.0	25.0	2.5	2.1
POLAND	659.8	688.2	17,312	18,073	21.3	21.3	31.8	31.8	0.7	1.2
SPAIN	232.8	1,415.0	13,415	29,715	24.2	24.2	36.0	36.0	0.8	1.2
CHINA	191.2	17,960.0	195	12,720	15.6	15.6	47.4	47.4	0.6	2.4
INDIA	186.3	3,390.0	267	2,389	15.6	15.6	35.7	35.7	0.6	0.7
BRAZIL	235.0	1,920.0	1,940	9,049	35.5	35.5	53.9	53.9	0.8	1.2
ARGENTINA	77.0	632.3	2,738	13,636	16.5	16.5	41.4	41.4	0.4	0.6
COLOMBIA	33.4	345.3	1,204	5,509	19.6	19.6	50.4	50.4	0.3	0.2
CHILE	29.0	302.2	2,577	6,064	22.4	22.4	47.7	47.7	0.5	0.4
GUATEMALA	7.9	95.2	1,082	5,332	12.5	12.5	52.0	52.0	0.0	0.0

*Closest historical available data

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CIA FACTBOOK :https://www.cia.gov/library/publications/the-world-factbook/index.html

COMMENTARY ON TABLE 2.0 ECONOMIC GROWTH VS SOCIAL INDICATORS

As we have seen in **Table 1.0** both groups experience GDP growth and likewise in their per capita. Although, not uniformly way in their R&D, since while developed economies manifest a clear upward trend to upgrade this sort of investment, peripherals on the other hand, observe a chiaroscuro outlook during the same period. This shows their governments´ lack of interest or concern on this vital issue.

However, on the social panorama depicted in **Table 2.0**, we observe a greater disparity between both groups, since developed ones emphasize social expenditure while

keeping low levels of income distribution during the analysis period. Concerning peripherals or emerging economies, such as **Mexico** and **China, India**, and **Brazil,** the three members of the BRICS group, clearly emphasize an improvement in social expenditure, although manifesting unacceptable levels of income distribution, not to mention the cases of **Colombia, Chile**, and **Guatemala**, for instance.

In short, in the face of globalization, during our period of analysis, it results evident that although both groups experienced growth through time, they did not uniformly emphasize R&D, since developed economies manifest a clear emphasis on upgrading this indicator through time, peripherals on the contrary, manifest a chiaroscuro behavior on this matter during the period. In the social arena, this comparison becomes even more dramatic, since developed economies observe a clearer trend to balance their economy, namely, growth and social people's well-being go hand in hand, peripherals, on the other hand, observe a disequilibrium between economic growth and social well-being, in other words, growth does not necessarily entail an increase in people's social well-being nor a better income distribution as well as a reduction of other externalities.

On the other hand, empirically it is observed that such socioeconomic imbalances are intimately tied to the country's political system, and the elites who rule the country are prone to embrace and implement hegemonic strategies in their domestic policies. Notice that among industrialized nations in **Table 2.0**, as in the special case, of the **United States** which manifests an unacceptable income maldistribution by 2022 despite its huge GDP, surpassing all major developed and emerging economies. The US reports a **Gini** coefficient close to Mexico's figure. In other words, this means that a developed and highly industrialized economy, like the US, and the BRICS, does not necessarily fit into a balanced economy prototype as previously stated.

DEPARTURING FROM HEGEMONIC STRATEGY: THE CASE OF MEXICO`S RECENT SUCCESSFUL EXPERIENCE

After the so-called **Mexican Miracle period** during **1954-1970 (**also known to be a "golden age" in which Mexico grew at 6.8% yearly**.** Strategy which followed a "stabilizing economic" model that caused an average growth of **6.8%** and industrial production to increase by **8%** with inflation staying at only 2.5%. Such a model pursued to attain economic stability to attain sustained and continued development during these years. And entailed a transformation from rural to urban development in the country. Such strategy was implemented in three consecutive Mexican governments such as Adolfo Ruiz Cortines (1952-1958), Adolfo López Mateos (1958-1964) y Gustavo Díaz Ordaz (1964-1970), **vid,**

Gayubas, Augusto(Nov6, 2024).

Unfortunately, the above-referred strategy was abandoned by consecutive neoliberal administrations from 1980 and onward during which Mexico experienced stagnation and poor economic performance, along with a host of externalities such as widespread corruption, poverty, and budget mismanagement endorsed by PRIAN ruling parties (PRI and PAN) which handed key Mexican sectors to private hands, such as mining industry, electricity (CFE), and oil industry (Pemex), and a host of public enterprises and thus exacerbating income maldistribution and poverty all over the country. Urging the compelling need to reorient such a model with a new one focused on social inclusion, economic growth, and sustainability, as this author pinpointed more than a decade ago, **vid, Luis-Pineda, O.(2008).**

Fortunately for Mexico, thanks to the rising social awareness and political pressure during the last four decades, particularly during the previous decade of continuous struggle by AMLO and supporters to win the Mexican presidency, and after two failed attempts, 2006 and 2012 (shadowed by political fraud from the ruling party) this could happen until 2018, **Lopez Obrador (AMLO)** eventually wins the **Mexican Presidency** on **July 1st, 1918,** for the period **(2018-2024),** with an overwhelming majority, 71% approval greater than the previous three presidents, **vid, Glz, Jimena(Jul1, 2018).**

Under the **AMLO regime,** a left-wing and nationalistic-oriented government**,** with strong social support, comes into power for the first time in years after the first **Mexican Miracle**, succeeds in achieving economic growth along with greater well-being under a socially inclusive strategy focused on rescuing the long-time impoverished Mexican population affected by former neoliberal policies that ruled Mexico during the long neoliberal period, vid, AMLO, economic Strategy, **vid, AMLO.PND(1988-2024).**

Despite the fact of strong political pressures from the right-wing opposition parties along with domestic private media and US permanent geopolitical meddling in the Mexican economy through myriad ways **vid, Dominguez, Arturo(Aug 24, 2024)** focused on systematically bullying and undermining AMLO's attempts to embrace a new and nationalistic economic route far from the Washington Consensus to struggle their long-time structural problems inherited by former neoliberal regimes similar to those faced by the rest of the Latin American economies which have undergone as well similar scenarios throughout this long period until our days. Incidentally, countries featuring immature democratic governments plagued by corrupt political elites are prone to implement hegemonic strategies and reorient their domestic strategies toward neoliberal paths according to their interests and foreign capitals but far away from their people's best social

interest and social inclusion, as **Washington Consensus,** implying**,** in reality**,** implementing a set of **"**strait jackets" or "recipes" into peripheral economies to reorient their domestic policies according to the neoliberal model, **vid, ElMostrador(2004)** which in turn gave rise to a set of misfortunate economic aftermaths for major LATAM economies, including Mexico itself, **vid, Guillén, Arturo (2012)**.

Notwithstanding, recent Mexican experience demonstrates that a sound economic strategy under a fully democratic and nationalist-oriented government such as President Lòpez Obrador(AMLO), is possible to occur in reality, under a globalized context and likely to succeed in a nationalistic-oriented strategy far from the **Washington Consensus** and **IMF strategies**. As already happened in the case of México during the pandemic years, when the country struggled against **COVID-19, vid, Luis-Pineda, O.(2022)**.

The result of Mexican strategy involving an emerging economy such as Mexico could successfully overcome the **Pandemic** in 2020 among most Latin American economies and the first one in this region to come out with economic growth after this misfortunate phenomenon as opposed to the economic routes followed by most countries in this region and other European nations because Mexico openly refused to follow IMF's recommendations of accepting foreign debt to get the vaccines and all required inputs to fight the Pandemic, but Mexico instead emphasized on funding large productive infrastructure megaprojects throughout the country (through Mexico's internal savings) such as the **Mayan Train** and **Transismic Corridor** and **Dos Bocas Refinery** and other geostrategic projects in Southeastern Mexico focused to paralleling, fostering economic growth and social inclusion, for instance, the Mayan Train alone it was expected, by early 2023, to generate 27 times more than Tesla's Gigafactory in the state of Nuevo León, (according to official sources 945,000 new jobs), **vid**, **Navarro,Sofia(March 7, 2023)** oriented to rescue and reactivate a long time lagged and deprived region but geostrategically important for Mexico **(Macrosouth)**.

In other words, the phenomenon of the Mexican State's involvement in coping with the Pandemic is undoubtedly a reference point and represents by itself an unprecedented strategy in history and a breakthrough growth path in the periphery that could be applied or extrapolated to the rest of the Latin American countries or elsewhere in periphery economies with similar stages of development provided the necessary provisions are taken.

LIKELIHOOD AND PERSPECTIVES OF A SOCIALLY INCLUSIVE STRATEGY IN THE PERIPHERY: THE MEXICAN CASE

The economic growth path so far implemented by AMLO's administration has already produced good results in Mexico to the extent that some scholars currently talk about a new **"Mexican Miracle"**, whose first results are manifested at the macro level with the high growth rates observed after the pandemic, highlighting a strong trend towards greater growth for the coming years, **vid, Torres, O.(Ago18, 2023)** and **Rosales C., Rodrigo (Jul31, 2020)**.

Therefore, the current Mexican economic model is an unprecedented phenomenon and a clear indication that such a strategy is feasible and working, benefiting most lagged regions but long-time overlooked by neoliberal regimes, as is the case of México's **Macrosouth region** (ingulfing three important economic regions of **Mexico**, namely, **Gulf of Mexico**, **South-Pacific** and **Southeastern** which houses three major infrastructure megaprojects already implemented by AMLO's administration, namely, the **Transoceanic Mexican Corridor, Mayan Train trailway** and the **Dos Bocas Refinery** in Tabasco federal state). All these mega public investments focused on long-time lagged economic regions, above referred, have implied an **economic boom** in Southern Mexico since the involving federal states within the Macrosouth are all currently growing at rates twice as big as the northern wealthy states, as being recognized by some analysts, **vid, Yorio, Gabriel(2023).**

Other AMLO's major accomplishments during the last six years and some expectations for Mexico in the years to come are:

- Rescuing two key Mexican State-owned enterprises such as the oil industry (PEMEX) and CFE (an electricity public enterprise largely almost privatized and mismanaged by former corrupt neoliberal regimes) aim to attain energy self-independence from abroad such as the Spanish Iberdrola (gas and electricity) and oil from American enterprises. In this regard, it is worth mentioning the efforts of the AMLO administration to reduce Mexico's oil imports through the acquisition, with public investment, of Deer Park Refinery in Houston, Texas in August 2022, already paid by Mexico and which scarcely after two years distance of this operation is showing profits for the country, vid, **Taborga, Sergio(Jul2, 2024)**.
- So far, these combined efforts have contributed, that total imports (gasoline, diesel, and turbosine) have been gradually dropping from 72 to 60% during the last six years (2018-2024), according to official sources, **vid, Pemex(Sep26,2024).**

- On alternative energy sources and vis-a-vis Mexico's future energy needs, a remarkable and strategical decision taken by the Mexican government which cannot be overlooked in this analysis has been the Lithium nationalization, during the AMLO regime, who signed the decree to nationalize this priceless strategic mineral in Sonora, Mexico, thus consolidating this mineral as property of the nation for its exploration and responsible exploitation, **vid, Gob.Mex.(Feb 18, 2023)**.
- Another achievement worth mentioning success has been in enhancing poor people's living standards and per capita income in Mexico through massive social programs and upgrading the minimum wage nationwide, which had been overlooked by prior regimes. Accordingly, during AMLO's administration, there has been a general minimum wage increase (20%) during the lapse (2021-2024), **vid, Statista(jul5,2024).**
- There are also two important massive and nationwide programs oriented to generate employment and enhance productivity in Mexico, the first one is called "Sembrando Vida" ("Sowing Life") focusing on sowing fruit, grains, or commercial timber trees throughout the country oriented to generating formal jobs for poor farmers in the countryside, currently operating in 24 federal states. By late 2024 for instance, this program has produced more than 442 thousand permanent jobs, with an annual social investment of 38.9 thousand million pesos, according to official sources, **Gob.Mex.(Jul 26, 2024)**. Such an iconic strategy has also been welcomed and successfully implemented by Mexico in Central American countries, such as El Salvador, Honduras, Guatemala, Belize, and Cuba.**vid,PNUD(July 2021)**.
- The other federal program is named **"Jóvenes Construyendo el Futuro"** ("Young People Building the Future") which combines the experience of workplaces with the energy of young people to promote job opportunities in situ among young people in the country and, thereby, contributes to the economy of the beneficiaries and their families—aimed at young people (between 18-29 years old with no jobs through a one-year stipend of about USD 350.00 plus medical insurance for one year during his in-workplace training time). Currently covering about 3 million young people throughout Mexico of whom 58% are women and 42% are men, **vid, Gob.Mex(Oct1,2024)**
- As expected all the above-referred measures have contributed to a poverty reduction in the country where millions of poor people have lifted extreme

poverty whereby the distance between rich and poor has been shrinking. This has been demonstrated by the fact that at least 8.9 million people have left extreme poverty during these years. Which in turn have contributed to an increase in the purchasing power of the low-income population thus impacting Mexico's aggregate domestic demand and Mexican GDP even during the pandemic years through myriad social programs to rescue poor people and Mexican SMEs, the major GDP and job generator in Mexico, **vid, Hacbarth Kurt(Ago26,2023)**

- During the lapse (2021-2024) Mexico has experienced a general minimum wage increase, **vid, Statista(jul5,2024).** Thereby contributing to poverty reduction in the country where millions of Mexicans have lifted extreme poverty and shrinking the distance between rich and poor in the nation. Manifested by the fact that at least 8.9 million people have left poverty during these years, **vid, Hacbarth, Kurt(Ago26,2023)**
- Enhancing political awareness among the Mexican population AMLO (71% approval in 1918) when taking power, greater than the previous three presidents as previously mentioned, **vid, González, Jimena (Jul1, 2018).** This implies a continuing growing social support and political awareness among the population as AMLO closes his administration with an 80% approval by the end of his administration in 2024, **vid**, **ElPais(Sep25,2024).**
- Formal job creation in Mexico continues to show strength, with a year-on-year growth of 3.4% in September 2023; in cumulative figures from January to September 757K new jobs have been created, the fourth-highest since 1998, **vid, bbvareseach.com(Oct13, 2023).**
- Regarding the inflation issue, Mexico's inflation from 2013 to 2022 has averaged around 4%. Although the country has faced several economic challenges, including currency fluctuations, changes in fiscal policies, and external economic shocks. Inflation was influenced by a mix of domestic and international factors, including oil prices and trade relations.
- The COVID-19 pandemic temporarily increased inflation, but the Bank of Mexico's monetary policy measures helped stabilize it towards the end of 2022. Consumer price inflation averaged 4.5% in the ten years to 2022 in Mexico, below the Latin America average of 8.4%. The 2022 average figure was 7.9%, **vid, focus-economics.com (Jul 9, 2024)**.
- Another worth mentioning accomplishment for Mexico is the fact that after 20

years, Mexico has become the first US trade partner displacing China and Canada **vid**,**Businessinsider.com(Feb9,2024),** due to a combination of factors and measures such as Mexican increasing manufacturing commodities and oil and gas exports (**593bn**USdlls in 2023, with a 4% growth), with 90% manufacture goods, (oil, and gas 5%), **vid, bbvaresearch (March 2024).**

- In addition to federal public investments focused on productive infrastructure throughout the country, such as in the Macrosouth region, remittances inflows to Mexico (reaching 63.3 billion USdlls in 2023), **vid, bbvaresearch(Feb1,2024)** and increasing foreign direct investment inflows to the country lured by **nearshoring** possibilities(40bn, USdls)**, vid, mexicobusinees.news(Feb2,2024),** but above all, undoubtedly a remarkably wise handling of macroeconomic domestic policy by Mexican authorities during AMLO's administration.
- At the international level likewise, Mexico is currently located in 12th place among the 25 largest economies in the world. Although at the Latin America level, it appears at the 2nd place just below Brazil, **vid, Investopedia.com.(July 13, 2024)**
- Another great attainment during AMLO's administration was the building of the **AIFA International Airport** (Felipe Angeles's new international airport) one of the most modern airports in Mexico and Latin America, built in record time, less than three years, by the Mexican Army engineers, **vid Expansion (March 23, 2022).**
- The above-mentioned airport represents an alternative to the old AICDMX (Aeropuerto Internacional de la Ciudad de México), originally planned during the former **Peña Nieto** regime to be built in former Texcoco's Lake ex-vase which came out to be an economic fiasco plagued by corruption by private enterprises during former **Peña Nierto** administration. Incidentally, **AIFA** airport was recently recognized as one of the most beautiful airports in the world and received the "Prix Versailles" in France, an award granted in the World Selection category in Paris, France. Award given to AIFA in recognition of its architectural and functional design, making it one of six airports distinguished globally, **vid, ElPaís(Dec3,2024)**.
- Besides the above-mentioned success, it has been the environmental rescue of all the land and premises focused on building the new **Texcoco's Lake Ecological Park (PELT)** in Mexico City around the former lands of the failed

New International Airport (NAICM), which took six years into to get completed and reconfigured as a giant ecological park in Mexico City (14,000 hectares) which has been already inaugurated by **President AMLO** this year **vid**, **ElEconomista(Aug30, 2024).**

On top of all above referred AMLO'S accomplishments, **Claudia Sheinbaum,** the brand new Mexican President for the period **(2024-2030)** arrives at power backed by strong social support, incidentally wins the Mexican Presidency showing currently with a 63.4% approval, **vid, Ramos, Rolando(Dec2,2024)** is fully committed to continuing AMLO's economic path (the so-called "**4th Transformation Strategy"**) plus adding her extra emphasis on sustainable development, among other important targets, such as continuing to emphasize the Program "Sembrando vida" ("Planting or sowing Life") and as well as AMLO's large infrastructure mega projects all over the country, such as railway megaprojects in northern and center Mexican regions in 2025 entailing a public investment totaling about **7.8** thousand million USdlls (157,000 million Mexican pesos) earmarked federal funding to build a 3,000 km railway network in Mexico during **Sheinbaum administration**, **vid, Rojas Arturo et al.(Nov29, 2024)**.

Under a global context, this particular program and Mexico's strategy have already been spread by the current Mexican government during the recent **G20 Summit in Brazil (2024).** In such a framework, **President Sheinbaum** was able to share Mexico's successful experience among the major world leaders who acknowledged Mexico's attainments in economic performance with particular emphasis on social inclusion and sustainability. For instance, Mexico's concrete proposal was the allocation of 1% of military spending to the largest reforestation program in history. Focused to deter "sowing wars and let us sow peace and sow life", as she pinpointed in the First Working Session: "Fight against Hunger and Poverty", **vid, Gob.Mex(Nov18,2024)**.

On the above-referred **G20 Summit** context, it is worth mentioning likewise, the convergence of four major left-winged presidents in Latin America against **Washington's neoliberal strategy** and its devastating economic aftermaths for the region, **vid, Martinez, R. Rubi et Al. (2016)** and their unanimous support for launching regional similar social inclusive programs into their domestic economies in the years to come based upon Mexican successful experience and perspectives in the medium and long run. Under this framework, Latin America's most powerful economies are led by left-wing governments, namely, **Mexico** (Claudia Sheinbaum), **Brazil** (Luiz Inácio Lula da Silva), **Colombia** (Gustavo Petro) and **Chile** (Gabriel Boric) are charting a new economic and political course in the region. And proposing a strategic pact, "Pact of the Americas", aiming to transform the global

economy and redefine international geopolitics focused on combating income maldistribution, climate change, and economic dependence in the region under a new economic model focused on social justice, **vid, Infobase(Nov11, 2024)**.

Lastly, as regards to Mexico's current success and perspectives, today the country is considered, from some sources, to be a "locomotive" in Latin America with a GDP projected between 2%-3% for 2024, the country has not only exceeded expectations but has consolidated its position as a growth engine in Latin America. Foreign direct investment reached a historic milestone of 31 billion dollars, boosting key sectors such as digital and construction, which experienced a growth of 10.1%.**Vid, PrensaAlternativa(Dec13, 2024).** This is also confirmed by some scholars, such as the Nobel prize winner James Robinson, who states that Mexico has to take advantage of its comparative and competitive advantage from world trade reconfigura0tion will come out as "the ultimate winner" through the "**nearshoring"**, **vid**, **Robinson, James(Nov11,2024).** However, this desirable achievement in the years to come won't take place seamlessly unless there exists a strong State involvement in the economy and doesn't leave the whole process unrestrained by market forces. Notwithstanding, this is quite the opposite of the Washington Consensus' proposal for minimal intervention by the State.Which pretends to impose among the periphery an updated version of the XVIII century Adam Smith´s economic liberalism thesis of "Laissez-faire, Laissez-Passer" and "Invisible Hand" principle of market self-regulation to achieve the equilibrium between the economic system and people's social well-being, **vid, Smith, Adam(1776)**.

CONCLUSIONS

From the above analysis, we can advance some preliminary conclusions

- Peripheral and developed countries have benefited from economic globalization over the last four decades, which means increased GDP and per capita over the years. However with asymmetric behavior on R&D and social indicators emphasis.
- While developed economies emphasize R&D(%) during the period peripherals overlook this subject, except for highly industrialized economies such as the BRICS.
- On social indicators, contrasting to developed economies, peripherals overlook emphasizing R&D(%) and social indicators, mainly income maldistribution as manifested by unacceptable Gini coefficients.

- However, under current market liberalization, it becomes apparent that not all the industrialized countries are entitled to be called **balanced and socially inclusive economies** as **in** the case of the United States, but also the BRICS in virtue of their current unacceptable income maldistribution index in more than 40 years. Given that establishing this key indicator in any country (whether developed or peripheral) is an entire State's responsibility and cannot be delegated or left to the free market forces. This fundamental finding is worth mentioning fact that cannot be overlooked in our analysis.
- Therefore, we consider that Mexican current experience is a breakthrough point and a departure in time to open a new gate for new economic routes that can be followed in the years to come for many peripheral economies with similar stages of development and to get rid of hegemonic policies from the IMF and other harmful hegemonic institutions such as the World Bank, Interamerican Bank of Development, and so on, in our current globalized context.
- In summary, based upon Mexico's experience and perspectives, and the previous analysis of the behavior of developed versus peripheral countries under the current global context, peripherals have a great opportunity in the foreseeable future to design their economic routes that best fit their socioeconomic domestic interests far from above referred hegemonic influences and thus fostering their population's well-being under a socially inclusive and sustainable framework.

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QUANTUM DOTS APPLIED IN HEALTHCARE – CBEB 2024

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ABSTRACT

This article addresses the applications of quantum dots in the health area, focusing on the applications of graphene and carbon dots. It also presents the explanation of what quantum dots are, and the motivation for using this technology in health. For this approach, research was carried out with several authors, in order to present to the reader the importance of fur- ther studies of this nanotechnology so that in the future it can be applied in the health network. It should be noted that only a portion of the studies already published on quantum dots and the health area have been addressed.

Keywords: Graphene quantum dots, Carbon quantum dots, Healthcare.

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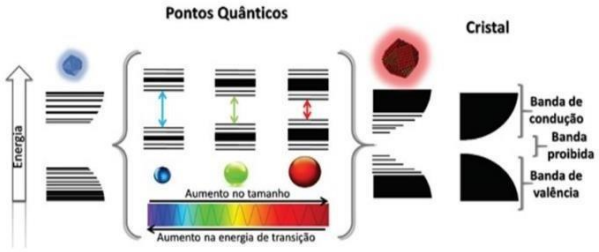
INTRODUCTION

In mid-1937 the French physicist Herbert Frohlich was discussing the existence of nanoparticles that are now known as quantum dots, at the time the discussion was nothing more than theoretical assumptions. Years later, three scientists prove that what was treated as a supposition was actually concrete and was called quantum dots. Because of these studies, the trio of scientists were awarded the 2023 Nobel Prize in Chemistry [1]. Although the most impactful development of quantum dots will be achieved after the Nobel Prize, the fascinating evolution of this area of study that correlates the physical, chemical and biological sciences begins, as previ- ously mentioned, in the mid-1980s on the effects of quantum size on colloidal nanoparticles. In the 2000s, notable ad- vances included Ekimov's synthesis of semiconductor quan- tum dots in a glass matrix, as well as Bawendi's development of optimal synthesis methods for quantum dots with well-de- fined size and resolution. By the middle of that decade, quan- tum dots showed promise in biomedical imaging, with sig- nificant improvements in brightness, stability, and tunable properties, as well as the development of biocompatible dots. Around 2010, this research marked an era of remarkable ad- vances in quantum dot applications, from integration into LED screens to improve color accuracy and energy effi- ciency to their use in electronics such as smartphones, tablets, monitors, and TVs. In the following decade, in 2020, we wit- nessed a substantial increase in the use of quantum dots in renewable energy, such as more efficient solar cells and greater energy capture and conversion, as well as in areas such as catalysis, nanomedicine, and high-speed communi- cation, highlighting their innovative potential in various sci- ences and technologies [2]. Quantum dots (QD) are consid- ered to be the trappings of a group of atoms in a place that is so small as to force a change in the position of the respective electrons. By this it is understood that the atoms are allocated in small places, where the electrons are according to their en- ergy level. When this space is moved and the quantum dot is allocated, there is then a separation of the energy levels and consequently there is a change in these levels. In this process of changing positions, when there are electronic changes in energy levels, the electrons emit a photon of a specific frequency, and this emission generates a coloration and this is one of the properties that can be observed [1]. The experi- ments carried out by the scientists showed that the particles had different optical properties, and that the size of the parti- cles influenced their coloration, with the larger particles ab- sorbing electromagnetic waves tending towards the red. Finally, quantum dots are small crystals that are composed of a certain number of atoms confined in a region [1]. It is con- sidered that quantum dots are outstanding materials due to their interesting optical and electronic properties, and this gives the material the capacity

for technological application in several areas. These materials are endowed with capabili- ties that make them nanocrystalline semiconductors, they are made up of various atoms and have charge carriers, these car- riers being the electrons and holes that are the positive charges [3]. Another term used and of great importance is that of quantum confinement, which is nothing more than the physical size of this material being below the Bohr radius of the exciton, Bohr radius is understood as the average distance between the electron and the positive charge. What was ana- lyzed in the research is that the smaller the size of the mate- rial, the greater the confinement of the charge carriers, and thus a higher energy is in the prohibited band, as can be seen in figure 1.

Figure 1 Color of Quantum Dots [3]

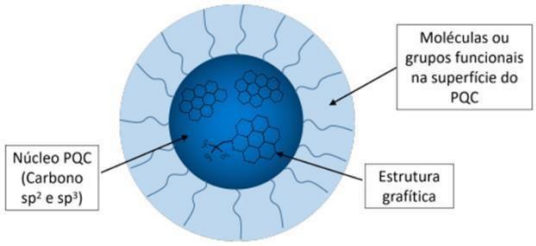


As can be seen in figure 1, the size is inversely propor- tional to the amount of energy, and the same chemical com- pound can produce different colors, it is only necessary to change the size of the nanocrystals. It is currently known that the dots have measurements from 1 nanometer (nm) to 10 nanometers (nm) [3]. QD can be manipulated through several elements of chemical groups II-VI, namely: CdSe, CdTe, CdS, ZnSe, ZnO, among others) or groups III-V such as InP and InAs. It should be noted that when handling Cd and Pb, there is difficulty in application due to the toxicity of the ma- nipulated materials. On the other hand, chemical compounds of groups II-IIIVI do not have toxicity, making these com- pounds more attractive for use [3]

CARBON QUANTUM DOTS

In 2004, while manipulating carbon nanotubes in order to carry out a purification process, the quantum dot of carbon was accidentally obtained. This material is based on carbon, has photoluminescence, quasi-spherical characteristics and has a zero dimension [4]. Since its discovery, numerous re- searches have been carried out, and from them it has been observed that this material is endowed with advantages, such as: Low toxicity, stable, it is considered low cost and abun- dant [4]. Carbon quantum dots (CQDs) are hydrophilic due to the presence of amino, carboxyl and hydroxyl functional groups. According to figure 2, the representation of the PQC point can be seen.

Figure 2 Representation of CQDs [4]



For the photoluminescence mechanism there are still doubts about its operation, and because of this there is no sin- gle explanation. Among these explanations are the factor of surface groups, size and even the presence of fluorescent molecules, so it is noted that there is not only a common un- derstanding of this issue, but several explanations. Because it is a quantum point, in general, it can be understood that flu- orescence comes from electronic excitations and exchange of its ground state.

GRAPHENE QUANTUM DOTS

Graphene is a material that is the allotropic form of car- bon, and its structure is two-dimensional and its thickness is that of a single atom. This material is considered of great value, due to its thermal, electronic, mechanical properties and also because of its chemical stability. It is observed that if when a portion of graphene is small enough to be under the influence of the quantum confinement effect, then it becomes a semiconductor and thus will exhibit special properties [5]. Graphene quantum dots (GQDs) are sheets with isolated na-nometric dimensions of graphene, these dimensions have a size smaller than 100 nanometers (nm), and due to their quan- tum confinement they generate intense photoluminescence, in addition to the confinement photoluminescence is gener- ated due to edge effects. They are part of the graphene nano- materials group [6]. GQDs have low toxicity, their disper- sions have stability when in water since their structure forms hydrophobic interactions, they have rapid interaction with chemical species, their optical properties have greater stabil- ity, and finally they have greater sensitivity to analytical re-sponses, all these advantages presented are related when compared to semiconductor quantum dots [6]. In this ele- ment, it is observed that some factors can influence the pho-toluminescence of the material, such as: structural defects, presence of oxygen-containing groups and finally the doping elements have generated influence on the luminescence, it is worth mentioning that there are doubts about the accuracy of the photoluminescence mechanism of the GQDs, and be- cause of this several theories have been generated [5]. These GQDs can have a range of colors ranging from ultraviolet, through blue, and up to red. These coloration bands can be observed when interacting with ultraviolet (UV) light.

There are different ways of preparing and synthesizing this mate- rial, but citation is not necessary due to the fact that it is not the scope of this work [5]. Some studies have shown that this material has the possibility of transporting drugs, as well as due to its size it is believed that it would have easy penetra- tion into the lipid layer and thus would not generate damage, thus facilitating the transport of drugs [7]. Thus, it is noted that quantum dots are nanomaterials of great applications and that they can promote a significant impact in several areas, including the health area. Its impact on health is broad and will be analyzed in further discussion, in addition to this ma- terial has economic advantages, which is positive for the health system.

MARKET

The market growth for quantum dots predicted from 2024 to 2029 is detailed in the report available by Mordor's Intel- ligence (https://www.mordorintelligence.com/pt/industryre- ports/quantum-dots-market-industry), a technical website for industrial growth and investment information, in this docu- ment several scenarios are considered for the applications of dots, in which possible biomedical applications are men- tioned. The market as a complex currently holds about 5 bil- lion dollars, concentrating the largest investment and expan- sion in the regions of Asia and Oceania, as shown in figure 3.

Figure 3 Quantum dots market



However, the report highlights the quantum applications related to imaging improvements, and their implementations in the market, in addition to their probabilistic applications such as biosensors and pathogenicity detectors, but does not corroborate for the applications related to drugs and treat- ment due to the toxicity effects of the compounds, which still have an experimental and investigative state.

BIOLOGICAL APPLICATIONS OF QUANTUM DOTS

CQDs are mostly relevant for biological applications due to their organic relationship

based on the element carbon, which not only composes molecular structures, but is also intrinsically related to biological structures such as peptides, cells and tissues. Cells are complex structures composed of several mechanisms, which perform the most diverse and complex functions, from the absorption of water, to their rep- lication for tissue renewal or defense against invading organ- isms. Because they have the most diverse differentiations in organisms, they can be identified by means of more precise markers, that is, if they are made of more permeable materials or even more compatible with the environment. The relation- ship of quatum dots as biomarkers is evidenced due to the excitation capacity providing signals such as photolumines- cence, enabling the localization of mutations (carcinomas) and/or metabolic maladjustments. On the other hand, treat- ments are related to the ability to help biological structures to carry out the defense or restructuring of their metabolic ac- tivities in a coherent way after invasions, whether by micro- organisms, mechanical accidents or others. Thus, targeted therapies seek to relate the dots of various materials, includ- ing carbon, with the lowest possible toxicity for the formula- tion and activation of drugs, thus promoting their dispersion or absorption only by the organs, tissues or areas of interest for the defined treatment. In order for less invasive and more effective treatments to occur, the health sciences seek, over the years, to research more assertive materials and practices. For which more detailed examinations are necessary, ranging from the general functionality of an organ, the biological tis- sues, to the reproductions carried out gradually and steadily by these structures. Consequently, the greatest prominence and market expansion are those related to image resolution through quatum dots and their light emissions, enabling the visualization of the areas where the disturbances occur, so that their nanometric structure facilitates the identification of reactions and activities related to pathogenicities.

METHODS

To understand the vastness of quantum dots and their ap- plications in the biomedical sciences, a multifaceted method- ology composed of multiple steps was adopted. First, a thor- ough review of the scientific literature related to quantum dots was conducted. This review has ranged from the theo- retical beginnings discussed by Herbert Frohlich to the most recent discoveries and applications, which are presented in articles. A variety of sources, including papers, technical re- ports, and other relevant publications, were consulted to gain a comprehensive understanding of the development and evo- lution of this area of study. In addition, previous studies con- ducted by renowned scientists such as Ekimov and Bawendi were analyzed, and then sought to understand the advances and

discoveries that contributed to the current knowledge about quantum dots. This analysis allowed us to identify the distinctive properties of quantum dots, especially carbon dots. Data collection played a key role in our methodology. Relevant information on applications in different sectors and market trends was gathered, with a greater focus on the areas of health. Ethical and safety considerations have been care- fully weighed throughout our research, especially with regard to the use of quantum dots in biomedical engineering. The challenges and ethical concerns related to the use of nano- technological materials in biomedical and therapeutic appli- cations were discussed, in accordance with international con- ventions on bioethics and animal welfare. Finally, a comprehensive market analysis was conducted, examining the growth trends, highlighted application areas, and eco- nomic and business considerations related to quantum dots. This methodology allowed a detailed and comprehensive analysis of quantum dots, from their theoretical bases to their practical applications, considering ethical, security and mar- ket aspects. The results and discussions obtained provided valuable insights into the potential of these materials in sev- eral areas, including health and technology.

RESULTS AND DISCUSSION

Quantum dots have several applications, as well as certain advantages already mentioned earlier in this article. It is therefore necessary to cite research that addresses the use of these materials in the health area, it is worth noting that the works cited here are only a sample of the potential of this material, thus not representing all the studies already carried out. It is presented from some authors that CQDs have been applied in bioimaging, quantum dots were prepared and after the preparation cancer cells from the human breast region were labeled, and human epithelial cells were used as con- trols. He then excited the cells to a certain length, and with this photoluminescence was presented. It was observed that this material is more biocompatible and that it was 80% higher in cell retention. In addition, cellular retention of quantum dots can be observed, and this retention has been observed using a common fluorescence microscope. After further testing, it was confirmed that the CQDs were inter- nalized into the cells and that this was accomplished by en- docytosis. It is concluded in this article that CQDs are inter- esting due to their low cost, they have a non-toxic character, demonstrating that they do not have problems for biological applications, demonstrating that their use will have a great impact [8].

Work was done to develop methods of analysis using gra- phene quantum dots, and these quantum dots would have the effect of a photoluminescent probe with the objective of de- termining a drug for cardiac patients. Graphene quantum dots were produced from

aqueous dispersions and prepared by glutathione and citric acid pyrolysis, this dispersion gener- ated GQDs functionalized with amino groups. In addition, analyses were also performed with or without the presence or absence of Fe^{3+}. These GQDs were used in the study as probes to determine the use of the medication, the results ob- tained were significant and with this it was observed that re-gardless of whether or not there was Fe^{3+}, but that it is possi- ble to use these probes to measure the medication. In addi- tion, it was also observed that these probes have a competi- tive advantage in relation to others already used, this differential is the fact that no toxic reagent is used [6].

In 2018, a broader study was carried out on the use of GQDs as an analysis probe, where in addition to the use for observation of medication for 6 cardiac patients, its use in histamines and kanamycin sulfate was also analyzed. When in the presence of histamines, the study evaluated the photo- luminescent scattering reactions. For Kanamycin sulfate, gold nanoparticles were needed to measure the effect of pho- toluminescence associated with the GQDs. The study demon- strated that the probe for use in the analyzed cardiac drug had good results, so the proposal proves to be competitive when compared to peers already described in the literature. On the other hand, for the histamine probe, mediators in an aqueous system were needed, and with this a good correlation of the probe with Fe^{3+} for histamine analysis was again observed. Finally, in the probe analysis for Kanamycin concentrations, the study was successful for the determination of samples for- tified with yellow fever and for samples of pharmaceutical formulations. Therefore, it is possible to observe in this work a good use of GQDs for the analysis of certain substances [5]. In 2019 it published studies and analyses referring to as- says using quantum dots for biomedical purposes, however, only in vitro and ex vivo studies were included, due to the difficulties of bioethical approval related to long-term tox- icity associated with their administration. The study reaffirms the relevance of the applications of these methods for more assertive and specialized treatments, focused on the permea- bility and affinity of the tissues under treatment, making them a suitable tool for personalized treatments [9].

In 2020, a study was carried out using the graphene quan- tum dot for the treatment of leukemia, the quantum dots in this case would be in charge of loading chemotherapy drugs, in order to reduce the toxic effects of the treatment. In this study, carbodimide was functionalized so that it could later be conjugated to the drug imatinib. This drug was intended to be synthesized and conjugated to the GQDs, and this pro- cedure was successfully performed by the study. It was pos- sible to observe that this conjugate was able to induce the death of leukemia cells, and presented lower toxicity to healthy cells when compared to the use of the drug Imatinib alone. This work was able to demonstrate

that drug carriers made from carbon nanoparticles have been effective in the treatment of cancer. In addition, they are less toxic, which is positive for the patient under treatment [7].

In addition to technical and scientific issues, it is critical to consider the ethical and safety implications associated with Quantum Dots studies in biomedical engineering. The bio- ethics conventions related to the studies in question are the Universal Declaration on Bioethics and Human Rights - UNESCO 2005, Oviedo Convention (Convention for the Protection of Human Rights and the Dignity of the Human Being with regard to the Applications of Biology and Medi- cine): - Council of Europe in 1997 and the Declaration of Helsinki, in which the need to inform patients about the risks of the research to which they are being submitted are high- lighted, the freedom in relation to the aggressiveness of the compounds or activities to be performed.

There are also conventions that cover animal welfare and protection, as well as the feasibility and authorization of their use in research, some of which are: European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes of 1986, Guide to the Care and Use of Laboratory Animals, Directive 2010/63/EU on the Protection of Animals Used for Scientific Purposes and Prin- ciples of the Three R's. These documents discuss the impli- cations of the well-being of individuals for the results and preservation of life in corroboration with the advancement of scientific research, predicting limits for pain, sleep depriva- tion, food, habitat area and other topics.

CONCLUSIONS

Quantum dots have been shown to have a high capacity for use in the health environment, in addition to their explo- ration capacity is still great, with this it is understood that over time this material will have greater use in the health area than it currently has. Through this article, it was demon- strated that the material is biocompatible, low cost and great applicability, these points are advantages that make this ma- terial have great potential for use in the health system. As a suggestion for future work, it was observed that there is a need for studies of this material for application in other ex- ams such as cardiac examinations, since there is a significant number of individuals who are affected by heart diseases, eventually using this material together with an image analysis device, it is possible to obtain clearer and better defined im- ages.

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APPLICATION OF INDUSTRY 4.0 TECHNOLOGY IN THE IMPROVEMENT OF PLASTIC INJECTION PROCESSES IN A COMPANY IN THE INDUSTRIAL HUB OF MANAUS

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ABSTRACT

Lead Time optimization ensures compliance with deadlines established with customers, which, in turn, promotes customer satisfaction and loyalty. In addition, the reduction of this time provides a more efficient management of resources, with direct impacts on the reduction of operating costs. This study aimed to implement Industry 4.0 technologies to improve plastic injection processes in a company in the Manaus Industrial Pole (PIM), reducing manufacturing costs, accelerating the Lead Time of device construction and optimizing time in the development of new products. In the methodology, data were collected on the new production processes and the evaluation of the impact of the technology on the reduction of manufacturing costs and the improvement of lead time was carried out, through mapping of the current flow of the process, analysis of production loss reports and production performance data. The results show a significant reduction in lead time, that is, in the time needed to create these devices, which had a period reduced from 35 (thirty-five) to 9 (nine days). 3D printing has also made it possible to create more complex and precise devices, with less material waste, directly contributing to cost reduction and an increase in product quality.

Keywords: Automation. 3D printing. Improvement. Industry 4.0.

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INTRODUCTION

In the highly competitive landscape of modern industry, operational efficiency has become an imperative necessity for companies that want to remain relevant and profitable (Serfontein, J., et al, 2013). The development of production devices, a crucial area for many industries, faces significant challenges related to lead time. High lead time not only compromises delivery times agreed with customers, but also affects the supply chain, increasing costs and reducing business agility (Chen, Chih-Jou., 2019). Investigating the root causes of delays is essential to develop practical solutions for each stage of the production process, taking into account everything from the purchase of inputs to the manufacture and testing of devices on the production line, where each phase will be thoroughly analyzed to identify opportunities for improvement. Through a systematic and integrated approach, it is expected to achieve a substantial reduction in cycle times and, consequently, increase the competitiveness of the companies involved.

Historically, development and production time has always been a critical factor in the success of manufacturing companies. From the early days of the Industrial Revolution, when production efficiency began to gain prominence, to the present day, where agility and flexibility are key, lead time has been an essential performance measure (Şen & İrge, 2020). However, with the increasing complexity of production devices and the demand for differentiated customization, lead time has become an even greater challenge. This research aims to address this contemporary challenge by exploring methods to reduce the development time of production devices. The analysis will cover the entire production chain, from the acquisition of materials to final tests, with a special focus on the practices that can be implemented to minimize delays and meet the deadlines established with customers. The intention is to offer a historical perspective that contextualizes the importance of productive efficiency and propose innovative solutions to current problems.

The success of a manufacturing company is intrinsically linked to its ability to deliver high-quality products within the established deadlines (Tortorella, L. et al. 2021). However, many companies face significant difficulties due to the high lead time in the development of production devices. This problem not only compromises customer satisfaction but can also result in lost revenue and increased operating costs. Using a combination of data analysis, project management techniques, and lean production methodologies, it is expected to develop a set of best practices that can be adopted by companies to optimize their processes and more effectively meet customer demands.

Lead time in the development of production devices is a crucial metric that directly affects the performance and competitiveness of companies (Henao, R.; Sarache, W.;

Gómez, I., 2019). A high lead time can result in delays in product delivery, customer dissatisfaction, and increased costs, which compromises the long-term viability of organizations (Mutua, M. 2015). This analytical research proposes to investigate in detail the causes of high lead time, using a systematic approach that includes the analysis of device purchasing, manufacturing and testing processes. The main barriers and bottlenecks at each stage will be examined, and solutions based on best practices addressed in the company, technological advances and innovations in process management will be proposed. The ultimate goal is to implement industry 4.0 technologies to enhance plastic injection processes in a company in the PIM.

LITERATURE REVIEW

PRODUCTION MANAGEMENT

Production is the process of creating goods or services from the combination of different resources, such as raw materials, labor, capital, technology, and has accompanied man since his origin.

Production management is an area of management that focuses on the efficient and effective management of an organization's production processes and operations, where it will ensure that goods and services are produced in an economical manner, with quality and within the established deadlines, being an important factor for the success of any organization (Paiva et al., 2009). Production management has its roots in the Industrial Revolution, when mechanization and mass production began to transform the way goods were produced. Pioneers such as Frederick Taylor and Henry Ford introduced scientific management and assembly line techniques, respectively, which revolutionized industrial production. Over time, the discipline has evolved to incorporate more sophisticated approaches, such as lean manufacturing, total quality management (TQM), and just-in-time (JIT) production (Jamba, 2024).

JUST-IN-TIME (JIT) PRODUCTION

JIT Production is based on several fundamental principles that aim to optimize production and reduce waste, eliminate waste, lean production, continuous process flow, quality at the source, and continuous improvement using Kaizen tools. (Carvalho, 2016).

JIT implementation uses several tools and techniques to achieve its goals:

- Kanban: A signaling system that controls the flow of materials and products in the production process, ensuring that items are produced and delivered only when needed.

- SMED (Single-Minute Exchange of Die): Techniques to reduce machine setup time, allowing greater flexibility and smaller production batches.
- TPM (Total Productive Maintenance): An approach to ensuring that machines and equipment are always in good working order, minimizing interruptions in production.
- Heijunka (Production Leveling): A technique for leveling the workload and avoiding peaks and valleys in production, promoting a continuous and stable flow.

JIT Production has been widely adopted in a variety of industries, including automotive, electronics, and consumer goods manufacturing, the practice offers several significant benefits such as reducing inventories by reducing storage costs and tied capital, eliminating waste and creating a continuous flow of production increases operational efficiency, emphasis on quality at the source, and continuous improvement results in higher quality products and lower defect rates, ability to produce based on actual demand allows for greater flexibility to respond quickly to changes in the market. (Ribeiro, 2017).

INDUSTRY 4.0

Known as the Fourth Industrial Revolution, it is a new phase in the organization and control of the value chain throughout the life cycle of products. This phase is characterized by the digitalization and integration of all elements of the value chain through the Internet of Things (IoT), Big Data and Analytics, Artificial Intelligence (AI) and other advanced technologies. Digitalization and the integration of value chains create significant opportunities for the optimization of production processes and innovation in business models.

Schawb (2016), says that "Industry 4.0 is characterized by the digitalization and integration of value chains, products and services, resulting in a fusion of physical, digital and biological worlds" did not emerge in isolation, but is the result of a series of technological and organizational evolutions that date back to the First Industrial Revolution. The First Industrial Revolution, which took place at the end of the eighteenth century, was marked by the mechanization of production through the use of water and steam. The Second Industrial Revolution, in the late nineteenth and early twentieth centuries, introduced electricity and mass production, while the Third Industrial Revolution, starting in the 1970s, brought automation and digitalization with the introduction of computers and information technologies.

Kagermann, Wahlster, & Helbig (2013) state that "each industrial revolution has brought significant changes in society and the economy, and Industry 4.0 is no exception, promoting automation and data exchange in manufacturing technologies." The Fourth Industrial Revolution continues this trajectory, but with a much greater focus on interconnection, artificial intelligence, and full automation of production processes, driven by a series of advanced technologies that together transform industrial processes. Among the main technologies are:

Internet of Things (IoT)

IoT allows the interconnection of devices and systems, facilitating communication between machines and optimizing production processes. Lee, Bagheri, & Kao (2015) point out that "IoT plays a crucial role in Industry 4.0, enabling real-time data collection and analysis for informed decision-making."

Artificial Intelligence (AI) and Machine Learning

AI and machine learning are essential components in Industry 4.0, providing advanced analytics and automation capabilities. "AI is revolutionizing manufacturing by enabling failure prediction, predictive maintenance, and process optimization" (Russell & Norvig, 2016).

Big Data e Analytics

The ability to collect and analyze large volumes of data is critical in Industry 4.0. "Big Data allows companies to identify patterns and trends, improving efficiency and decision-making" (Manyika et al., 2011).

Advanced Robotics

Advanced robots are increasingly being used for complex and repetitive tasks, improving accuracy and efficiency. "Robotics in Industry 4.0 is characterized by collaboration between humans and robots, creating a safer and more efficient work environment" (Bauer, Hämmerle, & Schlund, 2015).

Cloud Computing

Cloud computing allows for large-scale data storage and processing, making it easier to access and analyze information in real time. "Cloud computing is a crucial enabling

technology in Industry 4.0, enabling scalability and flexibility of resources" (Armbrust et al., 2010).

Additive Manufacturing (3D Printing)

3D printing is transforming manufacturing by enabling the production of complex parts quickly and cost-effectively. "Additive manufacturing is revolutionizing production, reducing waste, and enabling mass customization" (Gibson, Rosen, & Stucker, 2010).

Augmented and Virtual Reality

Augmented and virtual reality are being utilized for training, maintenance, and design, providing interactive and immersive visualization. Azuma (1997) notes that "these technologies are improving operational efficiency by providing real-time contextual information to workers." Industry 4.0 has a profound impact on several dimensions, including economic, social, and environmental. These impacts are felt across different industries and scales, ranging from changes in the labor market to digital transformations in companies. The adoption of this revolution is increasing the productivity and efficiency of companies, resulting in significant economic benefits. "The digitalization and automation of production processes are creating new business opportunities and revenue models" (Pereira & Romero, 2017).

This revolution is transforming the job market, creating demands for digital and technological skills. Lasi et al., (2014) states that "automation and AI are replacing repetitive and manual tasks, while generating new opportunities for skilled workers". Digital transformation is a core aspect of Industry 4.0, allowing businesses to quickly adapt to changes in the market and improve their competitiveness. "Companies that adopt technologies of this model become more agile and innovative, able to respond quickly to customer demands."

The adhesion of Industry 4.0 is promoting more sustainable and energy-efficient practices. Rüßmann et al., (2015) note that "the integration of smart technologies allows the optimization of the use of resources, reducing waste and improving sustainability". Despite the numerous benefits, the implementation of Industry 4.0 faces significant challenges that need to be overcome in order for its full potential to be realized, the technological complexity of Industry 4.0 poses a significant challenge for many companies. According to Müller, Buliga, & Voigt (2018) highlight that "the integration of heterogeneous systems and the need for interoperability are important technological barriers".

With increasing digitization and interconnection, cybersecurity concerns are increasing. "Protecting against cyberattacks and ensuring data security are critical challenges in Industry 4.0" (Müller, Buliga, & Voigt (2018). Small and medium-sized enterprises (SMEs) face unique challenges in implementing Industry 4.0 due to limited resources. "Lack of access to finance and the need for investment in technology are significant barriers for SMEs" (Mittal, Khan, & Romero, 2018).

The transition to Industry 4.0 requires a highly skilled workforce, which poses a significant challenge in terms of training and education. The development of technical and digital skills is essential to make the most of the opportunities offered by the digital economy and technological innovation, as the world becomes increasingly connected and dependent on technology, these skills become fundamental for competitiveness and adaptation in the labor market.

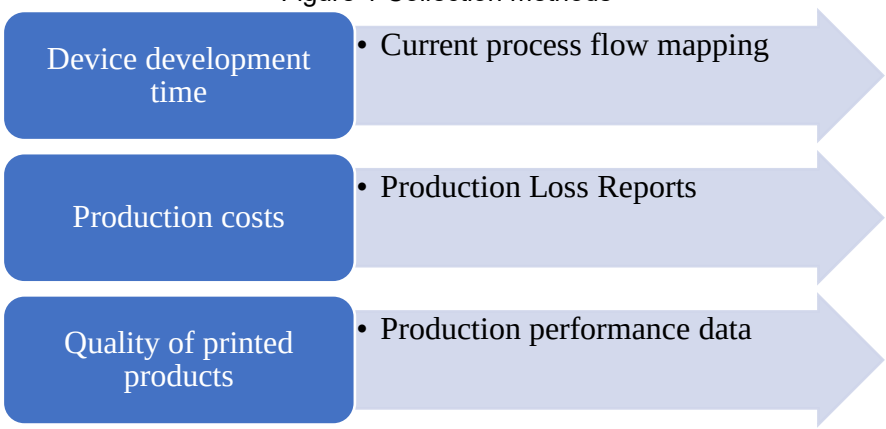
METHODOLOGY

RESEARCH AREA

The project was carried out in the plastic injection sector of a company located in the PIM. in which data on the production processes before and after the implementation of 3D printing technology was collected.

Initially, the mapping of the current process flow for the manufacture of Jigs and jigs was carried out, including the dependence on external suppliers, data collection of annual costs for new projects contemplating the delay in the development of new products, the production time, and the quality of the devices produced. These data served as a basis for comparison for the analysis of the impacts of the implementation of 3D printing. The company was accompanied during the transition process to the in-house production of the devices using 3D printing. Data was collected on the new production processes, including the development time of the devices, the production costs, and the quality of the printed products, where the analysis included the evaluation of the impact of the technology in reducing manufacturing costs and improving lead time. (Figure 1).

Figure 1 Collection methods



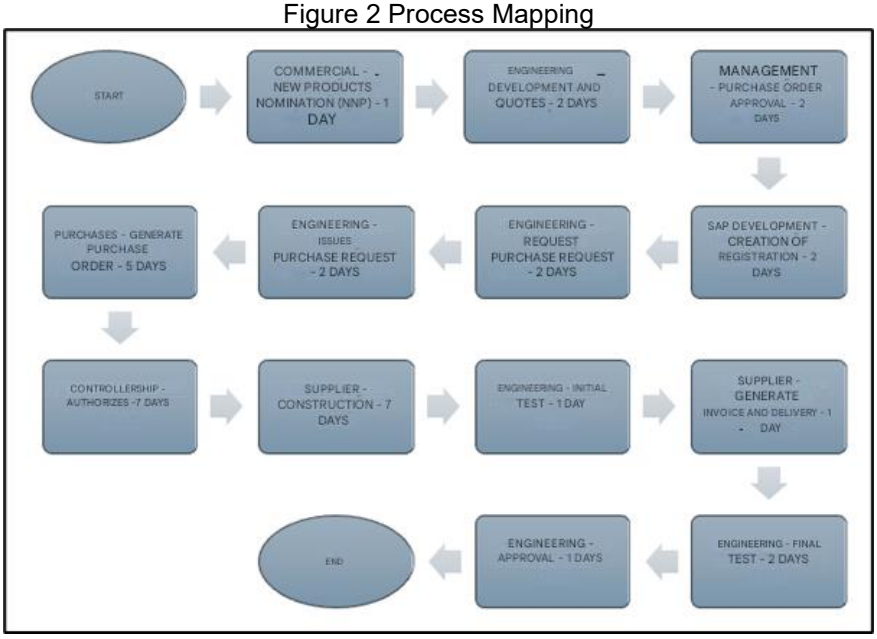
Source: Authors, (2024).

RESULTS AND DISCUSSIONS

MAP THE MAIN DEFICIENCIES IN CURRENT PLASTIC INJECTION PROCESSES

The mapping, as shown in Figure 2, consists of everything from the elaboration of the device design to the approval of the final device by the engineering team. This process, when the mapping was carried out to search for the deficiencies, in which it had a period of 35 (thirty-five) days, distributed in 13 (thirteen) stages.

Figure 2 Process Mapping



Source: Authors, (2024).

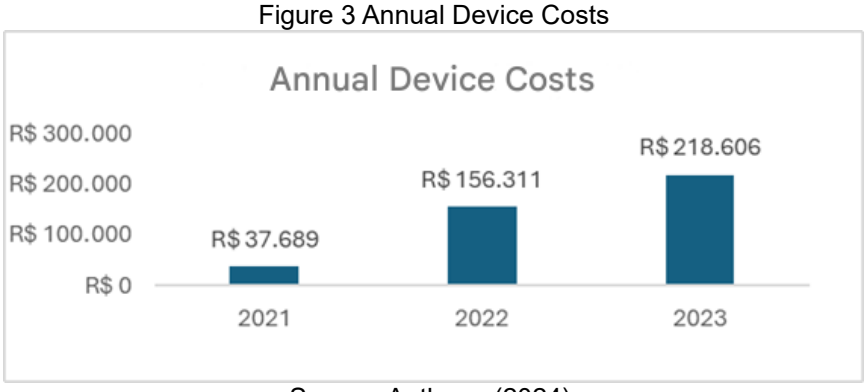
REDUCE MANUFACTURING COSTS BY ELIMINATING RELIANCE ON EXTERNAL SUPPLIERS

According to figure 3, it is observed that, in 2021, the production demand with the use of devices (Jigs) in the process was relatively low, this scenario reflected a limited use of this resource. However, in 2022, the situation underwent a significant change, with a

considerable increase in the use of Jigs, which led to an improvement in the company's processes and productivity. This growth, while contributing to an increase in production, also brought with it an increase in operating costs.

In 2023, the company received new processes, including more pad printing and assembly engraving, which generated a substantial increase in production costs. These processes, although they added value to the operation and allowed the diversification of production capacities, also resulted in a higher cost compared to previous years. The increase in costs is related to the complexity of the new processes and the need for greater investment in technology.

Figure 3 Annual Device Costs

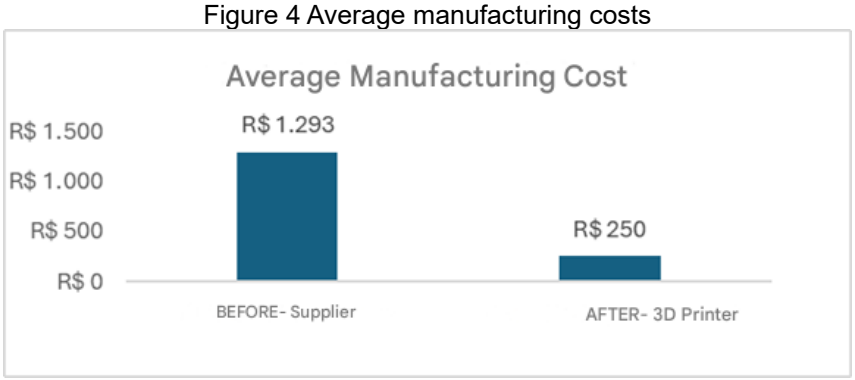


Source: Authors, (2024).

In the traditional manufacturing scenario, production processes often involve the use of machining processes, in addition, there is the cost of materials and the high production time of 240 hours as shown in Figure 5, which include steps such as design design, preparation, molding and finishing by the supplier.

With 3D printing, these costs can be drastically reduced. 3D printing allows the direct manufacture of the part from a digital model, without the need for additional molds or tools, eliminating preparation costs and considerably reducing material waste, the production time is significantly reduced to 6 hours as shown in figure 5, since 3D printing can create a part in hours, while traditional methods can take days, especially for small productions or prototypes. Recent research conducted by Gartner (2023) highlights that 3D printing has the potential to reduce manufacturing costs by up to 25% for companies adopting the technology for mass production, especially in high-personalization, low-print industries.

Figure 4 Average manufacturing costs

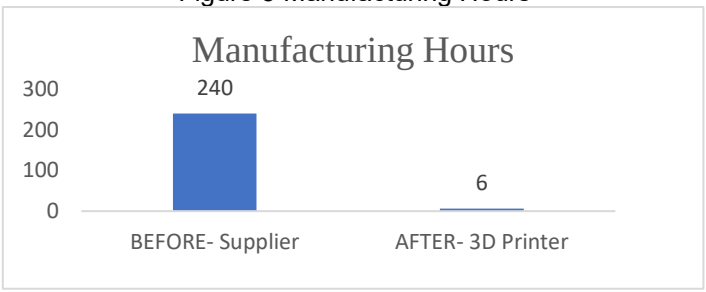


Source: Authors, (2024).

ACCELERATE THE LEAD TIME OF DEVICE CONSTRUCTION, IMPROVING AGILITY IN THE IMPLEMENTATION OF NEW PROJECTS

The implementation of strategies such as process automation, the integration of advanced technologies such as 3D printing has made it possible to significantly reduce device development time. Before the adoption of these improvements, the average lead time for building devices was 240 hours. After the implementation of the changes, this time was reduced to just 6 hours. This enhancement not only accelerates the launch of new products for customers but also strengthens the company's competitiveness in the market, allowing for a more agile response to consumer demands and innovation requirements (Kuczynski et al., 2023).

Figure 5 Manufacturing Hours

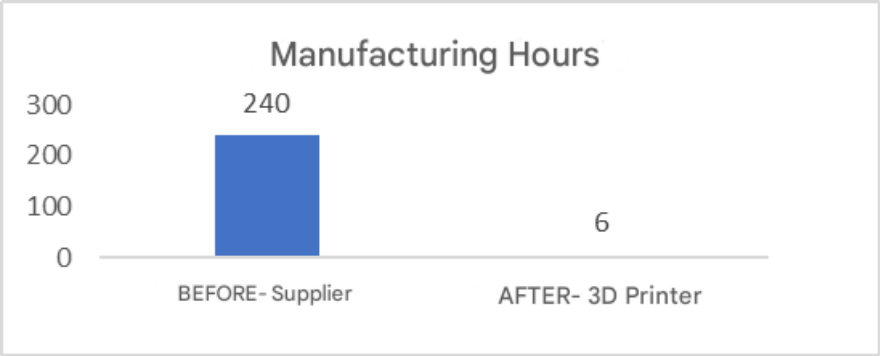


Source: Authors, (2024).

OPTIMIZE TIME IN NEW PRODUCT DEVELOPMENT BY UTILIZING 3D PRINTING TECHNOLOGY

This process, when the mapping was carried out after implementation, had a reduced period from 35 (thirty-five) to 9 (nine days) distributed in 9 (nine) stages, a 74% reduction in the time with the manufacture of the part itself, which eliminated the purchase by suppliers.

Figure 6 Flowchart after implementation



Source: Authors, (2024).

Steps of the 3D printing process

The 3D printing process has been broken down into a few key steps:

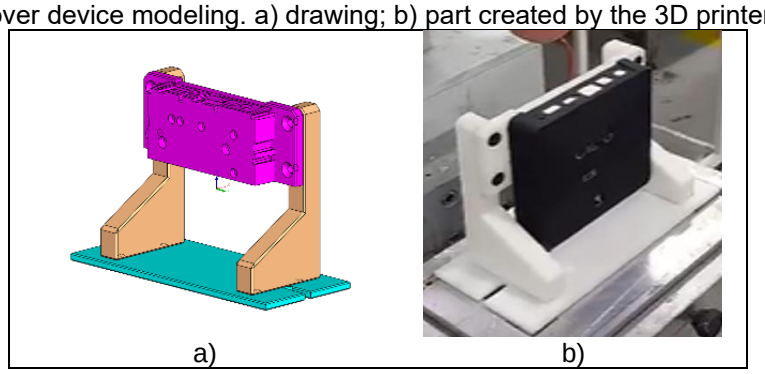
- Creation of the 3D Model: The first step consisted of creating or obtaining a digital 3D model of the object to be printed carried out in the 3D modeling software.
- Slicing: The 3D model was converted into thin layers (slices) through slicing software, this software generated the G-code that the printer used to determine how the object would be printed layer by layer.
- Printer Preparation: Before starting printing, it was necessary to verify that the printer was set up correctly, with the filament inserted and the print bed level.
- Loading the G-Code into the Printer: The G-code generated by the slicing software has been loaded into the printer, usually via SD card, USB, or direct connection to the computer.
- Start of Printing: The printer begins to heat the necessary components (such as the extruder nozzle and heated bed) and then begins printing layer by layer according to the instructions in the G-code.
- Print Monitoring: During the printing process, the monitoring process was important to ensure that the material was deposited correctly and that the model was being printed flawlessly.
- Object Finalization and Removal: After printing is finished, the object must be carefully removed from the printing platform.

Implementation of the improvement

These steps are quite common and apply to many 3D printers. Figure 7 shows the modeling of a "Jig" type device used to mount the Top Cover. This device has the function of facilitating the positioning and fixation of the piece during the pad printing process. Figure 7

shows the projected part, which was 3D printed, allowing a more detailed and accurate visualization of the design.

Figure 7 Top Cover device modeling. a) drawing; b) part created by the 3D printer, implemented.



a) b)

Source: Authors, (2024).

The evolution of production demands in recent years has driven a constant search for the optimization of industrial processes, in this scenario, 3D printing stands out as a transformative technology, bringing significant advances both in terms of cost and efficiency. The ability to produce parts on demand and with high customization makes 3D printing an essential tool to reduce waste and improve agility in processes. In industries, 3D printing allows the manufacture of rapid prototypes, which accelerates the development of new products. In addition, it makes it possible to create complex components, which would be difficult or impossible to produce with traditional methods. This flexibility in design results in a significant reduction in raw material costs and decreases the need for expensive tooling and tooling equipment.

Another crucial benefit of 3D printing is the decrease in production lead times. The ability to produce parts directly from digital models eliminates the need for additional steps, such as adjustments to tooling machinery. This not only speeds up the delivery of products, but also allows for better use of human and material resources.

Therefore, 3D printing not only improves operational efficiency but also offers practical and innovative solutions to the challenges of modern industry, effectively balancing costs and product quality. This technological advancement is an important step in meeting the growing demand for faster and more personalized production.

Figure 8 Future situation of the process with the Kings 3d Printer with its characteristics



Source: KINGS 800PRO industrial 3D printer, based on SLA (Stereolithography Apparatus) technology, (2024).

Table 1: Materials and Characteristics.

Material	Characteristics
Standard Resin	•Smooth surface finish. -Brittle.
High Detail Resin	- Increased dimensional accuracy. - Hig
Transparent Resin	- Transparent material. - Requires post-processing.
Moldable Resin	- Used to create mold parts. - Low percentage of ash after burning.
Resin Resistant or Durable	- Mechanical property similar to ABS. - Low thermal resistance.
High Temperature Resin	- Temperature resistance. - Used for injection molding and tooling.
Dental Resin	- Biocompatible. - High abrasion resistance.
Flexible Resin	- Rubber-like material. - Dimensional accuracy.

Source: KINGS 800PRO industrial 3D printer, based on SLA (Stereolithography Apparatus) technology, (2024).

Figure 8 shows a KINGS 800PRO industrial 3D printer, based on SLA (Stereolithography Apparatus) technology. The content is organized into three main sections: equipment, materials, and their characteristics. At the bottom of the figure, the following benefits are highlighted: Print Quality; Speed and Efficiency; Precision and Consistency and Variety of Materials. Figure 8 shows that the KINGS 800PRO 3D printer has high versatility, being able to use a wide range of resins, with specific characteristics that meet various industrial and technical applications (Table 1). Figure 9 shows the results according to a comparative analysis before and after the implementation of a 3D printer, highlighting the gains in cost reduction, manufacturing time and economic viability. Below is the detailed description:

Comparative Table:

1. Before Implementation (Supplier A): Manufacturing Hours: 240 hours; Unit Cost of Manufacturing: R$ 1,293.00.

2. After Implementation (KINGS 3D): Manufacturing Hours: 6 hours (97% reduction); Unit Cost of Manufacturing: R$ 250.00 (81% reduction).

The comparison shows a significant decrease in manufacturing times and costs with the use of the KINGS 3D printer.

3. Problems Identified: Location: 3D Printer.

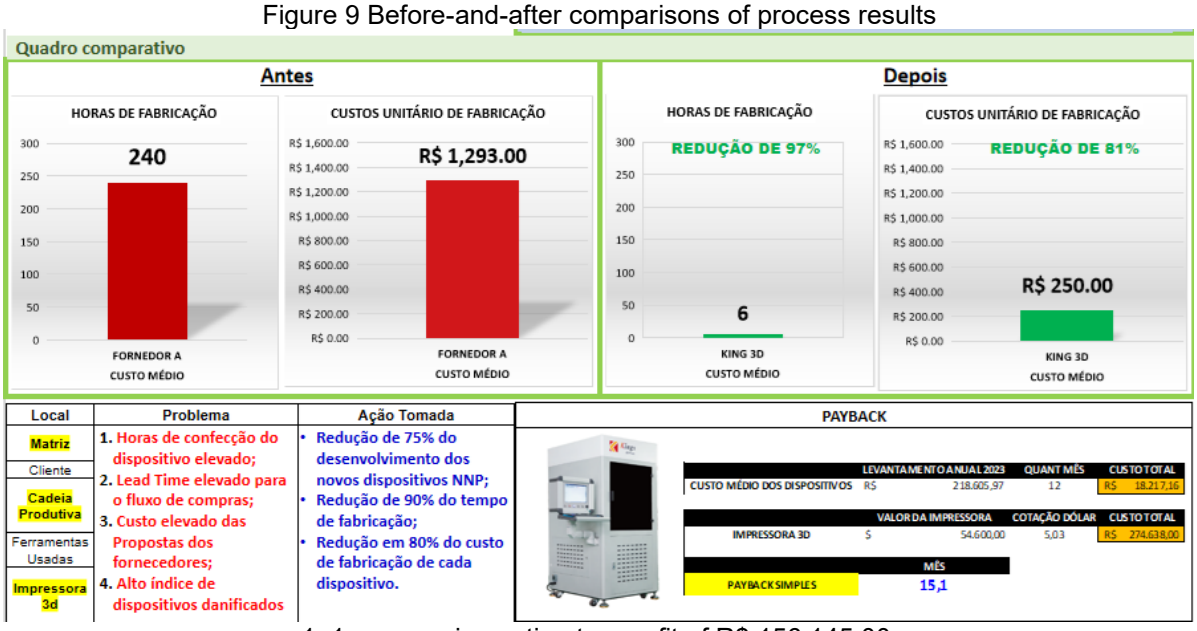
Problems: High device manufacturing hours; 2. High lead time for the purchase flow; 3. Suppliers and 4. Assessed high cost High rate of damaged devices.

4. Action Taken: a) 75% reduction in the development of new NNP devices; b) 90% reduction in manufacturing time and c) 80% reduction in the manufacturing cost of each device.

5. Payback (Return on Investment): The Payback section presents: a) Average Device Cost: R$ 1,293.00 before → R$ 250.00 after; b) Number of devices: 50 units; c) Total Cost (before): R$ 64,650.00; d) Total Cost (with 3D printer): R$ 12,500.00; e) Total Savings: R$ 52,150.00 and Simple Payback: 15.1 months.

The implementation of the KINGS 3D printer generated great advantages in the process: 1. Drastic reduction in manufacturing time (from 240 hours to 6 hours); 2. Significant reduction in unit costs (from R$ 1,293.00 to R$ 250.00); 3. Savings of R$ 52,150.00 on 50 devices and 4. Economic viability confirmed with a payback of 15.1 months. The action brought greater operational efficiency, cost reduction and agility in the production process.

Figure 9 Before-and-after comparisons of process results



1. 1-year saving estimates profit of R$ 156,145.00.
2. 5-year savings estimate profit of R$ 782,250.00.

Source: Authors, (2024).

CONCLUSION

Specifically Jigs, and as this technology positively impacted the development process, the main advantage highlighted is the significant reduction in lead time, that is, in the time needed to create these devices, in which there was a reduced period from 35 (thirty-five) to 9 (nine days) distributed in 9 (nine) steps in time with manufacturing, which provided greater agility in responding to customer demands. 3D printing has made it possible to speed up the stages of creating and adjusting devices, which were previously time-consuming and dependent on traditional methods such as manual machining. In addition, the adoption of printing technology has resulted in an increase in operational efficiency. The replacement of traditional methods with more modern industry 4.0 solutions has reduced production costs, improving the company's competitiveness in the market.

3D printing has also made it possible to create more complex and precise devices, with less material waste, directly contributing to cost reduction and an increase in product quality. Integrating 3D printing into jig development and production not only optimizes time and costs, but also offers benefits in terms of flexibility and customization, making companies more adaptable to specific customer needs. The adoption of 3D printing brings a significant transformation in the production process, providing continuous improvement in delivery times, cost reduction, and product quality, as well as boosting the company's competitiveness in the market.

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HEALTH IS INDEED A MAN'S THING: A REFLECTIVE ANALYSIS OF PROSTATE CANCER

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ABSTRACT

Prostate cancer is a malignant disease resulting from the disordered growth of cells, with morphological, structural and metabolic alterations, as well as accelerated division and genetic mutations. This neoplasm can invade adjacent organs and, in more severe cases, can reach places far from its origin. It is a disease that is usually associated with several triggering factors, a situation that proves its epidemiological importance in the country. It is a comprehensive review of the literature based on the narrative synthesis of scientific evidence. In clinical practice, it is observed that, in most cases, men only seek care when the disease is already installed, with greater chances of complications and early deaths. Because of this, it is of fundamental importance to include the male population in the health-disease process, so that the strong social and cultural influence rooted over the years and generations can give way to protagonism in health.

Keywords: Health promotion. Men's health. Prostate neoplasms.

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INTRODUCTION

Prostate cancer is recognized as a neoplasm of the elderly, since about three-quarters of cases in the world occur after the age of 65. In Brazil, the high incidence rates can be partially justified by the improvement of diagnostic methods, quality of information systems, as well as the increase in life expectancy (Brasil, 2020).

In this sense, in Brazil, the most incident types of cancer (except non-melanoma skin) are prostate (29.2%), colon and rectum (9.1%), lung (7.9%), stomach (5.9%) and oral cavity (5.0%). It is estimated that 65,840 cases of prostate cancer are diagnosed in the country annually. It is the sixth cause of mortality in the world, and in 2030, there are projections of approximately five hundred thousand deaths, with more deaths in underdeveloped countries (Peloso-Carvalho et al., 2021).

The etiology of prostate cancer is not yet fully known. However, evidence suggests that its origin involves a complex interaction between genetic and environmental causes. Therefore, the main risk factors are age (more than 3/4 of cases affect men over 65 years old); black ethnicity; exposure to ultraviolet radiation; Smoker; alcoholic; family history; mutations such as BRCA 1 and 2, HPC-1; and unhealthy diet - high-fat diet and smoked red meat (Iser et al., 2022).

There is also occupational exposure to chemical agents, which is responsible for 1% of cases (Brasil, 2021). In addition, it has been suggested that a history of sexually transmitted infections and/or prostatitis, as well as vasectomy, would be risk factors for prostate cancer. However, such associations proved to be inconsistent in later studies (Oliveira et al., 2021).

Among the conditions that can most favor the prevention of prostate cancer, a healthy diet stands out, especially with a diet rich in fruits, vegetables, legumes, whole grains and cereals and with less fat, especially those of animal origin; maintenance of body weight according to height; practice of physical activity at least thirty minutes a day and five times a week; and smoking cessation and alcoholism (Who, 2020).

Thus, considering that this disease represents a significant challenge for health systems worldwide due to its high incidence and impact on morbidity and mortality, it is justified to carry out this study for a better investigation. Therefore, the objective was to analyze the main available evidence on prostate cancer.

METHOD

It is a comprehensive review of the literature based on the narrative synthesis of scientific evidence. To this end, searches were performed in the Scientific Electronic Library

Online (SciELO), National Library of Medicine National Institutes of Health (PubMed) and Medical Literature Analysis and Retrievel System Online (MEDLINE) databases. After analyzing the main terminologies, the descriptors selected from the list of Health Sciences Descriptors (DeCS) were: Health promotion. Men's health. Prostate neoplasms.

From this perspective, in order to enable the quality and relevance of this review, full studies published in the last five years in English and Portuguese were included. On the other hand, course completion papers, master's dissertations, doctoral theses, editorials, expert opinions, and restricted-access papers were excluded.

The data analysis was done through the construction and systematization of the most robust results found. To this end, a qualitative investigation of the studies was carried out, with a view to identifying the main trends and gaps in the literature and favoring evidence-based medicine focused on clinical practice.

LITERATURE REVIEW

PROSTATE CANCER

Prostate cancer is a malignant disease resulting from the disordered growth of cells, with morphological, structural and metabolic alterations, as well as accelerated division and genetic mutations. This disease can invade adjacent organs and, in more severe cases, can reach places far from its origin. It is a disease that is usually associated with several triggering factors (Araújo, 2024). Today, it is the second leading cause of death from neoplasia in the male population, a situation that proves its epidemiological importance in the country (Brasil, 2022).

In this scenario, a study carried out in 2022 found that the mortality rate, specifically in the age group of 60 to 69 years, was increasing between 2000 and 2009. However, it was not enough to change the general trend of stability observed throughout the series. Five-year specific survival was 79.6% and had a negative association with age, with lower survival from seventy years onwards (Evangelista et al., 2022).

A study carried out in the United States, whose sample consisted of 24,054 patients, using the Surveillance Epidemiology and End Results Program (SEER) database, observed that the worst survival results were found in men aged 65 years or older and that mortality was related to age, marital status, race, Gleason score, stage and treatment approach (Zheng et al., 2020).

The prostate is an exocrine gland that is part of the male reproductive system. It is located anterior to the rectum and inferior to the bladder, surrounding part of the urethra. It has the function of producing and secreting prostatic fluid, whose alkaline pH favors the

locomotion of spermatozoa. When it unites with the secretion of the seminal vesicles and sperm in the urethra, it forms semen (Almeida et al., 2021).

In childhood, the prostate is relatively small. At puberty, due to the stimulation of testosterone, it begins to grow. Around the age of twenty, it reaches its maximum size and remains so until the age of fifty. After this age, regression occurs because of the decrease in testosterone. Testicular androgens act on the growth and survival of prostate cells. Thus, castration triggers gland atrophy resulting from diffuse apoptosis (Brito et al., 2024).

Often, three pathological processes affect the prostate: i) inflammation, ii) benign nodular enlargement, and iii) tumors. Of these, benign nodular enlargements are the most prevalent and occur a lot in advanced age. In view of this, they are often considered as a physiological process specific to aging (Gandaglia et al., 2021).

Prostate histology is composed of a pseudo-stratified epithelium, which has three subtypes: luminal, basal and neuroendocrine. Thus, according to recent studies, cancers of luminal origin are the most aggressive. There are also fibroblasts, smooth muscle fiber and autonomic nerve, vascular endothelium, defense cells, and lymph nodes, which can exhibit a varied type of behavior depending on the aggressiveness of the disease (Nascimento et al., 2022).

Some prostate tumors can grow abruptly, spreading to other organs, whose outcome is death. However, most develop insidiously (it takes an average of fifteen years to reach 1 cm^3). Therefore, it does not manifest signs during life or threaten men's health (Pereira et al., 2021).

When it spreads to other sites, the most common site of metastasis is the axial skeleton, and most of the time, osteoblastic lesions are observed. In addition, in descending order of frequency, the most affected regions are the lumbar spine, proximal femur, pelvis, and thoracic spine (Sekhoacha et al., 2022).

In this context, local spread harms periprostatic structures, such as the seminal vesicles and the base of the bladder. The lymphatic lymph nodes first affect the obturator lymph nodes, and later, the para-aortic lymph nodes. Hematogenous has a predilection for the axial skeleton, but the involvement of long bones and other organs and tissues is also common (Porcacchia et al., 2022).

In addition, prostate cancer is not unique and also does not occur identically in all men. Each typology has its own natural history and evolution. Therefore, in the same organ there can be several malignant tumors of the same lineage with different degrees of aggressiveness, characteristics, severity, and forms (Silva et al., 2021).

In this sense, according to Silva et al. (2021), there are five types of prostate cancer, namely:

Adenocarcinoma: it is the most common. It occurs with the abnormal proliferation of cells, which originates directly in the glandular tissue of the prostate.

Sarcoma: it is rare. It is not only found in old age, it can also occur in young adults and even children, and can appear in soft tissues and bone.

Neuroendocrine Tumor: in addition to being very aggressive, it is rare. It secretes atypical substances and accelerates disordered growth, which originates in the endocrine and neural cells of the affected tissue.

Carcinoma: occurs in any organ of the body. It appears in the epithelial tissue that surrounds the skin and various organs, including the prostate.

Transitional Cell Carcinoma: more specific. It damages the epithelium that covers the urinary system, being more prevalent in the bladder and prostate.

Because of the multiple modes of clinical presentation, the variable extent of the disease, the diverse architecture, and the unique cytological characteristics, several prognostic and staging factors have been described. As an example, the Whitmore system was one of the first, and is still useful in some organizations (Fontes et al., 2022).

There is also the Gleason score, which is the most used today. In this system, tissue cytoarchitecture is classified into five grades, with 1 being the best differentiated and 5 being the least differentiated. The others are intermediate between these two extremes. Also, the prognosis of each person can also be evidenced through the TNM classification (tumor, lymph node, and metastasis) (Oliveira et al., 2021).

Adenocarcinoma affects the posterior and lateral regions of the peripheral area of the prostate, being heterogeneous in 50% of cases. It often extends to the apex. Its prognosis is associated with some histopathological data, such as topography/laterality, tumor volume/size, type, degree of differentiation, presence of capsular and extraprostatic neoplastic invasion, state of surgical margins, and presence of metastases in regional or distant lymph nodes (Medeiros et al., 2023).

DIAGNOSIS OF PROSTATE CANCER

Among the control actions for prostate cancer, timely detection stands out and is divided into two actions: early diagnosis and screening, also called screening. The first identifies the disease in early stages in people with signs and symptoms. The second individuals are asymptomatic. These two strategies differ in terms of indications,

implementation criteria, and associated risks, in order to favor the chances of cure and reduce morbidity and mortality (Gandaglia et al., 2021).

Prostate cancer screening can be done with digital rectal examination and with serum prostate-specific antigen (PSA) dosage. Such conducts are recommended from the age of 45 for individuals with risk factors and 50 years for those who do not. However, there is no consensus among experts on this strategy, since this neoplasm, in most cases, grows indolently and does not show signs during life or threaten men's health. Although it can grow quickly and spread to other organs and cause death (Santos et al., 2022).

In this sense, a study carried out in 2021 found that, in all age groups, the incidence of prostate cancer began to decline in 2008, with the biggest drop between 2011 and 2012, a situation that can be associated with the reduction in PSA performance (Sung et al., 2021).

Also, a study carried out in 2024 showed that digital rectal findings associated with the PSA result may suggest the existence of the disease. In these cases, multiparametric magnetic resonance imaging is indicated in order to visualize suspicious lesions in the prostate (Brito et al., 2024).

On the other hand, Junior et al. (2023) point out that all men should perform PSA from the age of forty, and if necessary, do digital rectal examination, ultrasound via abdominal, transrectal, biopsy, tomography, magnetic resonance imaging, and bone scintigraphy. These tests can help in early diagnosis and determine the effectiveness of treatment, since prostate cancer is a silent and potentially curable disease (Silva et al., 2021).

Thus, abdominal ultrasound is the most used exam as the first choice in cases of suspected prostate anomalies. Transrectal ultrasound, despite providing more accurate information, is indicated only in the case of the need for biopsies, the result of which is given by means of the Histological Grading of the Gleason System, to evaluate the possibility of metastasis, since it is a heterogeneous neoplasm. Thus, the same tumor may present regions of greater and lesser cell differentiation (Taplin; Smith, 2022).

Despite the lack of consensus, prostate cancer screening is widespread, even though the best available evidence demonstrates an imbalance between risks and possible benefits. Routine PSA and/or digital rectal examination in asymptomatic individuals is associated with many diagnoses and is accompanied by notable damage to men's quality of life (Santos et al., 2022).

This damage is due to false-positive results, which may require a biopsy, triggering pain, bleeding, and infection. In addition, overdiagnosis and overtreatment can result in

erectile sexual dysfunction, urinary incontinence, in addition to emotional effects for both men and their families (Coylewright et al., 2020).

From this perspective, the World Health Organization and the Brazilian Ministry of Health do not recommend population-based screening for prostate cancer. However, it emphasizes the strengthening of educational and communication actions in health on self-care and prevention of chronic non-communicable diseases (Who, 2020).

Based on this, the National Cancer Institute, since 2008, has recommended that screening should only be done in men who spontaneously demand these exams and after a shared decision-making process, which takes into account the risks and benefits. As an alternative, it is suggested to control the disease through the training of professionals, organization of care, clarification to the population, and agility in the diagnosis confirmation and treatment of cases (Biondo et al., 2020).

Nevertheless, in clinical practice, it is observed that, in most cases, men only seek care when the disease is already installed, with greater chances of complications and early deaths. Because of this, it is of fundamental importance to include the male population in the health-disease process, so that the strong social and cultural influence rooted over the years and generations can give way to protagonism in health (Leal et al., 2023).

The lack of adherence of the male population to primary care and the limitation of specialized services not only hinder the control of this disease, but also highlight the need to make improvements in actions related to comprehensive care for men's health. In this way, strategies aimed at health education can contribute to the transformations of preventive care practice, as well as favor the perception of relevance and protagonism (Biondo et al., 2020).

CLINICAL MANIFESTATIONS OF PROSTATE CANCER

In the initial phase, prostate cancer has a silent evolution. As a result, many patients do not manifest any symptoms. When they develop, these are similar to those of benign prostate growth. However, the first clinical manifestations may appear during local growth, due to the tumor compressing the urethra. In this case, there is urinary retention, decreased urine stream, and frequency (Silva et al., 2021).

Soon after, cancer symptoms may appear invading neighboring organs, such as the bladder (hematuria) or rectum (hematochezia and rectal pain), and eventually, the lymph nodes of the pelvis (edema of the legs) and abdomen (abdominal pain). Most distant metastases occur in the bones, especially the spine, hip, and ribs, which can cause

localized pain in these areas. In more advanced cases, the disease can cause weakness, anemia, hyporexia, generalized infection, and kidney failure (Prado et al., 2020).

Involvement of the spine can trigger an epidural compression syndrome (paraplegia, sensory level, and sphincter disorder). Eventually, the diagnosis will be established through symptoms related to visceral metastases. These latter manifestations, in turn, are common in the terminal stages of the disease, especially when there is refractoriness to androgen deprivation therapy (Porcacchia et al., 2022).

Tumors identified by digital rectal examination are almost always relatively large, with a greater chance of advanced disease. This exam only detects more peripheral lesions, which are located on the lateral and/or posterior surfaces of the gland. However, in 25-35% of cases, this neoplasm is identified in other topographies. Therefore, it ends up not being noticed during the procedure (Takemura et al., 2022).

The PSA test is "prostate-specific" and not "cancer-specific". Thus, it is an exclusive laboratory marker of damage to the prostatic epithelium. Because of this, it increases not only in the presence of neoplasia, but also in benign conditions. In this case, it is usually kept between 4-10 ng/ml. On the other hand, values > 10 ng/ml are more specific for malignancy, and > 100 ng/ml predict the existence of metastasis with great accuracy. Thus, the follow-up of serum PSA levels is relevant to monitor the response to treatment (Brito et al., 2024).

TREATMENT OF PROSTATE CANCER

The most important aspects to guide the therapeutic approach in prostate cancer are the extent of the disease and the patient's clinical condition. The disease restricted to the gland is potentially curable with aggressive treatment, and younger individuals with fewer comorbidities are those who can actually benefit from cure, since the evolutionary course of most prostatic neoplasms is quite long (Fontes et al., 2022).

Thus, the treatment of prostate cancer encompasses the combination of surgery, radiotherapy, and chemotherapy. However, drug resistance, complications and adverse effects are common, and therefore, the therapy instituted is often not able to reduce mortality rates, remaining below the ideal. The choice of therapy is based on the patient's life expectancy, PSA, Gleason score, disease stage, comorbidities, side effects, and individual preference (Bravo et al., 2022).

Some of these criteria, especially the PSA value, the Gleason score, and the stage of the disease, allow patients to be stratified into categories according to the possibilities of

cure. For localized neoplasia, the two treatment modalities for primary therapy are surgery and radiotherapy, both with good results (Silva et al., 2021).

In this scenario, radical prostatovesiculectomy, also called laparoscopic radical prostatectomy, represents the main form of curative treatment for non-metastatic prostate cancer. Among the variations of existing techniques, retropubic radical prostatectomy (or open surgery) and robotic-assisted radical prostatectomy stand out (Medeiros et al., 2023).

Robotic-assisted radical prostatectomy contemplates maintaining the benefits of minimally invasive surgery and, at the same time, favors cancer control, preserves urinary continence and erectile function, decreases operative time and hospitalization, and reduces blood loss and the duration of bladder catheterization (Medeiros et al., 2023).

As for the treatment of locally advanced disease, the most indicated choices are hormonal blockade aids with prostatovesiculectomy and radiotherapy, as monotherapy is not effective in these cases. In this sense, a study carried out in 2023 pointed out that the use of immunotherapies has proven to be quite effective. However, it can cause toxicity in the endocrinological system, resulting in endocrinopathies, which can be fatal if left untreated (Vilaça et al., 2023).

In view of this, each case must be evaluated individually, in order to decide on the indication, maintenance, or interruption of therapy, define the risks, benefits, and best results, with the aim of offering the best available treatment, preserving the quality of life and autonomy of each patient (Vilaça et al., 2023).

Regarding the treatment of disseminated metastasis, it is known that cure is unlikely. Nevertheless, the therapy includes the suppression of androgens, luteinizing hormones, estrogens, as well as pure or mixed antiandrogens (cyproterone, bicalutamide, nilutamide, and flutamide), and the procedure considered the gold standard is bilateral orchiectomy (Klein, 2021).

In chemotherapy treatment, drugs are used that allow tumor cells to be reached at different stages of the cycle. As a result, there is cell destruction, preventing its development. Thus, the drugs used are docetaxel, cabazitaxel, mitoxantrone, and estramustine. The first and second are cytostatic agents that prevent the formation of the mitotic spindle during mitosis. Thus, individuals who are in an advanced stage of the disease should be treated with docetaxel, since, in general, they have metastasis in organs such as the liver and lung. However, it is more frequent in the skeleton (Souza; Lopes, 2020).

In principle, the more advanced the disease is, the lower the chance of cure, since there are no reliable means to establish its natural history, just as there is individual

variation in the prognosis. This means that some III stage tumors will be cured with treatments directed only at the prostate, while those in stage I may evolve with systemic recurrence, depending on the therapy initially indicated (Almeida et al., 2021).

CONCLUSION

Prostate cancer is a malignant disease resulting from the disordered growth of cells, with morphological, structural and metabolic alterations, as well as accelerated division and genetic mutations. This neoplasm can invade adjacent organs and, in more severe cases, can reach places far from its origin. It is a disease that is usually associated with several triggering factors.

From this review, it was possible to identify that despite the lack of consensus, prostate cancer screening is widespread, even though the best available evidence demonstrates an imbalance between risks and possible benefits. Routine PSA and/or digital rectal examination in asymptomatic individuals is associated with many diagnoses and is accompanied by notable impairments to the quality of life of men.

In clinical practice, it is observed that, in most cases, men only seek care when the disease is already installed, with greater chances of complications and early deaths. Because of this, it is of fundamental importance to include the male population in the health-disease process, so that the strong social and cultural influence rooted over the years and generations can give way to protagonism in health.

Finally, future perspectives need to move towards elucidating the etiology of this disease, which, so far, remains unexplained or incompletely understood, in order to obtain more efficient treatments and improve the quality of life of patients affected by this disease.

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CURRICULARIZATION OF EXTENSION IN HIGHER EDUCATION: CASE ANALYSIS AND PRACTICES AT FAVENI UNIVERSITY CENTER

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ABSTRACT

This study examines the implementation of extension curricularization in higher education, focusing on its implications for the academic and social development of students. Using the FAVENI University Center as a case study, the work analyzes the effectiveness of extension activities when integrated into the curriculum, promoting a comprehensive education that encompasses both theoretical development and social practice. The research was based on accessibility and nonverbal communication experiments, where students experienced common barriers faced by people with disabilities. The results indicate that practical activities provided greater awareness of inclusion: 83% of participants reported being better prepared to apply academic knowledge in real contexts, and 76% observed the development of interpersonal skills, such as empathy and collaboration. In addition, 92% of students highlighted a broader understanding of social and environmental issues. These findings reinforce the curricularization of extension as an essential political-pedagogical project for the formation of critical and engaged citizens. In response to the National Education Plan and Resolution No. 7/2018, the study highlights the relevance of extension practices as a central part of the academic curriculum, contributing to a more inclusive and transformative higher education.

Keywords: Curricularization. Extension. Innovation. Education. Higher Education.

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INTRODUCTION

The curricularization of university extension has been consolidated as a central theme in the Brazilian educational scenario, especially after Resolution CNE/CES No. 7 of 2018, which determines that Higher Education Institutions (HEIs) integrate extension activities into their undergraduate curricula, corresponding to 10% of the total course load. This movement aims to overcome the fragmented view of knowledge, promoting a comprehensive education that articulates teaching, research, and extension, by the principle of inseparability present in Art. 207 of the Federal Constitution (BRAZIL, 1988). However, despite the normative advances, there are challenges for this integration to be effective, both in terms of curricular adaptation and in the perception of students and teachers about the role of extension as an essential part of the educational process. The central problem lies in the difficulty of establishing an extension culture that goes beyond complementary activities, organically inserting itself into the curriculum and contributing to the citizenship formation of students (MACHADO et al., 2023). Although the curricularization of extension is an important step towards training professionals committed to social reality, it is observed that many HEIs still face difficulties in operationalizing this process, from the definition of activities and projects to the articulation with the communities involved (ANTUNES; PADILHA, 2010). According to Sacristán and Gómez (1998), the challenge is administrative and involves a conceptual restructuring of the curriculum, which should be understood as a comprehensive political-pedagogical project and not a set of disciplines. Thus, the question that arises is: how to implement the curricularization of extension in a way that contributes to the education of students?

The relevance of this work is due to its theoretical and practical contribution to the field of higher education. By exploring the application of the curricularization of extension in a real context, it is expected that this study will provide insights into the implementation of extension activities that are effectively integrative and capable of impacting both the student and the community involved. Furthermore, it seeks to highlight the role of extension as a promoter of critical and humanistic training, which encourages social transformation ((MACHADO et al., 2023).

This study aims to analyze the implementation of the curricularization of extension through a project applied at the FAVENI University Center, verifying the impacts of curricularization on the academic and social development of students. By adopting the single case study method, this work aims to understand how extension activities can be inserted in a practical and meaningful way into the curriculum, aligning with the principles established by the 2018 Resolution. The justification for carrying out this study lies in the

need to contribute to the debate on the challenges and potential of the curricularization of extension.

RATIONALE

The curricularization of university extension emerges as a process to integrate teaching, research, and extension, three fundamental pillars of higher education. Extension, traditionally treated as a peripheral activity, needs to be incorporated into the curriculum as a central pedagogical practice, promoting comprehensive and interdisciplinary training. This model seeks to overcome a fragmented approach, encouraging the connection between academic knowledge and community experiences, and enriching students' learning by engaging them in real projects that reflect social and cultural needs (ANTUNES; PADILHA, 2010).

In this way, the standardization of university extension in the undergraduate curricula of Higher Education Institutions (HEIs) is based on the constitutional principle of the inseparability of teaching, research, and extension. According to Article 207 of the Federal Constitution, "universities enjoy didactic-scientific, administrative and financial and asset management autonomy, and shall comply with the principle of inseparability of teaching, research and extension" (BRASIL, 1988).

The 2018 Normative Law, formalized by Resolution CNE/CES No. 7 of the Ministry of Education, determines that Higher Education Institutions (HEIs) must include extension activities in their undergraduate curricula, corresponding to 10% of the total course load. This guideline reinforces the constitutional principle of the inseparability of teaching, research, and extension, established in Article 207 of the 1988 Constitution, which proposes an academic education committed to social development.

With the regulation, extension activities must be integrated into the Course Pedagogical Projects (PPCs), encouraging students to have contact with the community and providing training that combines theory and practice. The standard also guides that these activities prioritize areas of great social relevance, solidifying the role of universities as agents of transformation.

This curricular integration seeks to train professionals with a critical and humanistic vision, promoting a connection between academic knowledge and the real demands of society (MACHADO et al., 2023). In this way, the 2018 Normative Law encourages curricular flexibility, allowing students to choose extension activities that are most aligned with their interests and social context, contributing to the formation of more aware and active citizens.

In this way, the curricularization process strengthens the social function of universities and expands the scope of student education, providing an academic experience that goes beyond theoretical content, favoring the development of practical skills, ethical values , and a humanistic vision that prepares them to contribute to society (FRANCO, 2008).

MATERIALS AND METHODS

This study used the single case study method to examine the implementation of extension curricularization projects at the FAVENI University Center, carried out between February and June 2024.

The single case study method is a qualitative research methodology that examines, in-depth and detailed, a single subject, phenomenon, or institution in its real context (YIN, 2015). This type of study allows for a comprehensive and contextualized understanding of the research object, providing a detailed analysis of its characteristics and particularities. According to Yin (2015), the single case study is ideal for situations in which the case to be analyzed is exceptional, exclusive, or critical, offering a unique value for understanding the phenomenon studied.

To this end, the project "Creating Bridges for Accessibility and Inclusion" was applied. The research was carried out through participant observation, where data were collected throughout the activities and experiments carried out by the students, with monitoring and evaluation stages. The following is a step-by-step description of the method used:

The first step was to select the project that would be implemented throughout the year, aligning it with the principles of the extension curriculum. The project was implemented in the first semester (February to June), “Creating Bridges for Accessibility and Inclusion”, with a focus on awareness and accessibility. Specific objectives, teaching methodologies, and practical activities were defined for the project that would allow students to apply their learning in real situations.

Between February and June, students participated in a project focused on inclusion and accessibility, whose objective was to develop critical awareness and practical skills to promote inclusive environments. At each stage of the project, students participated in theoretical classes on inclusion, accessibility, and the use of artificial intelligence to create accessible solutions. During the development of the project, two social experiments were carried out:

- Experiment 1: "Mobility" — Students experienced mobility difficulties to understand the barriers faced by people with reduced mobility.

- Experiment 2: “Nonverbal Communication” — This experiment focused on alternative communication, allowing students to understand the difficulties of people with hearing or speech impairments.

After these experiments, students mapped the accessibility conditions of the region and proposed improvements, developing a sense of responsibility and applying the learning in a practical context.

PARTICIPANT OBSERVATION AND DATA COLLECTION

During all activities of the two projects, the participant observation method was used to monitor the interactions of students with theoretical and practical content, as well as with the community. The students’ reactions, difficulties, and developments were recorded throughout the process, providing a detailed analysis of the impact of the projects on academic training and the development of social and professional skills.

At the end of the project, students were encouraged to reflect on their experiences and the importance of practical learning. Assessment sessions were held where students discussed the results of the experiments and extension activities, analyzing the impact of theoretical knowledge on practice and how this learning contributed to the community and to their personal and professional development.

RESULTS AND DISCUSSION

EXPERIMENT 1: "MOBILITY"

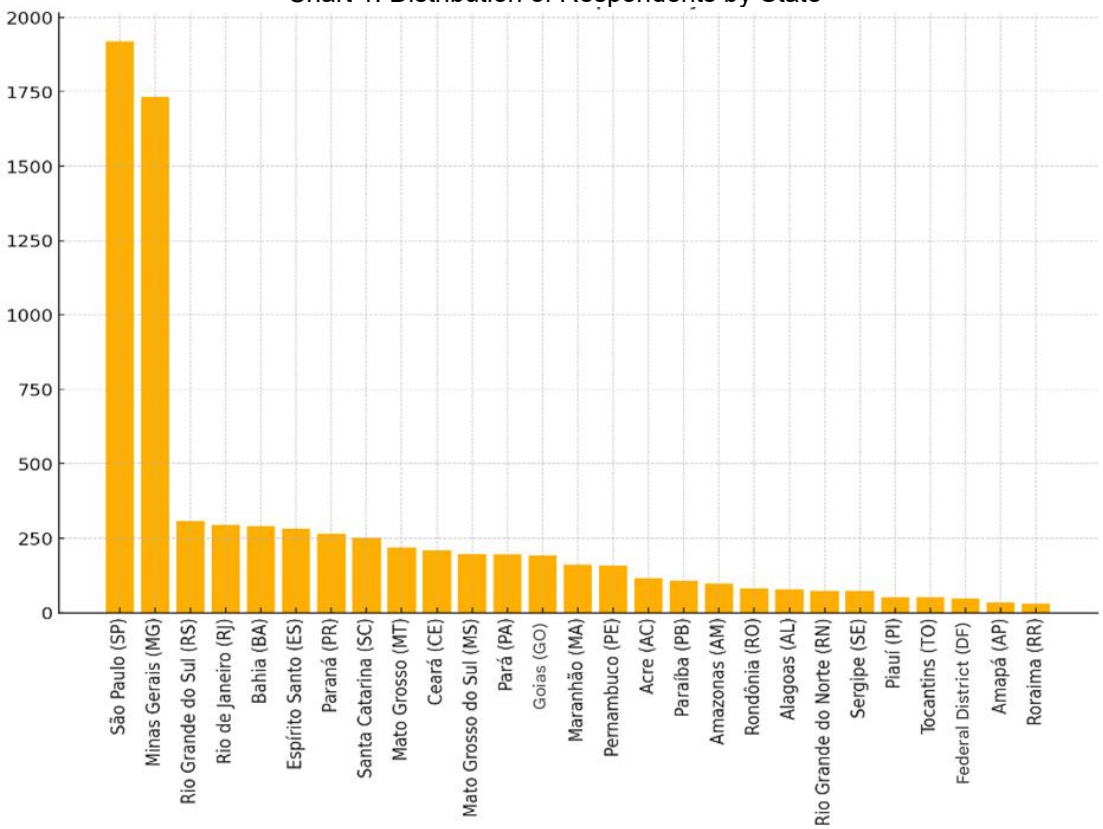
This experiment obtained a sample of 7,514 respondents, and the distribution by age group of the sample reveals that the age groups of 31 to 40 years and 41 to 50 years have the largest number of participants, with 2,560 and 2,286 responses, respectively. This profile suggests that the Faveni University Center has these age groups with the highest number of students, as they are people of productive ages and active in the job market, who could develop accessibility topics in this environment. and social responsibility.

The 23 to 30 age group is also well represented, with 1,399 participants. This age group tends to include young adults, possibly recently entering the job market, who may be developing a greater awareness of social inclusion and accessibility.

The 18 to 22 and over 60 age groups are the least represented, with 433 and 101 responses, respectively. The low participation of young people between 18 and 22 years old may indicate that the topic of accessibility is not yet widely discussed among this age group, or that opportunities for participation in activities like this are more limited. The over-60 age

group, on the other hand, has a reduced representation, which may be related to less familiarity with or access to digital tools. This sample is also distributed across all regions of Brazil, as shown in Graph 1.

Chart 1. Distribution of Respondents by State



Source: Survey Data (2024)

Graph 1 shows the distribution of participants' responses by state, highlighting the representativeness of each region in the study. There is a high concentration in the Southeast and southern states, with the states of São Paulo (SP) and Minas Gerais (MG) having the largest number of responses, followed by Rio Grande do Sul (RS) and Rio de Janeiro (RJ). This pattern suggests a greater concentration of participants in regions with higher population density and more developed educational infrastructure. States such as Bahia (BA), Espírito Santo (ES), Paraná (PR), and Santa Catarina (SC) also have a considerable number of responses, indicating moderate participation. This may reflect the interest or availability of access to research in these regions. The states of the North, such as Acre (AC), Amazonas (AM), Rondônia (RO), Roraima (RR), and Amapá (AP), have reduced participation, which may be related to factors such as lower population density, difficulties in accessing research initiatives, or lower representation of the institution under study.

Graph 2. Participant Comfort Level After the Experiment



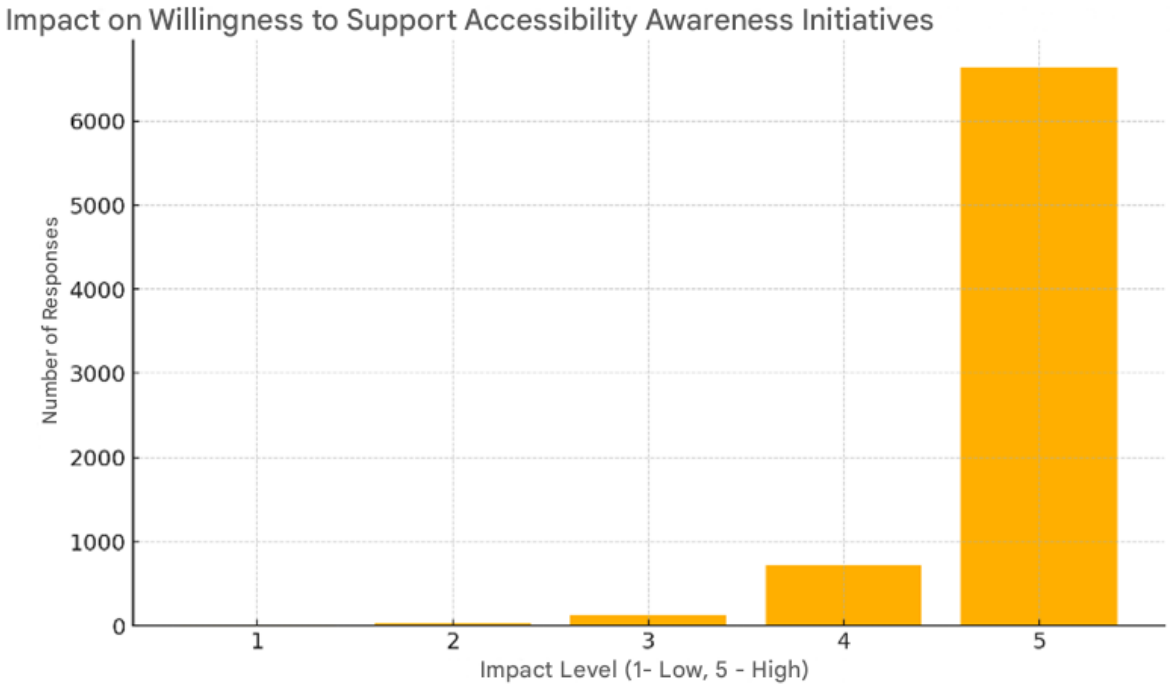
Source: Research Data (2024).

During participant observation in experiment 1, the first phase involved students walking around the college blindfolded and without assistance. During this first phase of the experiment, participants reported challenges when walking blindfolded in a disorganized environment, highlighting the sensory limitations experienced.

The second phase involved organizing the space, which considerably increased the comfort of the participants, highlighting the importance of a safe and well-structured space to assist the movement of people with visual limitations.

Graph 2 shows the data after the two phases, where most participants reported a high level of comfort when discussing the challenges faced during the experiment, suggesting that this practical experience increases awareness and encourages openness to dialogues about accessibility. This experiment in the extension curriculum promoted reflective learning, where students were encouraged to exchange experiences and debate solutions, consolidating communication skills and an understanding of accessibility needs. In the context of extension curricularization, practical experiences like this allow students to explore in practice the benefits of adapted environments, reinforcing the relevance of adaptations in everyday life and promoting an accessibility perspective in the development of future projects.

Chart 3. Impact on Willingness to Support Accessibility Awareness Initiatives



Source: Research data (2024)

Graph 3 indicates a high willingness of participants to support accessibility initiatives, showing that the practice contributes to more proactive attitudes toward inclusion. This predisposition is one of the main objectives of the extension curriculum, which aims to raise awareness and develop an active stance of commitment to ethical and social education.

It is noted that 76% of participants reported a significant increase in their awareness of accessibility after the activity, in line with the study's objective of promoting a practical understanding of relevant social issues.

After the experiment, participants were also asked "What were the main difficulties you encountered when walking blindfolded?" and the data revealed some recurring difficulties faced when experiencing locomotion without vision. The experience was reported as challenging by 89% of participants, who mentioned insecurity and difficulty in orientation as the main obstacles, and reported disorientation when walking blindfolded, even in familiar environments. The lack of vision causes a significant loss of spatial reference, which results in insecurity and hesitation during movement. This feeling of vulnerability highlights the importance of an organized and safe environment to facilitate the mobility of people with visual impairments.

The fear of bumping into furniture and objects was another common difficulty. This fear leads participants to move more slowly and cautiously. The experience shows that the presence of obstacles in the path represents a real risk, reinforcing the need to adapt physical spaces to avoid accidents.

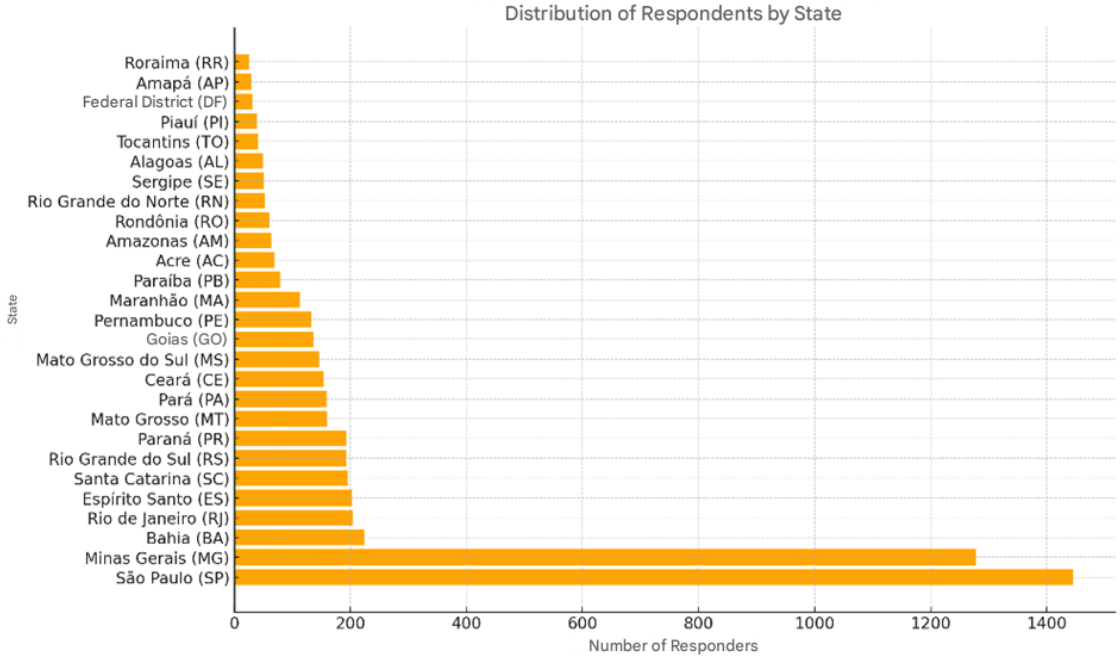
Some reported discomfort in relying on other senses, such as touch and hearing, to orient themselves. For people without visual impairments, adapting to this new form of perception in a short period creates a challenging and uncomfortable experience.

Several participants mentioned anxiety and a feeling of lack of control over the environment since they could not rely on their vision to predict or avoid obstacles. This experience simulates the stress and anxiety that many people with visual impairments face when navigating in unadapted spaces.

EXPERIMENT 2: "NON-VERBAL COMMUNICATION"

This experiment obtained a sample of 5,526 respondents, with the majority of respondents being in the 31-40 and 41-50 age groups. These age groups, which correspond to productive and active phases in the job market, possibly reflect the student population of the Faveni University Center and consequently a greater interest in topics related to inclusion and accessibility. The 23-30 age group is composed mainly of young adults. The extreme age groups (18-22 and over 60) are the least represented, which can be explained by a lesser familiarity with the topic or access to digital tools. A distribution similar to that of the previous experiment is observed.

Chart 4. Distribution of Respondents by State

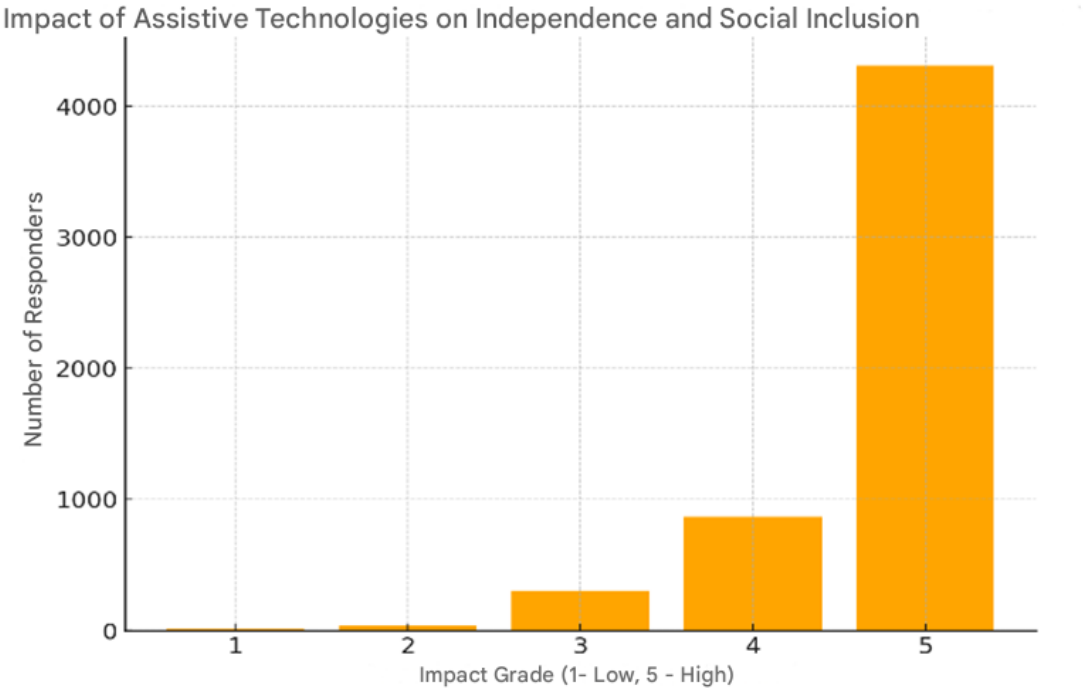


Source: Research data

Chart 4 shows the distribution of respondents by state. We can see that the states with the largest number of respondents are São Paulo (SP), Minas Gerais (MG) and Bahia (BA). The concentration in these states reflects a greater participation of populous regions

with more accessible educational infrastructure. In contrast, states in the North, such as Roraima (RR) and Amapá (AP), have reduced participation, indicating a possible challenge of reach and inclusion in less accessible regions. This pattern suggests the need for actions by the Faveni University Center to increase the representation of less served states.

Chart 5. Impact of Assistive Technologies on Independence and Social Inclusion



Source: Research data (2024)

Graph 5 shows that most participants positively assessed the impact of assistive technologies, with scores of 4 and 5, indicating that these technologies are widely seen as essential for independence and social inclusion. This data reflects the importance of continuing to invest in and make assistive technologies available to promote greater equality of opportunities and social participation for people with disabilities.

It can be seen that 81% of students reported feeling frustrated and anxious due to the lack of verbal expression, but at the same time, they recognized the importance of gestures and visual communication to establish interactions. After the experiment, the question was asked "How did the absence of speech and writing affect your ability to express yourself during the nonverbal communication experiment? Tell us about your experience". Participants reported that the absence of speech and writing was challenging and caused discomfort when trying to express themselves. Many mentioned that it was difficult to communicate ideas and feelings without these resources, experiencing frustration and discomfort. This response suggests that nonverbal communication imposes a barrier

for those who cannot use speech and writing, highlighting the importance of developing alternative and accessible forms of communication.

The question was also asked, "During the experiment, what were the reactions of the people around you regarding your nonverbal communication?". Participant observation showed that the reactions of the people around you ranged from curiosity and astonishment to confusion and difficulty in understanding nonverbal communication. Some responses indicated that people showed irony or strangeness, reflecting a lack of familiarity with nonverbal communication methods. This highlights the importance of education and awareness about alternative communication, which is essential to increase empathy and understanding of different forms of expression.

FINAL CONSIDERATIONS

This study demonstrated that the effectiveness of extension curricularization involves the intentional and planned integration of extension activities into the academic curriculum so that they are directly aligned with the contents of the disciplines and the training objectives of the course. Through the results obtained, it was evident that a well-structured curricularization facilitates the practical application of theoretical knowledge and promotes the development of interpersonal skills and humanistic values for the comprehensive education of students. Through the analysis of the implementation of extension curricularization in a real context, in this case, at the FAVENI University Center, it was shown that extension activities effectively integrated into the curriculum contribute to the academic development of students. The results obtained in the research show that 83% of the participating students reported feeling more prepared to apply their knowledge in real contexts after participating in extension activities. In addition, 76% of the students stated that extension experiences contributed to the development of interpersonal skills, such as empathy, communication, and collaboration. These data corroborate the idea that extension curricularization enhances learning by providing a practical educational experience, where students can apply theoretical knowledge to face real challenges in the community. Another relevant finding from this study is that 92% of the participants perceived that extension activities improved their understanding of social and environmental issues, which reinforces the contribution of these practices to the formation of critical and conscious citizens. The relevance of this work lies in its theoretical and practical contribution to higher education, especially for institutions that seek to implement extension curricularization effectively. In conclusion, for the curricularization of extension to reach its maximum potential as a promoter of comprehensive and socially responsible education, educational institutions

must adopt a planned and integrated approach, with extension activities that directly engage with curricular content. This alignment strengthens the institutional political-pedagogical project, ensuring that students not only master academic content but also develop a critical and humanistic view of reality. In this way, they contribute significantly to the construction of a more just and inclusive society, as demonstrated by the 84% of students who reported greater involvement in social issues after their extension experiences. This study provides evidence that the curricularization of extension, when well planned and aligned with the pedagogical project, promotes an academic education that prepares students to be agents of social transformation.

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DEMENTIA AND ITS FUNCTIONAL AND COGNITIVE IMPAIRMENTS: BIBLIOGRAPHICAL REVIEW

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ABSTRACT

Introduction: The diagnosis of dementia has increased in recent decades, being a relevant cause of cognitive and functional impairments in the population. However, the national literature on this relationship is extremely scarce. Objective: To analyze quantitatively and qualitatively the associations that exist between the variables dementia and cognitive and functional impairments. Methods: A systematic review of studies on the subject was carried out in the electronic databases Pubmed/Medline, Science Direct, Scielo, and Google Scholar in 2024. Finally, the synthesis of the study was through the comparison of qualitative and quantitative quantities, determining the most frequent characteristics. Results: Dementia constitutes a syndrome of great clinical variability, but always culminating in cognitive decline, in the most comprehensive areas, which leads, in the progression of the disease, to the impairment of the patient's functionality in daily activities of life, and, consequently, in their autonomy, affecting the quality of life. Early diagnosis and prevention are extremely important to maintain autonomy, as is attention to the caregiver. Conclusion: Dementia significantly affects the quality of life of patients and caregivers, as it causes a significant decline in the individual's functionality and autonomy.

Keywords: Dementia. Cognitive impairment. Functional impairment.

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INTRODUCTION

Dementia can be defined as an acquired and irreversible disorder characterized by a significant decline, and therefore affecting independence, in one or more cognitive domains, compared to the previous level of function, such as learning and memory, language, executive function, complex attention, perceptual-motor, and social cognition [1,2,3]. It is worth noting that, for diagnosis, the Diagnostic and Statistical Manual of Mental Disorders (DSM) requires only a substantial decline in a single cognitive area [1,3], even though, in clinical practice, a decline in at least two cognitive domains is often required for this [3], with memory decline being the priority. Dementia is the most common and most severe type of impairment of cognitive function.

Most dementia is caused by a neurodegenerative disease, with Alzheimer's disease (AD) being the most common form of dementia in the elderly, responsible for 60 to 80 percent of cases [3,4]. Other conditions include: Dementia with Lewy bodies (DLB), Frontotemporal dementia (FTD), Parkinson's disease dementia (PDD) (neurodegenerative) [3,5,6,7], and Vascular dementia (non-neurodegenerative), the progression of which can be slowed or halted if the underlying cause is identified and treated [3,8].

As the world's population ages, the prevalence of dementia is expected to increase significantly, especially in low- and middle-income countries. It is expected that by approximately 2050, around 152 million people will have dementia [9,10]. This impact is notable in our country, and by 2025, Brazil is expected to be the sixth country in terms of the number of elderly people [11,12], in 2015, approximately 800,000 people were already estimated to be living with dementia in Brazil [9,13].

Dementia is one of the main causes of disability in the elderly, with significant impacts on the autonomy and quality of life (QoL) of people with dementia and their families [9]. In addition to the decline in QoL, in the 2016 Global Health Estimates of the World Health Organization (WHO), deaths due to dementia more than doubled between 2000 and 2016, elevating the disease to the fifth leading cause of death in the world in 2016 [11,14]. In Brazil, AD was among the 10 leading causes of death in 2019 [9,15]. In addition to dementia itself, medical illnesses and comorbidities that exacerbate cognition are common in elderly patients, such as heart and kidney failure [3], making the therapeutic approach in these patients even more difficult. It is clear, therefore, that primary health care is essential for the care of elderly people with dementia. A multidisciplinary approach is necessary to act preventively, diagnose early stages, and improve quality of life in advanced stages since it is a disease with very limited course-modifying therapy (the success of treatment is often measured by the improvement in the individual's quality of life) [16,17,18]. For this action to

be effective, these professionals must be able to recognize and act on the functional and cognitive impairments of dementia, thus motivating the Literature Review of this work.

METHODOLOGY

The systematic review in question is based on the terms of PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses. And, its strategy was to determine dementia and the functional and cognitive impairments caused.

The searches were conducted in the electronic databases Pubmed/Medline, Science Direct, Scielo, and Google Scholar in 2024. “Functional impairment from dementia” and “cognitive impairment from dementia” were used, as well as the same terms translated into Portuguese, which will be applied in the electronic searches. Other descriptors used will be “dementia”, “functionality”, “cognition”, “prognosis”, “evolution” and “quality of life”. The articles were selected by reading the title and abstract written by two independent authors, with duplicates subsequently excluded. After selection, the articles were read in full, based on the inclusion criteria.

The sample will include observational studies that present data on the functional and cognitive impairments of the pathology in question in patients from all over the world. Study participants will be adult patients, preferably over 50 years of age, who have proven dementia or pre-dementia. Studies published in Portuguese, Spanish, or English, occurring in the national territory. Studies, articles, book chapters, and conferences that did not meet the criteria were excluded.

Finally, the study was summarized by comparing qualitative and quantitative measures to determine the most frequent characteristics.

RESULTS AND DISCUSSIONS

Population aging is associated with numerous pathologies whose importance is centered on physical or mental incapacity. Metal they generate, causing great individual, social, and economic impact [19,20]. Increasing age is generally associated with cognitive changes that may or may not be part of the natural evolution of senescence, and can range from mild changes to severe dementia [21].

Cognition, in turn, encompasses all human intellectual functioning, from the sensory perception of the environment, information processing, involving memories, experiences, reasoning, attention, and the formation of complex and interconnected knowledge structures, generating decision-making and problem-solving [22]. Dementia can be defined as a clinical syndrome that encompasses several diseases, usually progressive and

neurodegenerative, that affect various cognitive functions, such as memory, attention, language, praxis, recognition, understanding, learning ability, calculation, judgment, language, executive and visuospatial function, personality, behavior, and agnosia, significantly interfering with a person's ability to maintain their activities of daily living (basic and/or instrumental) and autonomy, causing impairment and functional loss [19,21,22,23,24,25]. It is generally a significant cause of disability and dependence, mainly among the elderly, causing impacts that encompass not only the individual but also their career, partners, caregivers, family, community, and society [21].

A wide variety of functions can be affected in a dementia syndrome, varying in quantity, intensity, and progression, causing a variety of functional impairments to the individual, and affecting their social and professional performance. There may be a decrease in reasoning speed, sleep impairment, intermittent or sustained episodes of confusion, and psychological changes that result in changes in daily hygiene, eating, dressing, and physiological needs, associated with emotional instability and changes in social behavior and motivation [22]. The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) defines dementia as a syndrome that includes the loss of cognitive functions with impaired functionality, that is, leading to the loss of the ability to perform daily activities for work, social, and family functioning, also encompassing psychological and behavioral symptoms, which may be initial or early manifestations of the syndrome [26, 27, 28, 29]. Historically, the definition was based on memory deficits (as observed in Alzheimer's disease) [30,31], but more recent revisions, such as the revised definition in 2011, bring more importance to the wide variety of cognitive and behavioral changes present in the syndrome that can cause a decline in baseline levels of functioning [30,32]. The most recent revised definition requires impairments in at least two neuropsychiatric or cognitive domains, not better explained by primary psychiatric disorders or systemic conditions such as delirium [30].

Dementia can be caused by a heterogeneous group of disorders, making etiological diagnosis difficult, the most common being Alzheimer's disease and vascular dementia [21].

Medical care is often sought when family members or close associates notice minor cognitive changes, most commonly related to short-term memory problems, such as forgetting where to put things that are commonly used at home or forgetting recent conversations, which begin to interfere with the ability to function adequately in daily life. It is also common to seek care initially due to psychological or behavioral changes, such as withdrawal from hobbies or social events, anxiety, or depression. Another common manifestation at the beginning of the condition is changes in executive function leading to

difficulty in performing daily tasks such as driving [25]. It is important to consider the individual's decline in their premorbid level of functioning [21,33].

From a more physiological perspective, dementia can be understood as a process that involves several specific molecular pathways that interact with each other, culminating in the loss of synaptic connections, inflammation, cell death, gliosis [30,34], and interruption of functional networks that guide cognition, personality, behavior, and sensory and motor functions, resulting progressively in loss of individual autonomy [30,35].

Clinical diagnosis is not always easy, given the great variability of cognitive function among the elderly, making it challenging to quantify normative limits in this population [21,33]. This highlights the importance of differentiating between normal age-related changes and pathological conditions.

Among the cognitive changes throughout life, expected from normal aging, we can highlight the decline in fluid intelligence and the preservation and increase in crystallized intelligence [36]. Intelligence Fluid intelligence comprises the speed of mental processing, working memory, recall and retention of verbal and visual information, related to learning and memory, and reasoning, which begins to decline around the age of 20 and 30 [36,37,38]. These changes can affect creativity, abstract reasoning, and learning of new problem-solving skills, resulting in lower speed and efficiency in acquiring and memorizing new information, which translates into a lower learning rate and slower retrieval of information and memories [36]. On the other hand, crystallized intelligence, which is the ability to apply knowledge and procedures learned throughout life, increases, given the accumulation of greater experience. Its best performance can be manifested in specific tests, semantic knowledge, reading, and vocabulary around the age of 50 to 70 [36,37,38]. These cognitive abilities depend on adequate retrieval of stored information, and the loss of this information storage is not considered a normal part of aging [36]. In medical practice, when evaluating a patient with cognitive complaints, whether self-reported or reported by a companion, it is common to come up with dementia syndrome as a diagnostic hypothesis (HD). However, as discussed, for this diagnosis, a cognitive and/or behavioral decline is required that interferes with activities of daily living, causing functional impairment about previous levels, not explainable by delirium or major psychiatric disorder [39,40]. Before this condition, two conditions can be diagnosed, which may or may not be precedents of dementia syndrome, which are subjective cognitive decline (SCD) and mild cognitive impairment (MCI). DCS is the condition in which the individual presents self-perceived cognitive complaints (mainly memory) but with normal performance in neuropsychological tests and without prejudice to their autonomy in performing ADLs. Similarly, CCL is the

condition in which the individual presents a cognitive disorder, but without prejudice to their autonomy in performing ADLs, although changes in neuropsychological tests already occur, and there may be mild problems in performing previously habitual complex tasks. However, it is important to emphasize that the individual is still able to maintain their independence [39,41,42,43,44,45]. It is clear from the above that the diagnosis of DCS and CCL is clinical, involving anamnesis, ideally including a family member or close informant, since the presence of anosognosia is common, and should identify whether there is an impact on the patient's functionality, the cognitive examination, generally using cognitive screening tests, which are structured instruments of brief application that allow a global assessment of cognition, with the Mini-Mental State Examination (MMSE) being the best known and most widely used, which assesses temporal and spatial orientation, memory, attention, calculation, language and constructive skills in approximately 5 to 7 minutes, and the functional assessment [39,46].

In continuing the approach to the patient with HD dementia, in addition to the explicit assessments, it is necessary to pay attention to somatic and neurological changes, such as changes in gait, ocular motility, and primitive reflexes (more observed in severe dementia cases) [39].

The key to assessing cognitive decline, however, is functionality, which helps determine the syndromic diagnosis, as demonstrated above. For a more objective assessment of this topic, validated instruments that are completed based on the informant's answers can be used [39,47]. The most widely used instrument in Brazil is the Pfeffer Functional Activities Questionnaire (QAF), which is simple to use and quick to apply (approximately 7 minutes) [39,48]. For basic activities of daily living (BADLs), the Kartz scale can be used [39,49].

SCD, MCI, and dementia syndromes can often be related, and there may be a continuum of the disease. However, many people with SCD can remain stable or even reverse the condition. This is because not only the initial stages of neurodegenerative diseases are among the causes of SCD; other associated conditions are normal aging itself, personality traits, and psychiatric disorders, for example [39,50].

MCI is recognized as a more heterogeneous and comprehensive entity of clinical presentation, etiology, and prognosis [39,50], and is divided into 4 subtypes, mentioned below: amnestic MCI - single domain, amnestic MCI - multiple domains, non-amnestic MCI - single domain, and non-amnestic MCI - multiple domains. In addition to the subtypes, it also has different possible etiologies: degenerative, vascular, metabolic, and psychiatric,

among others [39,51]. Given its characteristics, in 2013, the DSM-5 recognized it as a disorder mild neurocognitive [39].

It is worth remembering that in MCI, cognitive deficits do not interfere with the ability to be independent in ADLs, that is, complex instrumental daily activities are preserved, such as paying bills and controlling medications, but may require more effort or require compensatory strategies. In addition, it is necessary to individualize the functionality and cognitive alteration for the patient in the context of their particular circumstances and premorbid level of function and performance [36,52]. However, compared to controls, they have significantly lower performance and may correspond, in many cases, to an incipient stage of some form of dementia [39,53,54].

Finally, still, on the topic of investigating cognitive complaints, it is emphasized that assessments of cognition, function, and behavior must be personalized and interpreted within the context of the individual's psychosocial history, level of education or intelligence, function, and achievement, primary language, ethnicity, and culture [36].

Health professionals should be alert to complaints that indicate some form of cognitive decline, especially in the elderly, since often, in consultations motivated by other conditions, the patient or their companion may suggest changes in daily instrumental activities of living, such as difficulty taking medications and missing appointments or attending at the wrong time or day, or changes in behavior and mood, such as new depression or anxiety [55].

Along with cognitive decline, 90% of patients with dementia present behavioral and psychological symptoms, including aggression, agitation, anxiety, depression, and psychosis. Dementia-related psychosis (DRP) causes great harm to the individual's functionality and quality of life for them and their caregivers, including symptoms such as delusions and hallucinations and increasing the severity of the disease [56,57].

DRP can occur in all types of dementia, but studies report the following prevalence rates: Dementia with Lewy bodies (75%); Parkinson's disease (50%); Alzheimer's disease (30%); Vascular dementia (15%) and frontotemporal dementia (10%) [56,58]. Psychotic symptoms in this population often increase the patient's feelings of distress, the number of hospitalizations, and the caregiver's burden.

Hallucinations and delirium in patients with dementia are not easily explained, usually involving psychological, social, biological, neurochemical, neuropathological, and genetic factors [56,59]. Situations that can motivate and contribute to this condition are changes in the patient's environment, caregiver behavior, unmet needs, personal factors such as personality, past experiences, negative feelings, and dementia itself which leads to

memory problems and disorientation [56]. When approaching these patients, it is important to demystify the associated stigmas, explaining that these symptoms are part of the disease and that they are not “crazy”, and also to emphasize that it is not useful to argue with the patient or try to convince them that their thoughts or sensory impressions are not real, but rather, instead, to try to understand and recognize the patient's emotional reaction and direct it to other aspects or ideas [56].

Addressing the issue of caregivers is very important within dementia syndromes, given the life changes and overload on them, affecting not only the patient's quality of life but also extending to the family caregiver. Much of the burden of the disease falls on family caregivers. In this regard, compassion, patience and a lack of condescension are essential to establish harmony, trust, and expectations. Many patients with dementia have a profound loss of perception about their deficits and limitations, placing even more weight on the family of the diagnosis [60]. Stress-related to the diagnosis can be more dramatic when the patient is under 65 or has dependent children [61], demonstrating the importance of caring for the caregiver so that the patient can be cared for. Factors that affect the quality of life of both include the presence of other comorbidities, physical limitations, hearing limitations, visual limitations, mood disorders, pain disorders, and sleep disorders. In addition, in the social sphere, cultural and environmental factors interfere with the quality of life, such as the composition of the family unit, the challenges of the place of residence, the family's financial situation, or the health of other family members [60].

No less important, it is necessary to discuss and assist in end-of-life decisions that will have to be faced. Health professionals can make these passages through the dementia saga much less painful by being honest and offering empathy, knowledge, and validation of the caregiver's decision-making [60].

The diseases that make up dementia syndrome are irreversible visible and, many, neurodegenerative, with a variable survival rate after diagnosis, ranging from months to decades. As dementia progresses, vegetative functions also end up being affected, with death often resulting from swallowing difficulties, falls, and infections [30]. Therefore, it is necessary to act in the prevention and early diagnosis of dementia. Promoting health throughout life, such as a physically active lifestyle, smoking cessation, and a healthy and balanced diet, demonstrates, in addition to the commonly known benefits of hypertension and diabetes, also prevents or delays the onset of dementia syndromes, as it acts on biological mechanisms that involve the main pathways involved in the development and progression of dementia, such as neurodegeneration, brain resilience, vascular damage, neuroinflammation, and oxidative stress [62]. Systemic atherosclerosis, preventable by the

same means, also plays a role in cognitive deterioration in the aging process [62]. The factors that are commonly preventable with lifestyle changes, i.e. cardiovascular risk factors, are also risk factors for dementia. We can mention hypertension, diabetes mellitus, hypercholesterolemia, atrial fibrillation, and smoking. In addition to the aforementioned, another significant and modifiable risk factor is education, with better quality education and teaching meaning better protection against dementia [21].

In the approach seeking early diagnosis, high suspicion should be maintained in older adults who present neuropsychiatric symptoms with an atypical natural history or with first-episode psychiatric symptoms in adult life [55]. Patients already diagnosed with DCS, MCI, or Parkinson's disease should also be closely monitored, due to the risk of developing a dementia syndrome, with the presence of Parkinsonism increasing the chances of developing dementia by three times [55]. Sleep should also always be assessed with a careful history, including assessment of sleep time, insomnia, daytime sleepiness, and naps, which can facilitate the identification of preclinical dementia or high risk of developing dementia [55]. Slower walking speed can be associated with future dementia; population studies have shown that slow walking speed (below 0.8 m/s) can be associated with subjective or objective cognitive impairment [55]. Observational studies have also shown that hearing impairment is associated with the development of dementia [55].

Commonly in the progression of the disease and cognitive decline, leading to functional impairment, there is a limitation of autonomy. The loss of personal autonomy is relevant to the extent that it is an important construction of human dignity. The power to make decisions and have them respected is part of the recognition of an individual as a person within society and to the extent that this right is curtailed, the individual may be nullified as a person in society. Even though dementia affects decision-making abilities, it cannot be considered the immediate reason for determining that a person is incapable of making decisions [63,64].

Being designated as incapable of making decisions has several negative consequences for the patient. It reduces self-esteem, confidence, desire to live, and involvement in health care [63,65]. The will, relationships, and autonomy of older adults with dementia should be valued.

Unfortunately, as has been demonstrated, dementia has several factors that need to be addressed in its prevention, diagnosis, and treatment that are neglected, which impacts the progression of the disease and consequently the functionality and quality of life of patients and caregivers. Dementia is underdiagnosed worldwide, leading to a diagnosis at a late stage in the disease process, and long-term care pathways (from diagnosis to end of

life) for people with dementia are often fragmented, if not completely absent [21]. The rights of people with dementia are often violated or denied in the community, an example of which is the frequent exclusion of the patient from decision-making, with their wishes and preferences regarding the care provided not being taken into account. Part of this problem is due to late diagnosis, when individuals are no longer able to participate in this process due to the progression of the disease [21].

Early action and diagnosis with continued treatment enable patients with dementia to receive the care and support they need to face this condition with dignity, respect, autonomy, and equity. The ultimate goal is to improve the quality of life of people with dementia and their families, while at the same time trying to reduce the impact of the disease on the patient, as well as on the communities [21].

CONCLUSION

The main conclusion The findings of this research reveal that, predominantly, dementia significantly affects the quality of life of patients and caregivers, as it causes a significant decline in the individual's functionality and autonomy. To summarize this review, we conclude with the words of Tedros Adhanom Ghebreyesus (2021), Director-General of the WHO: “Dementia robs millions of people of their memories, independence, and dignity, but it also robs the rest of us of the people we know and love.”.

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FOOD DONATION TO HOMELESS PEOPLE: A NARRATIVE REVIEW

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ABSTRACT

This narrative review article addresses the impact of food donation to homeless people, analyzing practices that transcend welfare and promote Food and Nutrition Security. The research was conducted through the analysis of academic literature published between 2019 and 2024 in databases such as Scielo and PubMed. The data were organized around two guiding questions: i) Food donations in the Promotion of Food Security for Homeless People: Government programs and Solidarity Kitchens; ii) Evaluation of products donated

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to homeless people. The results indicate that, although donations are essential to reduce hunger, much of the donated food is ultra-processed and nutritionally inadequate, which aggravates health problems such as malnutrition and chronic diseases. On the other hand, solidarity kitchens, which offer balanced and fresh meals, prove to be effective alternatives, as they promote improvements in quality of life and food security. The review concludes that conscious donation is essential to mitigate nutritional inequalities and highlights the importance of public policies, nutritional education, and sustainable initiatives to promote adequate and dignified food for vulnerable populations.

Keywords: Donation. Nutrition. Food insecurity. Social Vulnerability. Human Right to Adequate Food.

INTRODUCTION

Food donation is directly related to the Human Right to Adequate Food (DHAA), ensuring not only access to basic food that meets daily caloric needs, but also, when composed of foods with nutritional quality, contributes to the supply of essential nutrients, promoting a balanced and nutritionally adequate diet (Duarte; Brisola; Rodrigues, 2021; La Cerda et al., 2023). This practice favors health promotion in vulnerable populations, such as homeless people, families below the poverty line, and residents of rural areas, where access to quality food is often compromised by availability limitations and geographical barriers (La Cerda et al., 2023).

One of the main benefits of food donations is the contribution to the reduction of food insecurity, defined as the condition in which individuals or families do not have sufficient physical, social, or economic access to adequate food for the maintenance of health. This condition can be classified into different levels: mild, when there is constant concern about the possibility of lack of food in the future, although the dietary pattern is still maintained; moderate, when there is a reduction in the quality and variety of food consumed, compromising nutrition and health, but still with the availability of some amount of food; and severe, when there is a significant lack of food, resulting in hunger and malnutrition (Brasil, 2014a). However, in addition to providing the caloric amount necessary to maintain body weight, it is essential that donations prioritize the nutritional quality of food, which favors well-being in various aspects of health (Barros; Tenuta; Teixeira, 2022).

The donation of food to people in situations of social vulnerability is an essential practice to reduce hunger and alleviate inequalities. However, the effectiveness of this practice may be limited by the absence of criteria for nutritional quality, regularity, and adequacy of donated food. Conscious food donation, which prioritizes the careful selection of nutritious foods and respects the specific needs of beneficiaries, emerges as a more sustainable and dignified solution. Individuals in a situation of food insecurity have access to foods of low nutritional value, protein-energy malnutrition and micronutrient deficiencies, which can cause lethargy, cognitive deficits, impairment of various physiological functions, in addition to making them more susceptible to the development of chronic diseases, such as Diabetes Mellitus, Systemic Arterial Hypertension and Dyslipidemia (Barros; Tenuta; Teixeira, 2022).

The donation of foods with low nutritional value, such as industrialized products that undergo changes to acquire new flavors, textures, colors or longer shelf life, usually through the addition of chemical dyes and preservatives, such as instant noodles and seasonings, artificial snacks, stuffed cookies, sausages and processed hamburgers, can aggravate the

health conditions of the beneficiaries (Louzada et al., 2021). To avoid these negative impacts, it is essential that donations are aligned with the recommendations and standards established by the Food Guide for the Brazilian Population. Conscious donations, composed of food of adequate nutritional quality, can promote a balanced diet and directly benefit the health of the vulnerable population (Brasil, 2014b).

In a scenario marked by deep social inequalities and growing food insecurity, donation emerges as a solution that transcends welfare, consolidating itself as an act of citizenship and dignity (Palmeira; Bem-Lignani; Salles-Costa, 2022). Another significant aspect of the donation is its contribution to reducing food waste. On a daily basis, large quantities of food in conditions suitable for consumption are discarded. Donation turns this waste into an opportunity, redirecting these resources to the individuals who need it most. In addition to fighting hunger, this practice promotes sustainability, contributes to the balance of the environment, by optimizing the use of food resources. Food Banks, solidarity kitchens and popular restaurants exemplify this virtuous cycle, by connecting food surpluses with vulnerable populations in an organized and safe way (Roseno; Santos, 2021; Tenuta et al., 2021).

For those in vulnerable situations, receiving quality food is not only a matter of satisfying hunger, but also of respect and appreciation. Donations made with care, such as food with good nutritional quality, in good condition, without contamination and that can meet the needs of the people who receive this food, convey the message that these people are important and deserve more than leftovers or low-quality food. Finally, food donation has an educational and transformative role, by providing not only food, but also information on nutrition, reuse, and preservation of food (Barros; Tenuta; Teixeira, 2022).

The objective of this article is to analyze the impacts of food donation for homeless people, a specific group within the population in social vulnerability, who, as our initial research indicates, depend mostly on donations and social programs to have access to food. This study seeks, therefore, to highlight donation practices and their role in combating hunger and promoting human dignity. The review was guided by two guiding themes: 1) Food donations in the Promotion of Food Security for Homeless People: Government programs and Solidarity Kitchens; 2) Quality of food donated to homeless people.

METHODOLOGY

This study adopted a narrative approach to analyze data collected from secondary sources available in academic and scientific databases. The methodology was structured in the following stages: selection of sources, definition of the guiding theme of the specific

search, data collection and critical analysis. The data search was carried out in the Scielo and PubMed databases, and the capture of studies was limited to the period from 2019 to 2024. The choice of this time frame is justified by ensuring that the study is updated with a focus on the last five years. No restrictions were established as to the type of study included, location, or language.

The search terms used in the construction of this argumentative analysis were: "Homeless", "Homeless", "Homeless People" and "Homeless Persons". These descriptors were combined with keywords associated with nutrition and food security, including "Food," "Food Deprivation," "Food Deprivation," "Food Supply," and "Collective Feeding." In order to investigate the effectiveness of food assistance programs, specific terms such as "Restaurant", "Solidarity Kitchen", "Solidarity Kitchens" and "Popular" were also included. The search strategies were adapted to the particularities of each database consulted. To ensure the reproducibility of the methods, detailed search strategies for each database are presented in Chart 1, providing transparency and methodological rigor in the selection of references that support the discussions in this article.

Table 1. Detailed search strategies in the Scielo and PubMed databases.

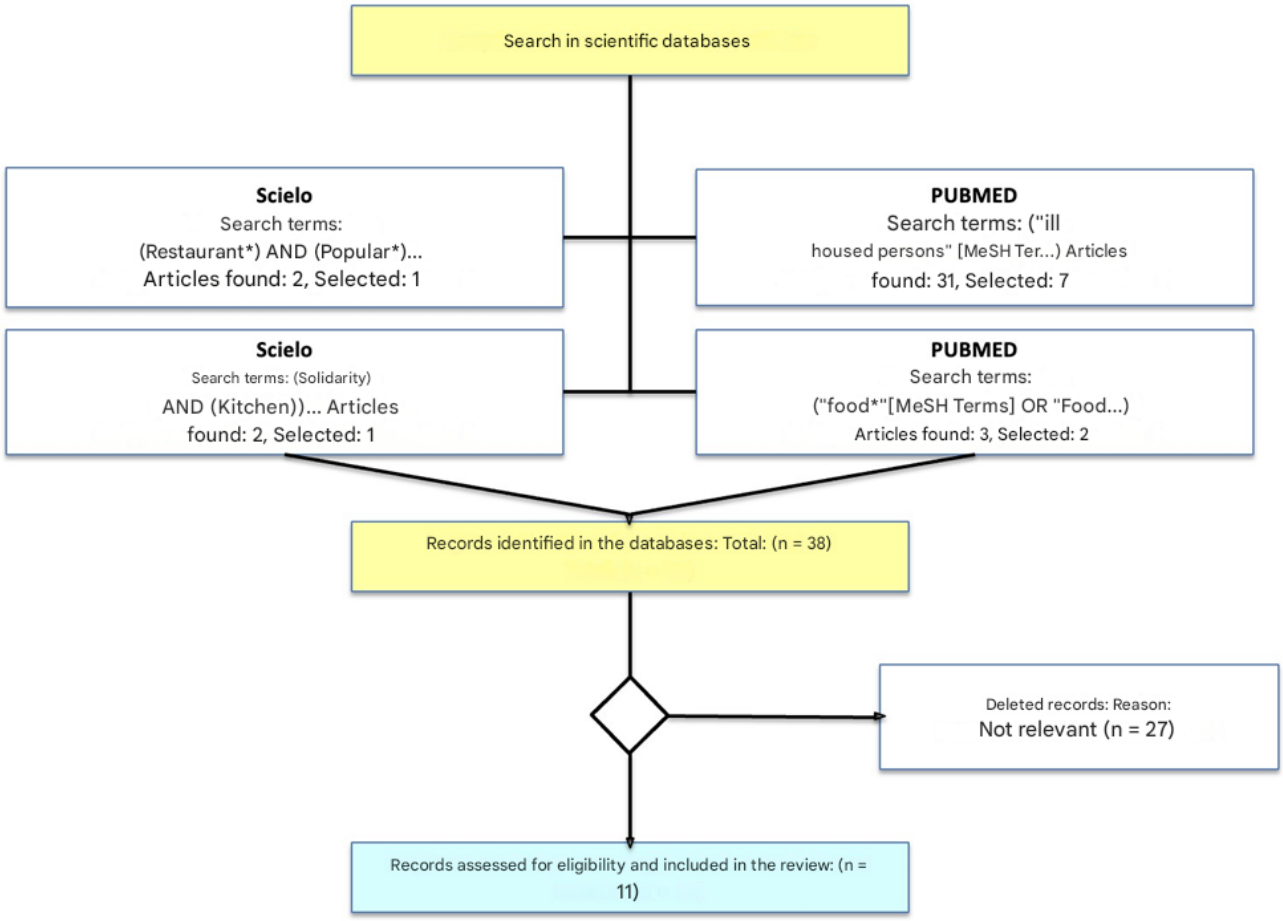
Database used	Quest	Articles found
Scielo	(Restaurant*) AND (Popular*)	2
Scielo	((Solidarity) AND (kitchen)) OR ("Solidarity kitchen")	2
PUBMED	("ill housed persons"[MeSH Terms] OR ("morador"[All Fields] AND ("drug effects"[MeSH Subheading] OR ("drug"[All Fields] AND "effects"[All Fields]) OR "drug effects"[All Fields] OR "de"[All Fields]) AND "rua"[All Fields]) OR (("pessoa"[All Fields] OR "pessoas"[All Fields]) AND ("embryology"[MeSH Subheading] OR "embryology"[All Fields] OR "em"[All Fields]) AND "situacao"[All Fields] AND ("drug effects"[MeSH Subheading] OR ("drug"[All Fields] AND "effects"[All Fields]) OR "drug effects"[All Fields] OR "de"[All Fields]) AND "rua"[All Fields]) OR "Abrigos"[All Fields] OR "Homeless Persons"[Text Word]) AND ("food"[MeSH Terms] OR "Food Deprivation"[All Fields] OR ("privacao"[All Fields] AND ("drug effects"[MeSH Subheading] OR ("drug"[All Fields] AND "effects"[All Fields]) OR "drug effects"[All Fields] OR "de"[All Fields]) AND ("alimento"[All Fields] OR "alimentos"[All Fields])) OR "Food Supply"[All Fields] OR (("alimento"[All Fields] OR "alimentos"[All Fields]) AND ("dieta"[All Fields] OR "dietas"[All Fields]) AND "e"[All Fields] AND "nutricao"[All Fields]) OR "diet food and nutrition"[All Fields])	31
PUBMED	("food*"[MeSH Terms] OR "Food Quality"[All Fields] OR "Food and Beverages"[All Fields] OR ("eating"[MeSH Terms] OR "eating"[All Fields]) OR "Street Food"[All Fields] OR "Perishable Foods"[All Fields]) AND (("ill housed persons"[MeSH Terms] OR ("ill housed"[All Fields] AND "persons"[All Fields]) OR "ill housed persons"[All Fields] OR "homeless"[All Fields] OR "homelessness"[All Fields]) AND ("people s"[All Fields] OR "peopled"[All Fields] OR "peopling"[All Fields] OR "persons"[MeSH Terms] OR "persons"[All Fields] OR "people"[All Fields] OR "peoples"[All Fields])) AND ("donate"[All Fields] OR "donated"[All Fields] OR "donates"[All Fields] OR "donating"[All Fields] OR " donation"[All Fields] OR "donations"[All Fields] OR "donator"[All Fields] OR "donators"[All Fields])	3

Source: Prepared by the authors (2024)

RESULTS

Initially, 38 articles that met the selection criteria were located, based on the presence of the respective keyword associations. These articles were categorized through critical analysis of their content, according to the relationship with the guiding questions. 8 studies with relevant data for the first guiding question were selected, while for the second question, 3 studies were chosen. The flowchart of the studies selected for review can be seen in Figure 1.

Figure 1. Diagram of the selected studies.



Source: Prepared by the authors (2024)

The synthesis of the information from the articles selected for this review is presented in Chart 2.

Table 2. Summary of title, authors, language, year, journal, type of study, and sample of selected articles.

Title	Authors	Country	Language	Year	Newspaper	Type of study	Sample
Food Acquisition Strategies of Homeless Youth in the Greater Seattle Area	Kloubec e Harris	United States of America	English	2021	Journal of the Academy of Nutrition and Dietetics	Cross-sectional study	122 Participants
Long-Term Food Insecurity, Hunger and Risky Food Acquisition Practices: A Cross-Sectional Study of Food Charity Recipients in an Australian Capital City	Pollard *et al.*	Australia	English	2019	International Journal of Environmental Research and Public Health	Cross-sectional study	101 Participants
"We have a roof over our head, but we have to eat too:" Exploring shifting foodscapes from homelessness into Housing First in Kingston, Ontario	Hainstock and Masuda	Canada	English	2019	Health & Place	Mixed-methods study	10 Participants
Diet Quality, Health, and Wellbeing within the Irish Homeless Sector: A Qualitative Exploration	Ravikumar *et al.*	Ireland	English	2022	International Journal of Environmental Research and Public Health	Qualitative study	22 Participants
Systematic review of the nutritional status of adults experiencing homelessness	Huang *et al.*	United Kingdom	English	2022	Public Health (Elsevier)	Systematic review	6 articles with a total of 1561 Participants

Nutritional needs, resources, and barriers among unhoused adults cared for by a street medicine organization in Chicago, Illinois	Adams *et al.*	United States of America	English	2023	BMC Public Health	Cross-sectional study	20 Participants
Who are the Solidarity Kitchen users? Study on inequalities to ensure food and nutritional security based on the experience of Sol Nascente community - Distrito Federal, Brazil	Madruga *et al.*	Brazil	English	2024	Revista de Nutrição (Brazilian Journal of Nutrition)	Cross-sectional study	83 Participants
Food Sources for Homeless Youth: An Evaluation of Food Availability at a Homeless Youth Drop-In Center	Yarcusko *et al.*	United States of America	English	2019	Journal of Nutrition Education and Behavior	Observational study at	N/A
The determinants of the nutritional quality of food provided to the homeless population: a mixed methods systematic review protocol	Ravikumar-Gr ant e Kelly	Europe, North America and Oceania	English	2023	Systematic Reviews	Systematic Review Protocol	N/A
Food security of food recipients of a food pantry and soup Kitchen	Mousa e Freeland-Grav es	United States of America	English	2019	Public Health Nutrition	Cross-sectional study	222 Participants

Popular Restaurants as strategies to fight hunger and to promote Food and Nutrition Security: an integrative review of scientific publications in the period 2011-2021	Oliveira *et al.*	Brazil	English	2023	Journal of Nutrition	Integrative review	35 items

Source: Prepared by the authors (2024)

DISCUSSION

FOOD DONATIONS IN THE PROMOTION OF FOOD AND NUTRITIONAL SECURITY FOR HOMELESS PEOPLE: GOVERNMENT PROGRAMS AND SOLIDARITY KITCHENS

A significant number of vulnerable people around the world are forced to turn to the streets in search of resources to meet their most basic needs. In response, governments have implemented social programs aimed at addressing these shortages and mitigating food insecurity among underserved populations (Brasil, 2023). This theme seeks to examine the effectiveness of government programs and solidarity kitchens in reducing food insecurity among homeless people, analyzing their real impacts and the limitations that still compromise the sustainability and quality of the support offered.

The study by Huang et al. (2022), analyzed 35 articles that assessed the nutritional status of homeless people, the research revealed respectively that between 33.3% and 68.3% of individuals were overweight or obese, while 3.5% to 17% were underweight. In addition, deficiencies of micronutrients such as iron, folate, vitamins C, D, and B12 were prevalent. Their diets consist of high-energy-dense, nutrient-poor foods, such as fast food and low-quality donations.

Following this same line, the qualitative research conducted by Adams et al. (2023) in Chicago with a sample number of 20 participants, investigated the food and health conditions of homeless people. Of the respondents, 11 reported severe dental problems, which limited their ability to chew and consequently consume nutritious foods, resulting in a dependence on processed foods and liquids, such as soups and sugary drinks. In addition, 10 of the 20 participants reported inadequate food intake, with an almost exclusive reliance on food donations and shelter. In this population, 50% of the participants suffered from chronic diseases, such as diabetes and hypertension, and found it difficult to follow medical dietary guidelines due to the lack of control over food. Additionally, the article suggests which foods can be safely donated, such as peanut butter, canned soups, and fruits that do

not need refrigeration, and identifies that partnerships with community gardens could help provide fresh food for this population (Adams et al., 2023). This dental issue points to the need for a careful selection of donated foods, which includes easy-to-chew and ready-to-eat options, especially to serve beneficiaries with oral health limitations.

A cross-sectional study carried out in the United States of America (USA) applied a nutritional food frequency questionnaire to 222 participants, made an analysis between food insecurity and the impacts on society. The data presented regarding food donation showed that 73% were unsafe foods to be consumed. Most of the participants were male, single, and homeless, with an annual income of less than $1,000. These individuals relied on donations from community kitchens, facing significant obstacles to accessing government assistance programs such as the Supplemental Nutrition Assistance Program (SNAP), also known as the Food Stamp Program. The main barriers to accessing the federal program included eligibility issues, such as criminal history or lack of citizenship, making it difficult for low-income families to access the benefit for the purchase of food. The study showed that participants who were fed by food donations in community kitchens had an improvement in their condition of food insecurity and increased the consumption of essential nutrients (Yarcusko; Slesnick; Hatsu, 2019).

In Ireland, Ravikumar et al. (2022) conducted a cross-sectional study that highlighted similar barriers faced by homeless populations. Dependence on food donations, often of low nutritional quality, has contributed to the worsening of mental health, with an increase in cases of depression. The lack of control over food and the scarcity of fresh food generate a lack of healthy options and result in a poor diet. The study by Hainstock and Masuda (2019) analyzed the food situation of individuals who started to live in more stable housing through the Housing First program in Canada. The results demonstrated that, despite the improvement in control over food storage and preparation, many participants continued to rely on food banks and charitable programs, evidencing the persistence of food insecurity even after moving to more stable housing.

In Australia, Pollard et al. (2019) conducted a study with 96 participants, finding that 91% of respondents reported food insecurity, and 56% stated that they had gone one or more days without eating in the previous week. Risky practices, such as walking the streets begging for food (32%) and money (36%), were common among this population. The study underscores the urgent need for reforms in the social protection and food assistance systems. In addition to international studies, the Brazilian study analyzed by Oliveira et al. (2023) addressed how government programs, such as popular restaurants, seek to mitigate the impacts of food insecurity. In an integrative review that covered 35 studies published

between 2011 and 2021, it was found that these restaurants offer nutritious meals at affordable prices to vulnerable populations, including informal workers, the unemployed, and people experiencing homelessness.

In addition to government initiatives to combat hunger, popular actions emerge that play an essential role in this confrontation. Among these actions, the solidarity kitchen stands out, which is entirely managed by the population itself and plays a relevant role in food support for groups in vulnerable situations. In Brazil, it is estimated that there are approximately 5,000 registered solidarity kitchens, located mainly in regions where government programs have difficulty reaching (Madruga; Axe; Oliveira, 2024).

A 2024 descriptive cross-sectional study analyzed the Solidarity Kitchen project of the Homeless Workers' Movement in the Sol Nascente Community, in the Federal District, Brazil, which consists of a social installation coordinated by the Homeless Workers' Movement (MTST) and financed by civil society and partners through donations (Madruga; Axe; Oliveira, 2024). It caters to an average of 120 people, including adults and children, and offers free lunch Monday through Friday. The space consists of an agroecological garden behind the kitchen, where species of food plants and medicinal teas are grown. It also incorporates incentives for the cultivation of community urban gardens and the reception of food produced by local farmers. This allows fresh foods, such as vegetables, to be integrated into meals, providing greater nutritional quality and contributing to food security (Madruga; Axe; Oliveira, 2024).

A total of 83 individuals were interviewed, most of whom were women, black and brown, with a mean age of 39.6 years. Of these, 42.2% had attended the 1st year of high school or more, approximately 65% received up to one minimum wage, most received social benefits and 81.9% were unemployed at the time of the interview. Women reported lower family income, greater dependence on aid, higher unemployment, and living with more people, who took more food from the solidarity kitchen, all of which were statistically significant. Almost 55.0% of respondents reported that other people in the household also brought food from the kitchen. According to the food security assessment, 49.8% of households were experiencing mild, moderate or severe food insecurity in the three months prior to the date of the survey. The number of daily meals was up to two for 46.3% of the respondents. Regarding the amount of food offered, 89.5% considered it good/sufficient. The study also identified that education and employment situation directly influence food security, with significantly higher security rates among those with higher education: 54.0% of individuals with higher education are frequent users and, among those with less

education, 76.5% consume food from the solidarity kitchen daily (Madruga; Axe; Oliveira, 2024).

QUALITY OF FOOD DONATED TO HOMELESS PEOPLE

A large part of homeless people have donated food as their only source of food, but these foods often lack nutritional quality, being composed of caloric items, with a large amount of sodium, sugar, and saturated fats, but poor in nutrients (Wetherill et al., 2023). This theme explores the evaluation of these products and highlights the importance of conscious donation, which prioritizes healthy foods with a greater amount of essential vitamins and minerals, aiming at the conditions of these people to promote health and reduce nutritional inequalities.

A systematic review protocol of a study from Europe, North America and Oceania highlights three situations faced by institutions responsible for supplying and receiving donated food. The article mentions that food donations are dense in energy, salt, sugar, and fat, but they are nutrient-poor foods. According to the review, most people dependent on donated food are characterized as economically disadvantaged, socially isolated, and unable to access safe and nutritious food, which makes the results of hunger relief programs fall short of expectations (Ravikumar-Grant; Kelly; Gabhainn, 2023).

An observational study at a homeless youth shelter in the U.S. assessed 13 food categories at a homeless youth center using a food inventory questionnaire. In this study, it was seen that dry cereals, vegetables, and meat were the most available foods, and foods such as sweets and dairy products were the least available (Yarcusko; Slesnick; Hatsu, 2019). It is noteworthy that caloric and nutrient-poor foods are often prioritized, even in donations from well-intentioned institutions. This data indicates the need for an intervention in donation policies, emphasizing fresh and balanced foods, so that the practice of conscious donation promotes not only food security, but also adequate nutrition.

A survey conducted with 112 users of a community soup kitchen in Tulsa, Oklahoma, conducted to redesign the menu based on health needs, highlighted that community kitchens rely significantly on donations to meet the basic food needs of homeless people (Wetherill et al., 2023). The study revealed that the main challenge lies in the quality of donations, often composed of processed foods, rich in sodium and saturated fat, but lacking in fiber, vitamins and minerals, compromising adequate nutritional care. By reformulating the menu, the study visualized these gaps and made a menu with a greater amount of fruits and vegetables, being a key point pointed out by the survey participants, where more than 75% of the participants approved the new recipes and reported wanting to see more fresh

and minimally processed foods, although dental problems limited the consumption of raw foods. In addition, the study emphasizes that community kitchens should be trained to use food preparation techniques that make meals more nutritious and accessible to individuals with dental problems. The article reinforces that "making your food your medicine" can be an effective intervention for the health of vulnerable populations and combat nutritional disparities in homeless people (Wetherill et al., 2023).

CONCLUSION

This study is justified by the urgency of encouraging donation practices that transcend welfare, promoting, in addition to fighting hunger, the strengthening of the health and dignity of homeless people and other vulnerable populations. Based on an analysis of the impacts of this practice, it seeks to contribute to the development and improvement of public policies and organizational strategies that improve the quality of life of these populations and promote food security in a lasting and effective way.

The findings of this review highlight the relevance of improving the quality of donated food, with special attention to the specific nutritional needs of vulnerable populations. While food donation can offer temporary hunger relief, it is critical that social assistance programs prioritize structural actions aimed at social reintegration and the removal of people from homelessness. In addition, it is necessary that donation initiatives consider the nutritional quality of food, aligning with the guidelines of the Food Guide for the Brazilian Population, in order to promote a healthy, balanced and varied diet.

It is suggested the implementation of public policies that encourage conscious, nutritionally balanced and inclusive donations for specific needs. Programs such as solidarity kitchens serve as an example to improve the diet of vulnerable populations by incorporating fresh, minimally processed and easy-to-consume foods. In addition, dietary supplementation strategies can be important interventions to compensate for frequent nutritional deficiencies in this population, such as iron and vitamin A health.

It is concluded that promoting food security in a dignified and effective way is a global challenge, which requires an integrated approach. The analysis of studies carried out in Brazil, Canada and the United States shows that the difficulties related to the conscious donation of food are not exclusive to a region, but reflect a global problem, deeply associated with social inequalities. To face these challenges, it is essential to combine robust public policies, the performance of nutrition professionals, and the active participation of society. In this context, conscious donation, guided by responsible and respectful practices, is a valuable strategy to reduce nutritional inequalities and improve the

quality of life of homeless people and other vulnerable populations. The articulation between governments, organizations, and citizens is essential to transform specific actions into lasting and effective solutions, promoting a positive and sustainable impact.

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GENERAL ASPECTS OF DISTEMPER: LITERATURE REVIEW

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ABSTRACT

Morbillivirus has single-stranded, negative-sense RNA and does not have the reverse transcriptase enzyme, and is therefore not a retrovirus. Systemic infection with Morbillivirus can be found in wild canids, procyonids such as raccoons, kinkajous, bears, mustelids, hyenas, big cats, domestic cats, cetaceans, non-human primates, and humans. The great ability of Morbillivirus to cross barriers between species is due to mutations in the H protein of the lipoprotein envelope, making it a pantropic virus. Outbreaks of diseases caused by Morbillivirus have been recorded in different species in the same period of time, because in addition to the high virulence, contaminated animals are reservoirs of the disease and intraspecies and interspecies transmission agents. This characteristic of Morbillivirus makes it difficult to eradicate CCV (distemper virus) infections, although there are vaccines for some affected species. The study of Morbillivirus interactions with different species leads us to discuss the concepts of 'One World One Health', 'One Medicine' and 'One Health', as they correlate with the risks to human and animal health that Morbillivirus represents. The epidemiological surveillance work of the VCC is significantly important because it is an emerging infectious disease that poses a threat to the health of humans and animals. Some studies point out that the measles virus is derived from the distemper virus or the rinderpest virus. This study is a complicated of articles published in the literature, which provide information about the pathological mechanisms used by Morbillivirus to infect the host and brain structures with the description of the lesions. In addition, the present literature review addresses the epidemiology, etiopathogenesis, histological alterations, clinical and laboratory diagnosis of distemper.

Keywords: Morbillivirus. Distemper. Epidemiology of Distemper.

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INTRODUCTION

Distemper is caused by a multi-host pathogen, *canine Morbillivirus* of the *Paramyxoviridae family*, responsible for causing severe immunosuppression and neurological disease associated with demyelination (ANDERSON et al., 2012; LIU et al., 2016). About 30% of dogs infected with *Morbillivirus* develop neurological syndromes after one to six weeks from the onset of clinical signs. Puppies aged 3 to 6 months can develop polyencephalopathies with dysfunctions in the proencephalon (GREEN et al., 2020).

The CCV (distemper virus) is a single-stranded, unsegmented, enveloped RNA virus of the *Paramyxoviridae family,* genus *Morbillivirus,* the same genus as human measles (VANDEVELDE & ZURBRIGGEN, 2005). *Morbilliviruses* have already caused epidemics in several species, since these diseases have similar characteristics with signs whose severity varies from subclinical manifestations to chronic brain degeneration, which can lead to the animal's death (UHL et al,. 2019).

Morbilliviruses can cause acute and progressive neurological diseases affecting the gray matter and white matter. These signs include partial or generalized seizures, myoclonus, paresis, paralysis, proprioceptive deficits, circular movements, behavioral changes, vestibular dysfunction, leading to the patient's death or generating chronic neurological sequelae (VON RÜDEN et al., 2021).

Dogs with distemper have a pattern of neurological alterations that resemble human diseases such as Alzheimer's, multiple sclerosis, leukodystrophies, lysosomal enzyme deficiency, epilepsy, cortical malformations (lissencephaly, polymicrogyria), dementia, focal lesions, among others (DATTA et al., 2012).

The anatomopathology model of distemper is the basis for studies on multiple sclerosis because it resembles the mechanism of demyelination. Demyelination is related to the action of the virus on different types of cells. Brain homeostasis is maintained by astrocyte-astrocyte and astrocyte-oligodendrocyte junctions. Changes in these gap junctions can trigger seizures in chronic cases (VON RÜDEN et al., 2017).

Considering that modifications in microglial cells alter brain nutrition, support, and defense mechanisms, the study of the neuropathogenesis of distemper can help to unravel the main consequences of neuroinflammation and how microglial lesions participate in the worsening of brain lesions.

MATERIAL AND METHODS

SYSTEMATIC REVIEW

The systematic literature review was performed in the Google Scholar, Medline, and Pubmed databases in order to obtain an in-depth view of the relevant studies available in the literature.

The following keywords were used to carry out this systematic review: etiology of distemper, distemper general aspects, neuropathogenesis, morbillivirus and anatomopathogenesis. The articles considered in this review were published in the last 40 years, prioritizing the most recent studies of the last 10 years.

Older studies were also used because they provided the first definitions of the characteristics of the disease under study.

The research bases indicated 254 articles, from which 88 publications were selected, in English, Spanish and Portuguese that provided detailed information about the neuropathogenesis of distemper.

After reading the studies, other bibliographies were included, such as veterinary anatomy books.

INCLUSION CRITERIA

The studies published on the general aspects of distemper that met the following criteria were systematic reviews, meta-analysis and scientific articles, as they are studies that provide scientific evidence and show the differences between the studies.

EXCLUSION CRITERIA

Published articles that did not describe or did not address in detail relevant information about the general aspects of distemper were not included in this study.

LITERATURE REVIEW

EPIDEMIOLOGY

Distemper is a highly contagious viral disease that affects carnivores of the Canidae, Mustelidae, Felidae and Procyonidae families in different countries of the world, such as the United States, Finland, Germany, Poland and the countries of the African continent. Wild animals such as foxes, ferrets, and non-human primates can also be affected by *Morbillivirus* (ATHANASIOU et al., 2017).

The seroprevalence of distemper in fox populations ranges from 4 to 17%, but this value may be underestimated due to the high mortality rates in this species that acts as a

reservoir of the disease (BILLINIS et al., 2013). The fatality rate of distemper is 5 to 30% in primates, and the main cause of death is pneumonia followed by neurological changes (VRIES et al., 2014). In a study carried out over seven years, it was observed that the prevalence of distemper in wild dogs in Africa was 16%, compared to 48% prevalence in domestic dogs (WOODROFFE et al., 2012).

Other viruses are related to the distemper virus, such as the human measles virus and the rinderpest virus. *Morbilliviruses* also affect species such as cetaceans, felines, bats, and rodents (UHL et al,. 2019; PFEFFERMANN et al., 2018). Several studies have reported that the distemper virus has a common ancestor and that it has adapted to a variety of hosts over time (VRIES et al., 2014).

Outbreaks caused by CCV have already occurred in several species, such as domestic dogs (*Canis familiaris*), African wild dogs (*Lycaon pictus*), black-footed ferrets (*Mustela nigripes*), Baikal seals (*Pusa sibirica*), African lions (*Panthera leo*) and the spotted hyena (*Crocuta crocuta*) (NIKOLIN et al., 2012).

In 1991 and 1992, CCV infections occurred in captive leopards (Panthera pardus), tigers (Panthera tigris), lions (Panthera leo) and a jaguar (Panthera onca) in North America. There were 17 deaths of these animals, and raccoons were considered the source of infection. In addition to these cats, two black leopards died at the Naibi Zoo, Coal Valley, Illinois, and 2 tigers died at the Shambala Reserve, Acton, California (APPEL et al., 1994). In 1994 approximately one-third of the lion population in the Serengeti, northern Tanzania, died from infections attributed to CCV. There have also been outbreaks in free-living cats such as lynx, Canadian lynx, Eurasian lynx, the critically endangered Iberian lynx and the Amur tiger (NIKOLIN et al., 2012).

The clinical signs found in these species were anorexia, gastrointestinal disease, respiratory disease, and seizures. The CCV was isolated through monoclonal antibody tests that identified the CCV of 3 leopards, 3 tigers and 3 lions that died. Macroscopic and histopathological examinations revealed lesions similar to those found in canids, but there were fewer lesions in the brain and a cell proliferation in the lung with bodies of the disease. Neutralizing antibodies to CCV were found in high titers in the serum of most animals, but were absent or low in some big cats that died after CCV infection (APPEL et al., 1994).

Morbillivirus was identified in domestic cats in China in 2012, the new species called *feline Morbillivirus* (MVFE) caused tubulointerstitial nephritis (MARCACCI et al., 2016). *Morbillivirus* was detected through PCR of urine and blood samples in 12% of stray cats in Italy, cytopathic effects, lysis and syncytial formation in kidney cells were observed.

Histological examination of tissues obtained at necropsy revealed inflammatory infiltrate, degeneration, and tubular necrosis (WOO et al., 2012). In Japan, a study in domestic cats identified the presence of MVFE in the renal tissues of 10 cats with nephritis in 40%. Although the MVFE have genetic diversity, the isolates from Japan and China showed an identical nucleotide sequence, suggesting that there are natural reservoirs. Genetic analysis showed that recombination occurred within the F and H genes (SAKAGUCHI et al., 2015).

In Italy, in a cat with chronic kidney disease (CKD), MVFE was found through urine RT-PCR testing. In 2013, cats with MVFE were recorded in Germany, and recently in Turkey and the United States (USA). Chronic infection caused by *Morbillivirus* may be responsible for viral recombination and heterogeneity. In addition, viral diversity is related to the existence of different viral ancestors involved in the origin of MVFE. In Europe, MVFE has been detected in cats with CKD. Studies show that cats seem to host a heterogeneous population of new paramyxoviruses that are related to CKD in these animals (MARCACCI et al., 2016).

In the VCC, the H protein is the most variable in the *Morbillivirus* genus, which explains a broad spectrum of hosts. The infection can lead to the formation of multinucleated cells, the syncytia. The formation of syncytia is determined by the H protein of the VCC. The cellular receptor for the H protein in host lymphatic cells is the SLAM (signaling lymphocyte activation molecule) molecule that binds to *the Morbillivirus*. SLAM is expressed in humans by memory T cells, B cells, and induced by a range of immune cells, upon activation. The specificity of the VCC H protein and the protein-SLAM receptor interaction represent a potential disseminator of the *Morbillivirus host range* (NIKOLIN et al., 2012).

In humans, the measles virus is a type of *Morbillivirus*. Measles virus and CCV use two cell receptors, CD150 expressed in subsets of cells of the immune systems and nectin-4 expressed in epithelial cells. The measles virus infects immune cells that express CD150, and these cells migrate the draining lymph nodes (SAKAGUCHI et al., 2015). The genus includes the Rinderpest virus (RPV) already eradicated by vaccination, ruminant plague, and distemper virus in dogs. There is evidence of *Morbillivirus* in marine animals, such as cetaceans, this virus being called *Phocid distemper virus-1* (PDV-1) and in felines Morbillivirus has recently been observed, in domestic cats, bat species and rodents (PFEFFERMANN et al., 2018). *Morbilliviruses* were also found in bats, in RT-PCR tests of blood serum, in an incidence rate between 3.3 and 3.1% in a total of 86 bat species, with 4,954 individuals from Brazil, African countries and Europe (DREXLER et al., 2012).

Morbilliviruses are responsible for epidemics that have decimated many populations over centuries, these diseases have similar characteristics among species, with signs whose severity varies from subclinical manifestations to fever, respiratory and gastrointestinal signs, dermatitis and immunosupretion, facilitating immune-mediated bacterial infections, brain damage, spinal cord damage and chronic brain degeneration, which can lead to death (UHL et al,. 2019).

It is estimated that dogs, as reservoirs, can represent a source of infection of the distemper virus for non-domesticated animals. This transmission can pose a threat to wild species populations (COSTA et al., 2019).

Epidemiological studies of the distemper virus, combined with constant epidemiological surveillance, prophylaxis measures such as vaccination, are necessary to contain the spread of the disease from dogs to other species. After rabies, distemper is considered the most relevant disease, due to its severity (COSTA et al., 2019).

Morbilliviruses cause diseases with very high morbidity and mortality in human and animal populations. Outbreaks of measles and rinderpest occurred in the same period in Europe, Asia and Africa between the seventeenth and nineteenth centuries, during these centuries, measles was endemic in Europe. The first record of distemper occurred in Ecuador and Peru in 1735. It can be seen that the occurrence of diseases caused by *Morbillivirus* in different species such as humans, cattle and canines occurred concomitantly on several continents, showing that the distemper virus is pandemic (UHL et al., 2019).

Table 1 shows that a severe measles epidemic occurred at a time when distemper was established in South America and Europe, as well as rinderpest that became endemic on several continents. Historical records of dog outbreaks with distemper in an endemic scenario of measles and rinderpest point to a broad understanding of multihost pathogens, which continuously threaten human and animal populations (UHL et al., 2019).

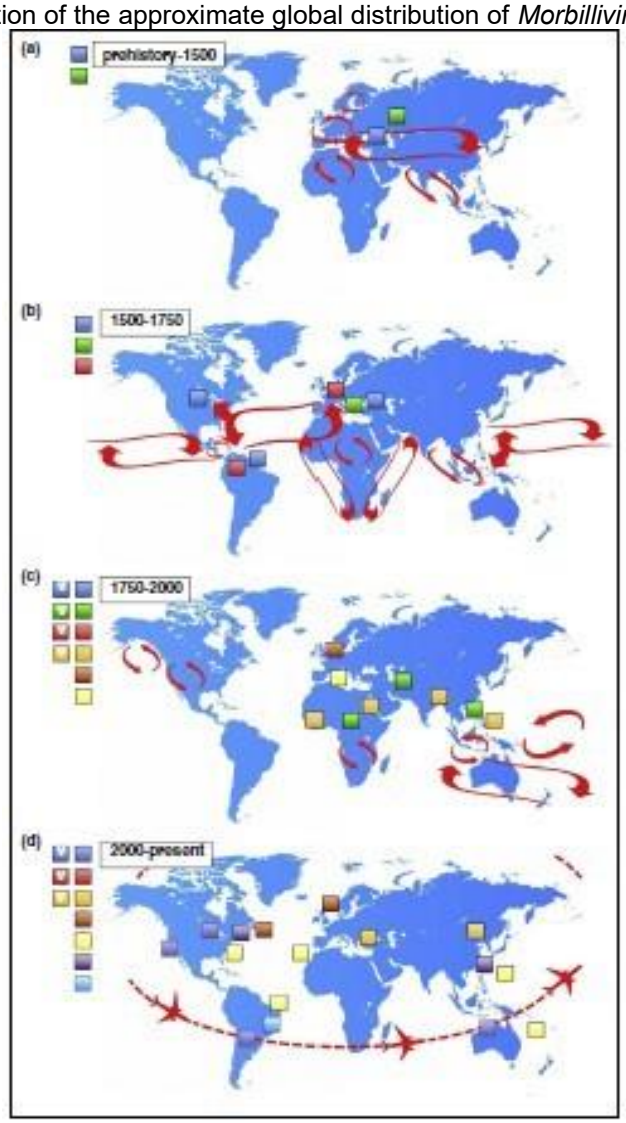
Figure 1 depicts the historical moments in which outbreaks and endemics of diseases caused by *the Morbillivirus occurred,* suggesting that this pathogen originated from a common ancestor and was transmitted to several species. Possibly there was an adaptation of *Morbillivirus* to humans after the first outbreak in animals. The development of resistance in people decreased morbidity and mortality rates. When the occurrence of dogs with distemper was recorded in 1809, similarities with the transmission of measles and greater susceptibility in puppies were noticed. (NAMBULLI et al., 2016).

Table 1: The widespread measles epidemic in the Americas preceded the first canine distemper epizootics between the sixteenth and seventeenth centuries

Sickness	Local	Countries	Century. XVI	Century. XVII	Century. XVIII	Century. XIX
Cinomose	America	Quito, Ecuador, South	NRF	NRF	1748, 1759	NFR
	Europe	England	NRF	NRF		
		France	NRF	NRF	1761-64, 1782-84, 1799	1808
		Germany	NRF	NRF	NRF	1834
		Ireland	NRF	NRF	1761-64	NRF
		Italy	NRF	NRF	1799	NRF
		Russia	NRF	NRF	1771	1820
		Spain	NRF	NRF	1761	NRF
Measles	Americas	Caribbean, Guatemala	1517, 15191523, 1529	NRF	NRF	NRF
		Argentina	1628, 1634-35, 1645	NRF	NRF	NRF
		Ecuador	1558, 15851591, 1597	1611,1612, 1618, 1628, 1634-35,1645	Endemic from 1785	Endemic
		Central America	153134,155963,1576-80	1604, 1613-17	Endemic	Endemic
		Peru	1531-33, 1557-62, 1585-91	16111614, 1618, 1628,1634-35, 1645	Endemic	Endemic
		United States	1533-1533,1592-96	1635, 1657, 1687	1713-1715, 1727,1729, 1739-40,1747,1759, 1772, 1788	1802, 1820, 1837, 1848, 1861-65, 1878-1879, 18831884
	Europe	Canada	NRF	1635, 1687	NRF	1819, 1844, 1846, 1865
		European Union	Endemic	Endemic in 1629–1700, 1665,1675	Endemic 1700, 1800, 1740, 1762, 1751, 1781 1783	Endemic 1808, 1811-1812, 1839, 1846-49, 1882
Rinderpest	America	The entire region				
	Africa	The entire region	NRF	NRF	1726-65	1887-97
	Europe	European Union	1514, 1559, 1598	1609, 1616, 1618, 1625,1665, 1673-74, 1682-83	170922,1726-65, 1769-1800	1887-97, 18001816, 1825-37, 18441863-67, 1877

Source: Modified from UHL et al., 2019.

Figure 1: Representation of the approximate global distribution of *Morbillivirus* throughout history.



(a) *Morbillivirus* (blue) and *Rinderpest morbillivirus* (green) are the oldest *Morbilliviruses* that spread along ancient trade routes (red arrows).
(b) The importation of *Morbillivirus* to the New World and canine distemper virus (red) to the Old World during the Age of Exploration.
(c) Spread of *Rinderpest morbillivirus* to Africa and Asia due to the transboundary movement of livestock and establishment of the first *globally distributed Morbillivirus* . Discovery of ruminant plague (light orange), rinderpest (dark orange), and *Morbillivirus* in cetaceans such as seals, respectively. The development of attenuated vaccines against *Morbillivirus* in different species has brought greater control of the disease in several parts of the world.
(d) The discovery of *feline morbillivirus* (purple), a proposed new member of the genus in Asia and the United States.

Determination of the sequence of *bat Morbillivirus* (light blue with dashed line) from clinical material obtained in Brazil. *Morbillivirus* expands its geographic reach in Asia and Africa and is isolated in Turkey and China. The resurgence of *Morbillivirus* (blue with red line) in regions of the world where they were endemic.

The detection of *Morbillivirus* in cetaceans (yellow) has occurred in a wider range of widely distributed marine mammals. After the eradication of *Rinderpest morbillivirus,* the use of the vaccine in cattle was suspended. *Morbillivirus* remains globally distributed (NAMBULLI et al., 2016).

ETIOPATHOGENY

The *canine Morbillivirus of the* Paramyxoviridae *family* causes severe and highly contagious systemic disease that affects both domestic and wild carnivores (SATO et al., 2012, LOOTS et al., 2017). Infectious diseases in general are the evolutionary result of complex interaction between infectious agents and their hosts, such as adaptation of agents to host cells, specific tropism, neuroinvasiveness, immune response to the virus, specific tropism, among other factors (VANDEVELDE & ZURBRIGGEN, 2005).

The VCC genome is 15,690 nucleotides long and contains six genes. Of these, two are non-structural and six are structural proteins, which are encoded by messenger RNAs (PLATTET et al., 2007). *Morbilliviruses* are encased in lipoprotein envelopes that have an unsegmented negative-sense RNA genome that encodes a single matrix protein associated with the envelope.

The envelope consists of the N nucleoprotein and M protein that is located on the inner surface of the envelope, displaying two surface glycoproteins: the fixation protein (H) and the fusion protein (F). The cellular receptor for the H protein "in vivo" has not been determined. *Morbilliviruses* also have two proteins associated with polymeric RNA (polymerase complex), which are phosphoprotein P and large protein L, and a nucleocapsid protein (N) that encapsulates viral RNA (VANDEVELDE & ZURBRIGGEN, 2005; SATO et al., 2012; LOOTS et al., 2017).

Fusion protein (F) is a classic type I glycoprotein, composed of 662 amino acids essential for viral penetration and dissemination in the host. The translation of the F protein begins at the first codon of initiation, AUG1, or the second codon, AUG61, generating the pre-F0 AUG1 and pre-F0 AUG61, which are translocated to the endoplasmic reticulum and cleaved between amino acids 135 and 136 by a cell signal peptidase, thus producing a peptide of 75 or 135 amino acids, depending on the codon of the translation (VANDEVELDE & ZURBRIGGEN, 2005; SATO et al., 2012; LOOTS et al., 2017).

For membrane fusion to occur, the F protein undergoes a cascade of changes, the F protein represents a potentially active structure of receptor- and hemagglutinin (H)-dependent fusion for the plasma membrane, the F protein undergoes conformational changes, which finally lead to membrane fusion (PLATTET et al., 2017).

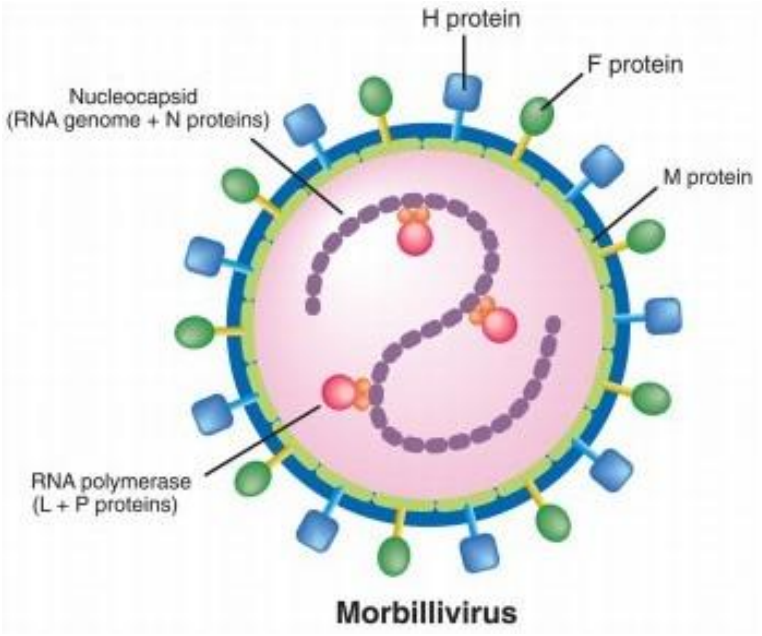
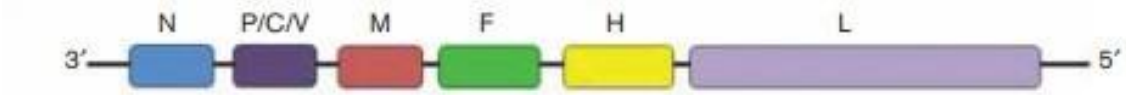


Figure 2



a) The figure shows the viral particle with the lipoprotein envelope, containing the ribonucleoprotein complex consisting of the nucleocapsid. In the envelope, there are M proteins, fusion protein F, and hemagglutinin (H). Viral RNA polymerase contains the L and P proteins (Adapted from SATO et al. 2012 and LOOTS et al., 2017).

b) The two glycoproteins, the hemagglutinin protein (H) (yellow) and the fusion protein (F) (green) together with the large protein L (purple) constitute the ribonucleoprotein complex (RNP) (Adapted from SATO et al. 2012 and LOOTS et al., 2017).

SLAM: THE *MORBILLIVIRUS* RECEPTOR AND THE MECHANISMS OF VIRUS ENTRY INTO THE HOST CELL

SLAM (Membrane Lymphocyte Activation Molecule) acts as a cellular receptor for *Morbillivirus* (FUKUHARA et al., 2019). SLAM is a member of the immunoglobulin superfamily subset and has two extracellular domains (V loop and C2 loop) along with a transmembrane region and a cytoplasmic tail. The interaction between the H protein of *Morbillivirus* and the V domain of the SLAM molecule in target cells is responsible for *Morbillivirus infection* (YADAV et al., 2019).

Morbilliviruses mainly use three types of receptors, which play a role in host specificity and the tropism of viruses in tissues. The signaling lymphocyte activation molecule, SLAM, is the main cellular receptor for viruses in humans, cattle, and dogs, first

identified in humans as the activation receptor of T, B, and B cells induced after activation (YADAV et al., 2019).

Human SLAM is selectively expressed in lymphoid tissues, so human SLAM exhibits tissue tropism. Dogs and cattle have a SLAM molecule homologous to human SLAM that acts as a cellular receptor for VCC and RPV, respectively (TATSUO & YANAGI, 2002).

The mechanisms of entry of *Morbillivirus* into host cells are important to determine its multi-host characteristic and tissue tropism. *Morbilliviruses* have two glycoporteins, hemagglutinin (H) and fusion protein (F) on the viral surface. During the virus invasion, the H protein binds to the host's entry receptor, SLAM, which is also known as CD150. SLAM is an immune cell-specific protein, expressed on the surface of thymocytes, activated lymphocytes, mature dendritic cells, and macrophages (FUKUHARA et al., 2019).

The SLAM receptor is considered a determinant of immunosuppression and induces conformational changes in the F protein, causing the virus to melt to the plasma membrane of the host immune cells. During fusion, some amino acids of the H protein are important to favor the binding of nectin-4 that is expressed on the cell surface, being responsible for the susceptibility of infection by *Morbillivirus* (MESSLING et al., 2005; FUKUHARA et al., 2019).

Figure 3: The 5804PeH strain of the wild-type VCC infects nectin-4-expressing cells in humans and dogs. Members of the VCC and measles virus groups share tropism and common diseases. The study suggests that the abundance of nectin-4 as a VCC receptor on the cell surface is related to its susceptibility to VCC infection. Fluorescence images were captured four days after infection and superimposed with contrasting phases; nectin-4 in the corresponding cell line shaded with IgG; nectin-4, nectin-4-red antibody (NOYCE et al., 2013).

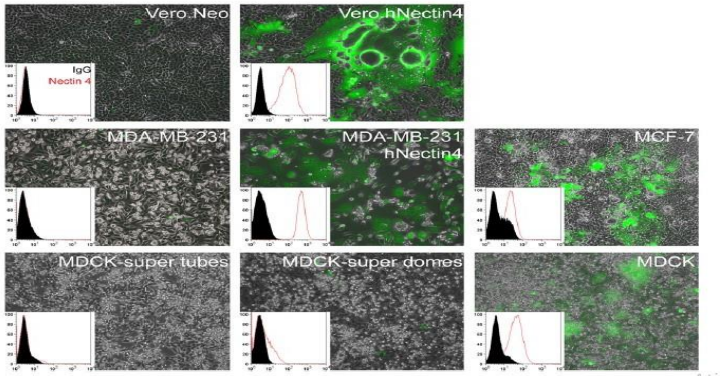
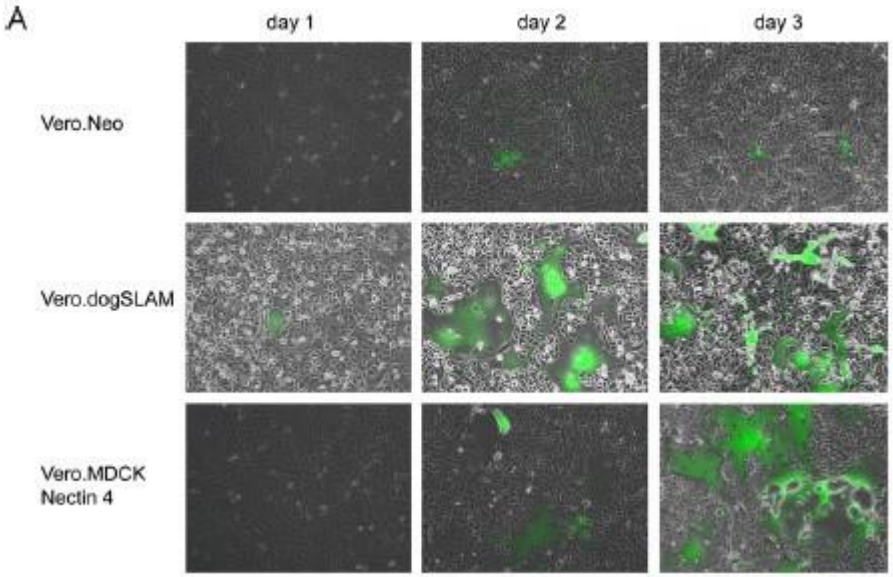


Figure 4: Wild-type CDV5804PeH efficiently infects Vero cells that express dog nectin-4. Canine Vero cells express SLAM. The nectins-4 of the MDCK (canine kidney cells) expressing dog nectin-4 and a plasmid in the control group were infected with the CDV5804PeH strain. Contrast and fluorescence phase: Images were captured and overlaid to visualize the extent of virus replication, with a significant increase in CDV5804PeH. (Adapted from NOYCE et al., 2013).



For many years it was believed that CCV reproduced in the respiratory epithelium before disseminating, but it has recently been concluded that CCV infects macrophages and dendritic cells of the airways using SLAM as a cellular receptor. Infected cells cross the respiratory epithelium and transport the infection to the lymphoid organs, causing viral replication. Nectin-4 is an immunoglobulin, known as the host exit receptor, interacts with high affinity with the viral attachment protein through its distal membrane domain, enabling viral dissemination in the airways. (MÜHLEBACH et al., 2011).

Morbilliviruses infect cells that express CD46 and SLAM, but they also infect other cells through the cell receptor, nectin-4. The cells that express nectin-4 are the epithelial cells, cells of the trachea, bronchi, lungs, oral cavity, pharynx, esophagus, intestines, liver, and urinary bladder. Nectin is a family of adhesion molecules, but only nectin-4 is an epithelial receptor for *Morbillivirus* (YADAV et al., 2019).

Nectin-4 has a transmembrane glycoprotein in its structure with three similar ectodomains, a transmembrane region and a cytoplasmic tail. It is expressed basolaterally in the epithelial cells in the vicinity of infected lymphocytes and dendritic cells and acts as a viral receptor through a mechanism similar to the interaction between SLAM domain V and *Morbillivirus H protein* (YADAV et al., 2019).

SLAM is an efficient receptor for wild VCC in canine tissue cultures. In immunocytochemical analyses, SLAM is expressed in a limited way in the CNS compared to lymphoid tissues, showing that there are probably other viral receptors (VANDEVELDE & ZURBRIGGEN, 2005). The transmission of *Morbillivirus* occurs through aerosols to the

respiratory tract, and the first replication occurs in lymphoid tissues, causing severe long-term immunosuppression (VANDEVELDE & ZURBRIGGEN, 2005; COSTA et al., 2019). The SLAM receptor in the immune system correlates with immunosuppression associated with Morbillivirus-mediated cytolytic infection in lymphoid tissue. Other receptors are responsible for the entry of VCC into nectin-4, as the epithelial cell receptor contributes to *Morbillivirus multitropism*. The SLAM receptor binds to the H protein of the distemper virus in specific regions, which comprise 500 to 550 amino acids (COSTA et al., 2019).

After six days of infection, all lymphatic tissues are affected and viremia is developed (KIM et al., 2001). The incubation period is approximately 1 to 4 weeks, depending on the immune status of the affected dogs (AWAD, 2019). Dogs without antibodies against the distemper virus die in approximately three weeks after infection (KIM et al., 2001).

At the beginning of the infection, the distemper virus invades macrophages, respiratory tract and later affects other organs such as the gastro-intestinal tract, lymphoid organs, urinary bladder and central nervous system. The manifestations can be subclinical to lethal, and the main clinical signs are fever, respiratory, gastrointestinal and dermatological changes (ATHANASIOU et al., 2017).

The depletion of lymphocytes, especially TCD4 cells, due to lymphoid cell apoptosis in the initial phase causes persistent immunosuppression, and secondary bacterial infections may occur. (BEINEKE et al, 2009).

During the acute phase of infection, T cells are more affected than B cells, while CD8+ cells are less affected and recover faster compared to CD4 lymphocytes. After 10 days of infection, CCV replicates through epithelial tissues, causing multisystem involvement in the respiratory tract, gastro-intestinal tract, and dermatological changes (BEINEKE et al 2009; VANDEVELDE & ZURBRIGGEN, 2005).

On its way to the CNS, the CCV invades the brain through infected mononuclear cells, circulating through the cerebrospinal fluid (CSF) and fusing with the ependymal lining of the ventricles, causing periventricular and subpial lesions. When it affects the CNS, it determines the neurological syndrome with demyelinating lesions, which can occur within 3 weeks of the onset of infection. Neurological signs can occur in the absence of systemic signs (VANDEVELDE & ZURBRIGGEN, 2005).

The virus can cause damage to the brain, such as demyelinating leukoencephalomyelitis, and to the spinal cord, which induces immune-mediated chronic neurological manifestations, with increasing levels of MHC class II molecules as a result of the virus's permanence in nervous tissue (BEINEKE et al 2009; KLEMENS et al., 2019; RENDON-MARIN et al. 2019). Demyelination occurs mainly in astrocytes, with hypertrophy

of these cells, isomorphic gliosis, reactive astrocytes (gemiocytes) and, occasionally, the formation of astrocytic syncytial (KLEMENS et al., 2018).

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MANAGEMENT AND NURSING IN THE TRANSDISCIPLINARITY OF HUMAN CAPITAL ASSESSMENT

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ABSTRACT

A model of evaluation of human capital is presented, through a tripartite system; that is, three members carry it out, becoming a broad vision that makes it possible to reduce biases in such management; its objective is to make known why this tripartite system is ideal for the evaluation of the performance of the human factor of nursing. The method developed was focus groups, with the group interview being the technique executed; In it, the participants presented their ideas, which were recorded, and later transcribed; Thus, the exhaustive and critical reading of data together with an interpretative framework of content, proceeded to carry out the analysis of these, an action that allowed to understand the perspective that the twenty-eight participants had. With the support of the chromatic technique, the information was brought together in order to integrate the categories. Regarding the scientific discussion, conceptualization was carried out, then the contrast of empirical data with Campbell's theoretical foundation, arriving at logical reasoning. The predominant result was: technical performance, technical skills, quality indicators, initiative, work effort, workload, respect for bosses and colleagues, absenteeism/work presence, leadership among team members, collaborative work, availability, individual contribution to the work team, care management. In conclusion, performance evaluation is a critical and reflective process that goes beyond all dimensions of the work of nursing professionals, it is evident that giving an important value in the evaluation to respect for bosses, patients and colleagues, directly influences work attitudes, user satisfaction and the progress of the health organization.

Keywords: Nursing. Management. Nursing Evaluation. Personal initiative.

INTRODUCTION

The evaluation of human capital is described, from the perspective of performance evaluation, in which elements that answer the question are considered: Is the tripartite system ideal for evaluating the performance of the human factor of nursing?, Currently, the available evaluation methods leave aside the reaction and experience of those evaluated, however, it should not be limited to a simple superficial and unilateral opinion, without a broad vision that reduces the biases of the evaluation process.

This is due to the high degree of perception of injustice, due to the lack of motivation and dissatisfaction related to the prevailing evaluation system, mainly due to the poor precision of the assessment, qualification, the lack of initial definition of consistent objectives, which measure adequately, and allow feedback; in addition, it must be in accordance with the reality and characteristics of nursing.

Performance evaluation assumes the role of being a strategic instrument for the management of the human factor, for the provision of quality services; through the implementation of formal performance evaluation systems, organizations seek to obtain the potential utility of controlling and improving the performance of their employees, to have a measurement system capable of neutralizing subjectivity, provide measures to improve the performance standard of their subordinates, as well as make them understand that evaluation is an objective system, which allows them to know everything about their performance (Chiavenato, 2019), and thus differentiate between performance and merit. In this sense, the **objective** is to make known if the tripartite system is the ideal one for the evaluation of the performance of the human factor in nursing.

PATH TRAVELED

The research was carried out under a qualitative approach, since this methodology answers questions about why people "do what they do" and seeks to understand the meaning of the experience or explore a phenomenon from the point of view of the other. The theory that supports the study is the performance evaluation theory developed by Campbell, as a theoretical reference, which is based on basic substantive factors of individual performance in a job role (Campbell, 2015).

The research was carried out in two stages, the first to diagnose the phenomenon to be studied (performance evaluation), the second in order to develop a tripartite performance evaluation instrument.

The focus group method was used; the technique instrumented was the group interview; therefore, groups of nurses were brought together to work with the concepts:

evaluation of the effort/initiative of the nursing staff, professional practice, as well as evaluation of technical performance.

Four planned sessions were held, lasting one to two hours. The first meeting was to inform the management authorities, so that they could designate participants who met the inclusion criteria. The sessions were held with the attendance of six to eight people in each of them. To establish a comfortable environment where the focus groups were developed, a place with adequate structure, ease of access for the participants, which would offer a welcoming, comfortable environment, with privacy, good lighting and adequate temperature was sought. Each session began with a brief presentation of the research project, the objectives and the reason why they had been convened were clearly announced, in addition. They were given, in writing, an informed consent; Later they were assigned a letter and a number to maintain anonymity.

During the development of the focus group methodology, the participants presented their ideas, which were recorded by means of a recording, and then transcribed rigorously; then an exhaustive and critical reading of these data was carried out. With the support of the chromatic technique, the relevant information was brought together, in order to form the categories and subcategories, thus, the object of study was achieved. The analysis of the data was carried out through an interpretative framework of content, to respond to the guiding questions and in turn, to the objectives set, as well as to understand the perspective that the different social actors had on the evaluation of performance. The scientific discussion was developed with conceptualization, then the empirical data was contrasted with Campbell's theoretical foundation, to arrive at a logical reasoning, and finally, the presentation of results.

The findings are the product of the experience of personnel who have participated for more than five years, at least, in evaluations, considering supervisors, heads of service and operational personnel, where these three actors must participate in the work performance evaluation system, integrating parameters such as:

TECHNICAL PERFORMANCE

All models recognize that virtually jobs or job roles have technical performance requirements; these can vary depending on the substantive area and the level of complexity or difficulty within the area. The work roles will be variable according to the measure of efficiency and their levels of effectiveness, to facilitate teamwork, by getting each of the collaborators to perform their roles or performance techniques. According to Belbin's theory (Catalá, 2022), when completing or interpreting work roles, the ability to fulfill central

interpersonal tasks is required, capable of providing the necessary care to patients, clients, or community members, thus assuming the commitment to quality in service due to the growing demand of clients (Herrera, Cantero & Leyva, 2021).

TECHNICAL SKILLS

The technical skills of nursing professionals are based on the rigor, scientific knowledge, and creativity that are required when performing the practice to provide care in the use of equipment during the execution of interventions (Moreno, Martínez, & Serna, 2022). They describe skills as those that seek to carry out the practice of their values in the areas of action that are carried out, such as patient care (Chaca & Contreras, 2021). To achieve a safe performance of technical skills, both theoretical knowledge and the ability to adopt critical thinking for each specific situation are required, in this sense:

> The technique is not according to the profile they have. In this area we see the profile of our personnel, whether or not they have the code with which they are being paid, if they have those skills, then we evaluate them at that level (S-1).
> Review the procedures in this technical aspect: if you are really using the correct hand washing, if you are using the correct notes for your patient, the venoclysis technique, the bladder catheter technique (J-6).

Derived from the above, it can be reflected that, as pointed out by Rodríguez (2021), working in a team is to add skills and abilities of the different members of the team, which will have the consequence of enhancing the results of performance evaluations such as the efficiency and effectiveness of a company. Regarding nursing teamwork within a hospital, the same purpose or objective is sought: to preserve the well-being of patients, developing a more complex care environment that, interrelated, will allow progress towards the achievement of functional results (Paravic, Lagos, 2021). Today, increasingly technical and complex health care places great demands on nursing professionals to meet the demands of the health organization, therefore, technical skills have considerable value to be included in performance evaluation.

QUALITY INDICATORS

Quality indicators are a tool for improving the quality of nursing, used to monitor and compare patient outcomes, as well as satisfaction in services. For the foregoing, it is stated that:

> One way to evaluate this technical competence is with [quality] indicators (J-5).
> Considering in this aspect, the indicators that we are carrying, I think it is a good way to evaluate this technical aspect (J-6).
> I would take in this aspect the indicators, from how the nurse presents herself to the patient, how she addresses him, how she carries out that treatment (J-6).

It is evident that quality indicators are recognized as an indispensable tool as they are a set of principles, procedures, and evaluation scales used to quantify the level of quality of nursing interventions, and thus evaluate the results of nurses in clinical practice (Afaneh, Abu-Moghli, & Mihdawi, 2024).

At the international level, the use of quality indicators to estimate performance has become standard practice in order to improve results and competitiveness; becoming a gateway to the dynamics of improvement cycles and an unavoidable component of quality design or planning, so it is necessary to include in the performance evaluation system.

INITIATIVE/EFFORT

Initiative and effort are actions that are easy to observe, it is anticipating events in the development of ideas that act in favor of carrying out activities within teamwork, and thus provide a wide quality of service (Adecco, 2020). Among these, we find:

PERSONAL INITIATIVE

It is a developed set of cognitive and behavioral skills that facilitate self-improvement (Vuyk, Codas, 2022). It has been considered as a behavioral syndrome directed towards self-initiated, proactive, persistent work, capable of modifying the environment and reorganization. In competitive terms, limiting oneself to doing only what is asked does not allow efficient performance, consequently, individuals must display a wider range of behaviors. This manifests itself in:

> If I have initiative, I say - it's okay - the patient comes infiltrated, - I know you have more activities, I channel it here (J-1).
> A colleague tells me -boss, I prepare the patient-, then there is availability, we make a team, another example -I help my colleague who is going to come in later- (J-6).
> A colleague says to another – I'm going to talk to dietology to request a diet – so it's something non-specific, that's an initiative that nurses have to solve (J-6).

These expressions reflect that personal initiative is a predisposing factor to participation in the improvement in the organization, compliance, by showing that individuals must be aware of and accept the order to make an effort (Low, Ramos, & Hernández, 2020). Currently, nursing managers require active participants in the work, instead of passive people who only perform what is stipulated in their job description, and/or explicit to improve the dynamics of work performance, for that reason, it is essential to consider personal work initiative as part of the performance evaluation.

WORK EFFORT

Work effort, also known as job performance, will not be contemplated only with the quality of the service provided by the employee, it also includes their competencies as a service provider and interpersonal skills, these will be directly involved in the behavior and the way in which the work is carried out (Medina, 2022). Work effort is a measurable behavior that is affected by motivation. Therefore, motivating employees to increase their work effort to achieve organizational goals is an important issue for managers. For this reason, it was considered relevant to determine how work effort in nursing is evaluated, since:

> There are colleagues who do not limit themselves to their work (S-6).
> Do not limit yourself to saying "ah no, I am hired as a technician and I do not do this" (J-6).
> Functions that do not correspond to their academic degree, functional code, physical possibilities (E-6).

The congruence with Zaragoza, Silva, Pineda, and Salazar (2023) is reflected, who define job performance as the set of actions and behaviors observed in the individual who occupies a job in an organization, in relation to the content of their position, attributions, tasks, and activities to be developed. In addition, if they have the freedom to do so, people can carry out their own job redesign —that is, change the behavioral content of their job roles— to better use their knowledge and skills, increasing the effort they are willing to make; The more intense people's efforts, the better they will perform. This element is a good predictor of work performance, so it is extremely important to take it into account in the evaluation of the performance of the human factor of nursing.

WORKLOAD

It is a factor that contributes to the appearance of negative outcomes, especially in seriously ill patients, and the daily increase in the number of patients assisted by these professionals is considered a nursing care workload (Olivera, Januário, Toledo, et al., 2020). The nursing workload is related to currently controversial issues that impact health care in the world: safety and quality of patient care, job satisfaction and nurses' health. The high level of workload experiences decreased levels of performance quality. Therefore, it is considered essential:

> We have such an organized team, they work so well, without us telling them, if they don't see personnel, one says "I'll keep two patients" and another says "I'll take the vital signs", they organize quickly (S-6).
> Well, if I have already finished my activities and I see that the boss has pending activities, then help her (J-1).

> So I would evaluate the effort of the nursing staff according to the workload they have, because sometimes there are few nurses with many patients (J-5).

A moderate workload greatly improves performance, significantly affected by extreme levels of workload, whether it is very low or very high. Very high workload levels are likely to produce feelings of helplessness and burnout, which could cause employees to abandon their efforts. On the other hand, nurse managers must carefully manage the distribution of the workload to ensure efficient staff performance, as it can compromise the quality of care offered to the patient; it is important to establish a minimum demand on the workload to guarantee quality care and assistance (Olivera, Januário, Toledo, et al., 2020). In addition, it is necessary to consider the workload of nurses to ensure optimal performance.

RESPECT FOR BOSSES

In any area of work, respect for hierarchies is paramount. The boss-subordinate relationship is hierarchical within an organization; otherwise, it directly affects employee morale, productivity, job satisfaction, and ultimately, organizational success (Nouel, 2023). In the same sense, respect can be manifested in a scale of values that one possesses oneself: from the show of affection towards others, the body movements shown when communicating with others, the attitude towards conflict situations, as well as the excitement. This aspect is raised as follows:

> Respect for lines of authority, I think it is the maxim of discipline to respect that line of authority, to respect the boss, to respect colleagues, to respect our supervisors (J-6).
> There are people who can be very excellent in the operational, but they have a very bad attitude of addressing both the supervisors, their equal rank, sometimes with the user (S-3).
> Respect for both the staff, our superiors, the staff in charge, the patients and their families (E-6).

When a person has respect for his manager, the productive potential of the company improves; good employee relationship management is critical to organizational success (Nkeobuna, 2020). Leaders should adopt "respect" as a guiding principle for treating their subordinates fairly. Consequently, employees' respect for managers can be strengthened when leaders are sensitive to the needs of their followers and strive to help them by acting with revelatory sympathy and kindness. The quality of the respectful relationship that the nursing professional has with his or her manager influences the nurse's work attitudes and performance.

RESPECT FOR COLLEAGUES

When people get sick, they enter a state of fragility, vulnerability and dependence that can negatively affect them, therefore, the nursing professional must preserve their dignity through respect and adequate care, since the former is defined as the honor of nurses in terms of rights, privacy and human dignity on the part of health professionals. patients and other colleagues. For Rudoph, Katz, Ruppel et al., (2021) respect is essentially a moral attitude that, when translated into action, manifests itself as the demonstration of admiration, consideration, esteem and/or kindness, as well as consideration for the other. All definitions of respect imply that one person recognizes the value of another; that is, that it gives dignity to the human being; This refers to:

> As a supervisor, he tries not to make a bad comment to the classmate, so that he does not get offended or will take it badly, thinking of telling him "try to address you with respect", the classmates say "he is not very treatable" (S-6).

In this sense, the absence of respect in employment is an important issue that can have a negative impact on both the work environment and the productivity of the organization (Brown, 2020). Likewise, disruptive behaviors in the workplace create unhealthy work environments, the absence of respect such as direct verbal or physical harassment behaviors, open exclusion of the worker, dissemination of rumors and/or withholding of information, could affect work performance, and often result in poor results in the organization in general and in particular health.

ABSENTEEISM/FACE-TO-FACE WORK

Face-to-face absenteeism refers to the loss of time in activities that are not productive at work while in good health. The reasons may be: having a low workload or minimal supervision by managers (Sesma, Smith, 2020). Likewise, presence and permanence in the work area are directly related to the feeling of lack of competence, effort or knowledge; lack of expectations, work horizons and generalized dissatisfaction. This aspect is interpreted as follows:

> It is believed that discipline is to be there in the service, but they do not do the functions, we see them a lot in the services that are 15 minutes with the patient and 4 hours in other activities, they do not really perform the functions that they have to do to the patients (S-1).

Consequently, hospitals, as an important service sector, encounter this behavior that causes loss and waste of personnel, which leads to a lower quality of services provided to users. This phenomenon seems to be costly for organizations, but also in the nursing field,

where it has a negative impact on patient health and safety (Abdelmoteleb, 2020). Nursing work refers to continuous and quality care, so being absent or wasting time in other non-work activities decreases the quality of care, as well as work performance. Herein lies the importance of estimating the permanence in the service within the performance evaluation.

PEER/TEAM MEMBER LEADERSHIP

The content of this factor parallels the actions that comprise supervisory leadership. The defining characteristic is that these actions are in the context of the interrelationships between peers or team members and the relationships between them can be at any organizational level (Campbell, 2021). In view of this, it is proposed to evaluate the performance in nursing work teams as follows:

> In nursing it has always stood out for working as a team, these personnel cannot work individually. That is, in whatever service you say, you have to work as a team, from the boss to the operational nurse, the floor is divided and they work in teams (J-2).
> In fact, nursing work is teamwork, -we are in an area and to provide quality care-, I have seen it, when the patient requires something, if the colleague is busy, I have an attitude of service, I provide what she requires (J-1).

These opinions reflect that teamwork skills are essential for successful collaboration between individuals or groups and involve the ability to communicate effectively, cooperate with others, and manage conflicts (Navarro, 2023. It should be noted that nursing supervisors have understood that, in order to advance in human talent management strategies in the hospital institution, it is necessary to integrate the staff into work teams that promote a balance between the capacities and behavior of nurses, in which each of its members assumes the responsibility of performing their role and actively participating with the others. imbued with a sense of solidarity and support that contributes to the achievement of objectives (Gómez, Gómez, 2020). Due to the nature of nursing work, several tasks must be handled at the same time, so teamwork is key to accomplishing them. In addition, a team culture must be created that achieves mutual cooperation, hence the importance of including this category in the evaluation of work performance.

COLLABORATIVE WORK

Nursing teamwork leads to better patient care, reducing sentinel events, fostering stronger teamwork among nursing staff is essential to promote effective multidisciplinary work (Baek, Han, Cho, 2023).

Collaborative work is considered when. the members are focused on the same goal; that is, they do not work alone and must recognize that one needs the other, as shown:

> The activities that have to be done as a team, such as counting service material during the delivery and reception of patients in the shift link (S-4).
> Teamwork is reflected when service is delivered on time (S-5).

There is agreement that teamwork is considered a key factor for patient safety and it is recognized that good teamwork is one of the assumptions of a healthy nursing work environment (Bragadóttir, Kalisch, & Flygenring, 2023). Collaborative work, as an articulated process designed together to achieve the objectives of the organization, will facilitate work and performance, while promoting the integration of agents, knowledge and actions, as observed in several actions:

> From the initiative that the staff may have, both for care and for collaboration with their colleagues (J-6).
> When there are, or are not enough, personnel, one says "I am left with two patients" and another says "I take vital signs", they organize quickly (S-6).
> There is something that the head of service evaluates for us, among those is teamwork (E-5).

The foregoing refers to the fact that one of the best examples of teamwork is the daily work of hospitals, since a large number of the activities carried out in a hospital organization are the result of teamwork, where coordination and cooperation allow the achievement of objectives, guaranteeing warm care, safe and efficient (Rodríguez, Secín, & Ramírez, 2021). Therefore, nurse managers must capitalize on core attitudes to develop and maintain effective team performance. In addition, it is necessary to provide organizational support that can improve the possibilities of collaborative work and the decision-making capacity of nurses. This will maximize the efficiency of the professional practice of nursing work.

AVAILABILITY

Availability for work is defined by the sum of two factors that must come together simultaneously in a person: that they want to work; and that it can do so (Gómez, López, 2021). This condition is decisive for the development and proper functioning of teamwork, as indicated:

> If there is an event, we all enter at the same time, even if it does not correspond to me, however, I have the availability, that is what I would evaluate (J-6).
> I evaluated in relation to availability. I have staff who come in at 7 am, a patient is going to have surgery at 8 am, then a colleague tells me "boss, I'll prepare it". So, there is availability, we make a team, I help my partner who is going to come in later (J-6).

This coincides with the argument of Rodríguez, Secín, and Ramírez (2021), who point out that, when teammates are perceived to be constantly available to collaborate,

teams may be able to more effectively use their skills and knowledge, use task-appropriate performance strategies, and be prepared to implement organizational changes. The availability of team members and other aspects of the team structure improve performance, impact other team and organizational outcomes; hence the importance of considering it in the performance evaluation.

INDIVIDUAL CONTRIBUTION TO THE WORK TEAM

To improve teamwork skills, it is necessary to create a culture that achieves mutual cooperation, as it allows institutional objectives to be achieved more efficiently, and even to achieve objectives that would otherwise be impossible to achieve (Peiró, 2024). Individual contribution to teamwork refers to the degree of positive participation of the nursing professional in the analysis, activities, and problem solving to achieve the objectives and goals of the health organization in a timely manner. Cooperativism has made it possible to unify individual efforts, which leads to identifying opportunities and achieving more satisfactory and productive work, since teams are made up of people with different knowledge, skills and attributes, who contribute particular characteristics to the team's performance, as marked:

> How do I evaluate? When the critical patient arrives at the shock room, there is no need to give them the indication to integrate, immediately the team is integrated, and each one knows its role, those who remain remain with the patients (J-5).
> In the service, a colleague who is a nurse in intensive care, his category is not that of a specialist, it is that of a general nurse; however, if we have problems in inhalation therapy, we ask for support. He with all the availability, performs not with the category, but with the knowledge he has. I think that is also worth a lot, that attitude and that performance have to be evaluated (J-6).
> So, there are people with many skills, they share it by carrying out a program of in-service teaching, the willingness of the compañeras to say that I consider that we have failures. I give the subject that is required, they share their knowledge, I consider that this is teamwork (J-6).

This shows that, in the teams of a hospital, most of the members value contributing so that everyone is a benefactor and beneficiary, as well as making skills, gifts and talents come together, establishing a more enjoyable work, by getting them to be members of the work team (Rodríguez, Secín and Ramírez, 2021). In work teams, the competencies of their members determine the level of performance.

In this sense, the team will be defined by the synergies that are achieved between the nursing professionals, the defined specialization in the tasks, the trust that is obtained between them and the skills as a team to meet the objectives they have in mind. Consequently, contributing to teamwork related to performance evaluation is essential to recognize the individual contribution of each professional.

CARE MANAGEMENT

Nursing care management is understood as the professional practice of nurses, supported by their discipline and the science of care, through planning, organization and control actions, as a heuristic process, aimed at mobilizing human elements and resources of the environment aimed at maintaining and favoring the care of the person, who, in interaction with his or her environment, lives health experiences (Tumbaco-Quimis, Tumbaco-Quimiz, 2021), and thus receive timely, safe, and comprehensive care, in order to guarantee their continuity. A scenario in which care management becomes a rigorous task that requires analysis, deduction, discernment and knowledge; that is, the application of *nursing judgment*, based on the being, knowledge and doing of nursing as a profession and discipline (Ceballos, 2015), therefore, care management acquires transcendence within nursing practice, since:

> From the moment the patient is admitted, the nurse begins to manage. When a patient has interconsultation, application of medications, then the management for care begins, with their treatment started, with laboratory studies and X-ray rays. From there, I would evaluate nursing management for patient care (J-2).
> I evaluated from the moment I arrived, prioritizing is what I have to do. Once I have reviewed my patient, then I make the clinical records, that is the management of my operative partner. The priority is patient care, there is the management of operational personnel (J-6).

The above makes clear the congruence that enterprising nurses in care management are an adequate professional model for the contemporary labor scenario (Ferreira, 2016), since these professionals, by showing themselves in accordance with organizational goals and objectives, seek the continuous improvement of practices and processes, the optimization of time and resources, favoring organizational development.

Similarly, Hernando (2015) points out that effectively managing institutional resources, coordinating and wisely articulating the work of the team, in addition to acting as an intermediary in actions that ensure better care for users and their families, are important requirements for the work of nursing professionals in the current market, in addition to enhancing the practice of care management.

The final result, with respect to care management, is the application of the nursing process, the current form of management. In relation to the subject, for nursing, evaluation turns out to be an important strategic factor for organizational performance, since it impacts the quality of user care, so it is essential to assess it in a formal system of job performance evaluation; These implicit aspects must be integrated into the evaluation of professional performance.

CONCLUSION

Important achievements were generated for nursing management, specifically in the control element of the administrative process, since every health organization needs improved systems of evaluation measures, where the experiences, perspectives, and experiences of the collaborators in the evaluation process are not left aside or ignored. This will make it possible to transform traditional administration into humanistic management that will be able to ensure the quality of nursing care and enhance human talent to achieve the organization's objectives.

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GAMIFICATION IN THE DEVELOPMENT OF COGNITIVE SKILLS AND LEARNING FOR STUDENTS WITH AUTISM SPECTRUM DISORDER (ASD)

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ABSTRACT

The clinical picture of children with Autism Spectrum Disorder (ASD) is characterized by deficits in social interaction and communication, as well as repetitive interests and activities. Technology is an essential component in the education of students with special needs, as it allows them to access tasks that would otherwise be out of their reach. The general objective was to investigate the contribution of gamification in the development of cognitive skills and learning of students with Autism Spectrum Disorder (ASD). The most relevant results indicate that the interaction with digitized activities allowed concepts, such as mathematics, to be elaborated in a more accessible and attractive way for students, overcoming the barriers found in non-digital environments. The adoption of gamification as a teaching method has contributed significantly to the development of cognitive and social skills, highlighting the potential of these technologies to promote more inclusive and personalized learning. Despite the limitations, the results obtained reinforce the feasibility of using digital technologies in the teaching of students with ASD, aligning with the need for pedagogical innovations that meet the specificities of this audience. Thus, by adopting technologies as teaching tools, the education of students with ASD can become more dynamic, accessible, and effective.

Keywords: Education. Inclusion. Autism Spectrum Disorder. Gamification. Technology.

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INTRODUCTION

The theme covering autism has been widely disseminated in literature, magazines, social media, and, therefore, society has been gradually, although incipiently, beginning to be interested in the subject, however, it is worth mentioning that there is still a need for comprehensive knowledge of the disorder, which can contribute to society and the difficulties faced by parents and family members who have children with this type of disorder in their contexts.

Currently, Autism Spectrum Disorder (ASD) affects a significant number of people who have communication and socialization difficulties, which results in complexities for their learning. Studies are being conducted indicating the use of technology and computer-based interventions to teach people with ASD language and social skills.

Corroborating, Moraiti et al., (2023) add that according to numerous studies, information and communication technologies (ICT) offer new opportunities for people with developmental disorders to develop their autonomy and independence in their daily activities. For Hodges and Fealko (2020), in particular, according to the following research participants with cognitive difficulties and autism spectrum disorder used two technological tools to carry out their educational activities. The combination of visual and textual information significantly helped students with cognitive disabilities and ASD to focus on the content presented, avoiding usability and accessibility issues and therefore improving their learning process.

The advancement of technologies is becoming present in the most diverse branches of the areas of human knowledge, and when it comes to education, it is evident that technologies are also increasingly present in the learning processes of students.

The use of new technologies as effective teaching tools can be the answer to some of the specific educational demands of students. According to Vlachou (2023), due to the accelerated pace of technological advancement and its effects on the educational scenario, the presence of information and communication technologies (ICT) in society is a reality that needs specific consideration and continuous evolution. In an effort to improve their teaching outlook using ICT equipment, most institutions have included this technology in their educational institutions.

According to Bouzas and Pérez (2022), the integration of the different types of digital games environments and SG in the educational context is increasingly noticeable, also in the field of Special Education. Specifically, people with ASD tend to prefer digital resources over traditional ones, in order to interact for educational purposes, since their structure and support are adjusted - to a greater extent - to their cognitive processes.

Therefore, the playful activity in the form of games is actively correlated with the daily life of society, evidencing in itself its rules, ideas, limits, witnessing itself in society in norms and imposed rules that must be followed due to the cultural structures that are taught and passed on to the people to organize themselves in the society in which they live and that they act day by day, and each time appropriating new changes that occur in the historical-cultural context of society.

Thus, the present study seeks to present strategies for teachers to achieve the inclusion of students with ASD, and the role of assistive technology, with identification of its benefits, among them: improvement of communication, organization, memory and attention skills.

Based on the results , it is expected that this research can contribute to the integration of people with ASD in the educational context with the help of technological means. Children with ASD have different learning characteristics. Each has a preferred learning style and specific needs when receiving information. Meeting these needs in a classroom setting can be a challenge for teachers, as many are not prepared to give students at various points on the autism spectrum beyond the undivided attention needed. With this, the need for technology as an educational tool to assist teachers and improve learning among students with ASD.

To this end, the general objective was to investigate the contribution of gamification in the development of cognitive skills and learning of students with Autism Spectrum Disorder (ASD).

THEORETICAL FRAMEWORK

The term "gamification" originated in the digital media industry. The first document that used it was published in 2008, but "gamification" was only widely adopted in the scientific community in 2010, when many promoters at symposia disseminated this designation (Rodrigues et al., 2019).

Costa et al., (2018) point out that the continuous growth of digital games as a media, cultural artifact and market product has made it possible to explore new ways of employing and applying game mechanics in different contexts. It is from this perspective that the concept of gamification emerges, a term derived from the English "gamification", any application, task, process or context can, in theory, be gamified, which allows the implementation of gamification in a variety of areas.

Verzani and Serapião (2020) report that, among the strategies employed to increase motivation, gamification has stood out as a widely used resource. The application of

techniques from the area of games, even if out of context, aims to foster motivation for the involvement, engagement and interaction of people, also reaching areas such as training and health. In addition, gamification contributes to the pursuit of goals through extrinsic motivation. However, when motivation is intrinsic, individuals tend to resume the practice on their own initiative, while those who are extrinsically motivated need an external stimulus to resume the activity.

Digital games employ several methods to engage and motivate the player to achieve their goals; Gamification seeks, therefore, to address these methods and apply them in everyday situations. Scoring systems, badges and other forms of reward can, in addition to encouraging the user, foster the creation of rankings and, consequently, promote a form of competition that stimulates participants. It is important to note that there are other elements that fit the context, which will be detailed in subsequent topics. Gamification can be implemented in digital or non-digital environments, creating both online and offline experiences that promote a greater degree of interaction and socialization. It must also be recognized that, just as there is no single type of game, there is no single method of gamification: the incorporation of game elements into the method — and the way they will be used — will depend entirely on the context in which they are inserted (Costa et al., 2018).

Magalhães et al., (2019) explain that gamification enables the recreation of reality, transporting the user to an environment that incorporates audiovisual and interactive elements and stimuli. This leads to an innovative approach to a given content, allowing the reconfiguration of daily activities both in the classroom and outside it. This process stimulates the user, and the design and elements of the games empower the player by transforming interactions with services, products, policies, and daily tasks that can be monitored and modeled. In this way, the player becomes part of this scenario, changing it with each interaction. Thus, the proposal of gamification is to create an environment that combines learning and playfulness.

The inclusion of students with ASD in the regular school system has been activated over the years in the Brazilian context in Brazil (Souza and Silva, 2019). When addressing inclusive proposals, both public policies and pedagogical practices should not be limited only to providing access to education at all levels of education. A widely recognized and accepted conception currently considers that inclusion also implies the availability of all the necessary resources so that students with any type of disability can effectively become an active agent in their learning process, in addition to having ample opportunities to access historically and culturally constructed knowledge (Souza e Silva, 2019).

Corroborating, Stamberg et al., (2017) illustrate that in the contemporary social context, the promotion of inclusion represents one of the viable alternatives, with the insertion of digital resources in educational institutions being an additional tool for the development of teaching and learning of Mathematics. Thus, this study aims to present the ongoing actions resulting from a research project that proposes the use of technological tools, which are configured as a significant resource in the area of Mathematics, in addition to contributing substantially to the intellectual and emotional formation of students.

In the context of mathematics education, as in any educational field, Gomes et al., (2024) observe that technological advances radically modify the teaching and learning processes, with the use of new didactic methods and strategies, taking advantage of all the potentialities offered by them, including elements such as images, interactivity, dynamism and infinite resources, that can be used to the fullest.

The development of teaching strategies that are sensitive and adjusted to the individual abilities of students is essential for the consolidation of an effective Inclusive Education. This approach transcends the mere transmission of knowledge in subjects such as Mathematics or other areas, requiring the educator to have an in-depth understanding of the diversity and complexity present in their classroom (Santos, 2024).

According to Libâneo (2008), participation is one of the categorical elements for fruitful learning, as participation aims to ensure democratic teaching management. The student's participation in their own learning is inserted within a democratic management, which aims to democratize the school space by dialoguing with students and seeking to understand the local needs of the school community.

To effectively combat limited perceptions and promote an education that truly welcomes inclusion, it is imperative to develop and adopt innovative pedagogical practices. These approaches should be aligned with the specific needs of students with ASD, facilitating their academic and personal development. In the field of Mathematics Education, there has been a significant growth in studies and research aimed at this purpose (Santos, 2024).

METHOD

For the preparation of this article, a quantitative methodology was adopted , on the influence of gamification in the improvement of cognitive abilities and in the learning process of students diagnosed with Autism Spectrum Disorder (ASD) as mentioned by Rocha and Aguiar (2003), this research modality aims to increase the volume of data in the academic sphere and improve the quality of life of a certain group. In this sense, it is

possible to highlight, for the formulation of the research-intervention, important references, such as a certain conception of subject and group, of autonomy and practices of freedom, as well as that of transformative action.

Some applicable criteria will be outlined, which will be explained below. Among these criteria, the following stand out: ethical aspects, research environment, data collection procedures and data analysis procedures.

The first stage consisted of the preparation of an e-book that aims to present a Didactic Sequence that followed the following processes: present proposals that use different technological resources organized for students with Autism Spectrum Disorder (ASD).

An e-book (ISBN- 978-65-01-15093-2) was prepared, which aims to present a Didactic Sequence (S.D.) with proposals that use different technological resources organized for students with Autism Spectrum Disorder (ASD) in the Early Years of Elementary School, meeting the proposals of the BNCC - National Common Curricular Base for the teaching of Mathematics, for students with ASD, organized for students with ASD. This DS was applied within a private school unit, in the Brisa neighborhood of the city of Rio de Janeiro, to peers, where approximately 20 teachers participated in this moment.

In the Didactic Sequence, different technological resources and gamification strategies developed for the teaching of Mathematics were used, where teachers were able to perceive the performance of students with Autism Spectrum Disorder (ASD) in the activities proposed by the Didactic Sequence, taking into account the individual characteristics of the students, such as age, cognitive level, and ASD level.

The study involved the application of a DS entitled "Pedagogical Practices with the Use of New Digital Technologies Applicable to Mathematics Education for Students with Autism Spectrum Disorder (ASD)". Before the application, the research participants were introduced to the theme of the dissertation and the methodological path chosen. Then, an authorization form for participation, the Informed Consent Form (ICF), was made available for knowledge and agreement, in which they were informed about their rights and duties.

The field study took place in a private school unit, located in the neighborhood of Brisa, in the city of Rio de Janeiro. The sample of teachers invited to participate in the research consisted of 20 teachers from Elementary School, Early Years. All 20 teachers of Elementary School, Early Years, participated in the training. The application of the Didactic Sequence was carried out in a classroom of the institution, where I presented and explained the DS through slides. After the application of the DS, a questionnaire was

presented to the teachers to evaluate the proposed practices; for this, the Forms platform was used, in which 17 of the 20 invited teachers answered the questionnaire.

A field interview was conducted from July to September 2024, with the aim of investigating the difficulties faced by teachers. Data collection was carried out in person, through a semi-structured questionnaire, focusing on an exploratory research.

100% of the teachers who worked in this niche in a private school unit located in the Brisa neighborhood, in the city of Rio de Janeiro, were invited to participate in the research. With the acceptance of the professors, the completion of the Informed Consent Form (ICF) was requested. Then, a date was scheduled for the training to be carried out within the school unit, in which the teachers actively participated.

RESULTS AND DISCUSSION

The data collected with participating teachers revealed that in this continuous process of reflection on their practices, in daily activities, in the formulation of pedagogical practices, in the elaboration of projects that meet the interests of the school and the needs of the students.

Novoa (2019) makes an important approach, emphasizing that at the beginning of the twenty-first century, it became evident that both the contract and the educational model need to be reevaluated in a significant way. It is not just about improvements, improvements or innovations, but a true metamorphosis of the school institution.

Next, there was a survey on frequency and technological inclusion in the educational context. Among the participants, the majority, composed of 10 teachers, indicated that they use technology "sometimes", which suggests an intermittent practice, possibly related to factors such as the type of content covered or familiarity with the available tools (Graph 1).

Three teachers stated that they use technology "rarely", which may indicate a resistance to the inclusion of these tools in their pedagogical practices or a perception that technology is not essential to their teaching methods.

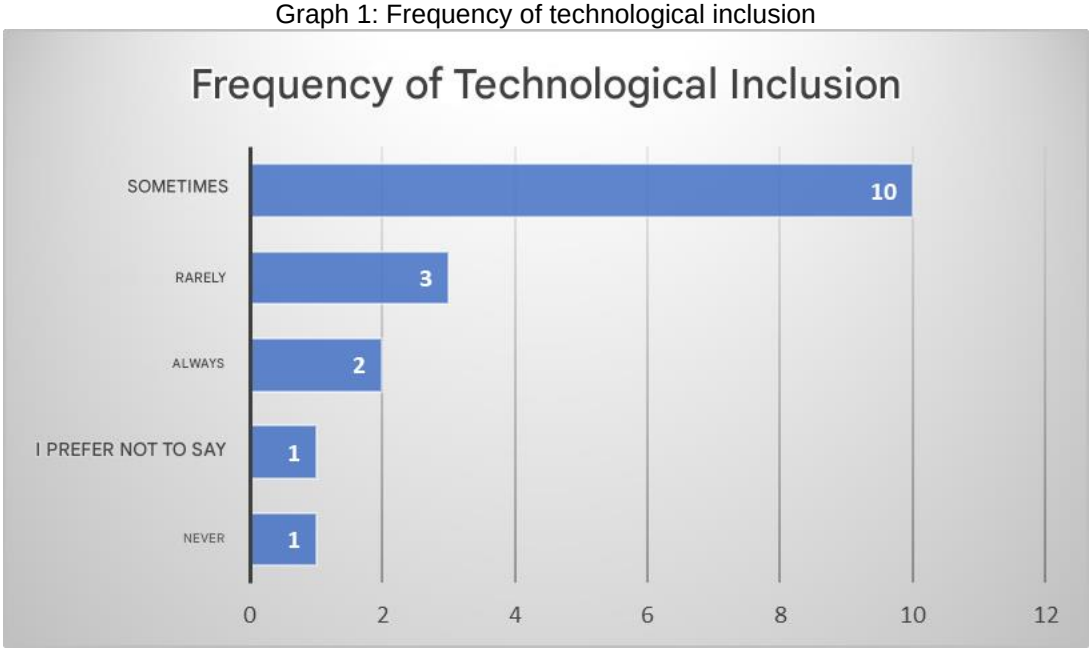
Only two teachers reported that they use technology "always", which may reflect a commitment to educational innovation and the search for strategies that promote more interactive learning.

One teacher chose not to answer, while another stated that he "never" relates technology in his classes, which is a concern, as it may indicate a disconnection with the current needs and expectations of students in relation to the use of digital tools in the teaching-learning process.

These data highlight the need for continuous training and support strategies to integrate technology more consistently and effectively into teaching practices.

According to Santos (2024), in order to implement a truly inclusive educational practice, it is essential to create learning environments that value diversity and meet the specific needs of students, awakening their interest in knowledge and fully integrating them into the teaching and learning process. This involves the adoption of innovative and non-exclusive pedagogical practices, which focus on the potential of students with Autism Spectrum Disorder (ASD), allowing the immersion of the learner both individually and collectively and promoting the pleasure of learning.

Graph 1: Frequency of technological inclusion



Source: Prepared by the author

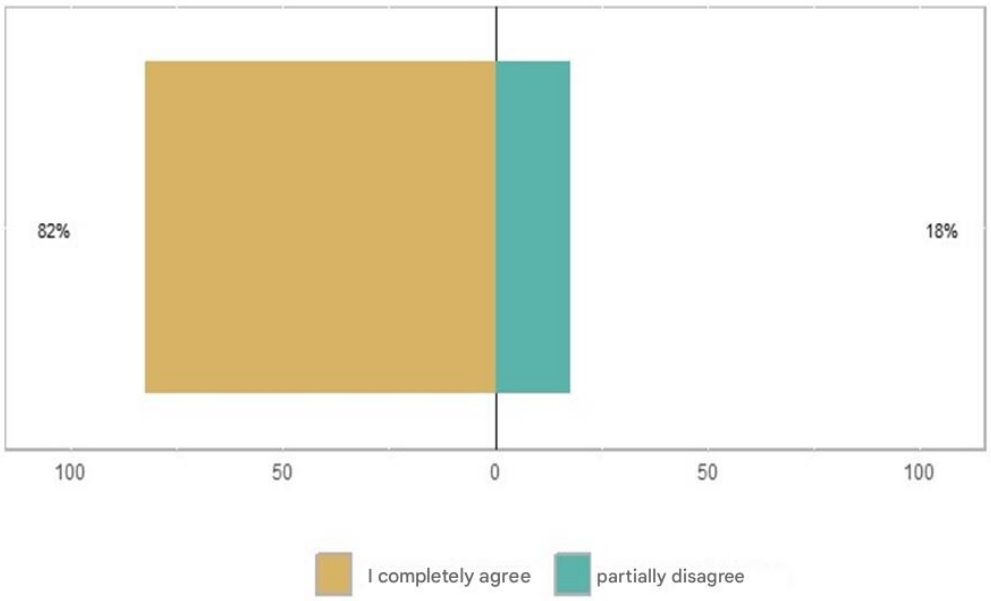
Next, an analysis of the respondents' perception of gamification as a facilitator of learning in mathematics teaching was carried out, as well as its contribution to increasing student engagement (Graph 2).

According to Sailer and Homner (2020), gamification in the educational context has attracted increasing attention and interest in the last decade, due to the hypothesized benefits in terms of motivation and learning. However, some researchers question whether the effects of games can be transferred to non-gaming contexts. Although the positive effect of gamification on cognitive learning outcomes can be interpreted as stable, the results on motivational and behavioral outcomes were less stable.

In a complementary approach, Souza (2019) emphasizes the importance of using digital technologies in the educational environment, arguing that, when integrated with well-structured pedagogical practices mediated by the teacher, these technologies can facilitate

effective inclusion, respecting the particularities of autistic students. In this way, the use of technologies in conjunction with adaptive pedagogical strategies can avoid the exclusion of these students in the school context, promoting a more inclusive and effective teaching of Mathematics.

Graph 2: Gamification: engagement and math learning



Source: Prepared by the author

The relevance of the research is confirmed, as the results indicate that gamification and digital technologies can be effective in the learning process of children with ASD, especially with regard to the development of cognitive and social skills. The use of digital tools in the educational context not only facilitates student engagement, but also promotes the acquisition of concepts that would be more challenging in traditional approaches. This evidence reinforces the importance of incorporating assistive technologies and gamification as pedagogical strategies, especially when considering the growing demand for more inclusive and adaptive teaching methods.

Regarding the methodology adopted, the method used was adequate for the objectives of the study, as it allowed the analysis of teachers' experiences and the observation of the impacts of gamification on the learning of students with ASD. The construction of the e-book, as a pedagogical resource, provided a practical way to apply the didactic sequences and observe the direct effects of these practices on the engagement and cognitive development of students. The combination of interviews with teachers and the analysis of participants' responses provided a comprehensive and detailed insight into the effectiveness of gamification in this context.

FINAL CONSIDERATIONS

Thus, the present study aimed to investigate the contribution of gamification in the development of cognitive skills and learning of students with ASD is concluded, exploring different dimensions of the interaction between these pedagogical tools and the educational needs of this population. The proposed objectives were, in fact, achieved, corroborating the effectiveness of these approaches in the educational context.

The study carried out was of great importance for teachers, especially for Mathematics teachers who work with students with ASD. These educators face specific challenges in the teaching-learning process and, therefore, need adequate tools and resources to support the development of their students. The study highlighted the importance of providing teachers with access to strategies and materials that can facilitate this process, guaranteeing them the right to use all available resources to promote more efficient and inclusive learning.

The methodology adopted was effective for the objectives of the study, allowing an analysis of teachers' experiences and observing the impacts of gamification on the learning of students with ASD. The creation of the e-book as a pedagogical resource enabled the practical application of the didactic sequences, enabling the observation of the direct effects of these practices on the engagement and cognitive development of students. The combination of interviews with teachers and the analysis of participants' responses provided a comprehensive and detailed view of the effectiveness of gamification in this context.

Therefore, the adoption of gamification as a teaching strategy has demonstrated a significant impact on the development of students' cognitive and social skills, highlighting the potential of these technologies to promote more inclusive, personalized, and effective learning.

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CIVIL LIABILITY: AN ANALYSIS OF THE LIABILITY OF ACCOUNTING PROFESSIONALS IN THE FACE OF BOOKKEEPING ACTS AUTHENTICATED BY THE BOARD OF TRADE

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ABSTRACT

The present research aims to analyze the civil liability of the Accountant in relation to the acts of bookkeeping authenticated by the Board of Trade. It is important to understand the civil liability of the accountant, as a liberal professional, within the scope of his duties, which include the preparation of reports, accounting entries, articles of incorporation, trial balances and financial statements, which are, depending on the legal nature of the organization, authenticated by the Securities and Exchange Commission, Boards of Trade and Registry Offices. The methodology adopted is based on a basic and qualitative research approach, based on the Accountant's Code of Ethics and on bibliographic, legal and jurisprudential analysis. The analysis revealed that the civil liability of accountants is a complex and multifaceted topic, covering legal, ethical and practical aspects that must be strictly observed by accounting professionals to ensure the integrity and legality of accounting information. The accountant's civil liability is an extremely relevant area that requires a constant commitment to ethics, legislation and the quality of accounting information. Thus, it goes beyond the civil and criminal spheres, covering a broader and more collective view.

Keywords: Civil Liability. Accountants. Acts of Bookkeeping. Board of Trade. Ethics.

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INTRODUCTION

This work aims to analyze the civil liability of the Accountant in relation to the acts of bookkeeping authenticated by the Board of Trade. To this end, it is crucial to address the dogmatics of civil liability in its broadness, which concerns the legal obligation to repair or compensate for damages caused to third parties or their property, resulting from negligent, reckless, deliberate or unlawful conduct.

Accountants and administrators of organizations share responsibility for the potential negative impacts of the information they generate and disclose. According to the principles of civil liability, it is widely accepted that anyone who, by inappropriate conduct, causes damage to others can be held legally responsible and obliged to compensate for the damage caused. This responsibility can emerge in various scenarios, such as traffic accidents, medical negligence, environmental damage, and even in the case of providing incorrect information, as occurs in accounting fraud. However, the main objective is to ensure the reparation of the damage and offer fair compensation to the injured party, aiming to reestablish the situation prior to the harmful event.

In this essential perspective, it is crucial to understand the civil liability of the accountant, as a liberal professional, within the scope of his duties, which include the preparation of reports, accounting entries, articles of incorporation, trial balances and financial statements, which are, depending on the legal nature of the organization, authenticated by the Securities and Exchange Commission, Boards of Trade and Registry Offices.

The faithful representation of the patrimonial, economic and financial situation of the entities through these reports is a crucial and indispensable factor. Thus, it is essential that the accountant is in full compliance with the legislation that regulates consumer relations in his area of expertise, maintains strict adherence to the ethical principles outlined in the Code of Ethics for Accounting Professionals and is aware of the jurisprudence consolidated in the courts.

Regarding the consumer relationship, the exception established by the Consumer Protection Code (CDC) in relation to the liability of liberal professionals is brought to the fore. While the CDC adopts strict civil liability as a rule, prioritizing consumer protection (principle of vulnerability) in consumer relations, it establishes an exception for liberal professionals, requiring the consumer to prove the fault of the professional in his conduct to hold him responsible for damages or threats of damage, due to the personal and assumed nature of the risks inherent to the activity of these professionals.

The complexities of this subject arise from the lack of understanding of those involved about the implications of the Consumer Protection Code in commercial relations, especially when the consumer is in a position of vulnerability (BRASIL, 1990). It is essential for suppliers to understand that they cannot escape responsibility to provide quality services or products and to repair damage caused by recklessness, malpractice, or negligence. This prevents them from taking advantage of the consumer's fragility in search of undue advantages.

It is important to emphasize that the concept of consumer of accounting services is comprehensive, as those interested in the information provided by these professionals go beyond the internal users of organizations. They also include the tax authorities, investors, financial institutions and others, who are external users of this information. In this way, the impact of fraudulent information can be devastating.

The accountant's civil liability must also be evaluated under the prism of the Accountant's Code of Ethics (CFC, 2019). The relationship between the accountant's civil liability and the accountant's code of ethics is quite significant. While tort refers to the legal obligation to repair damage caused due to improper conduct, the accountant's code of ethics sets out the principles and standards of conduct that accountants must follow in their professional practice.

The accountant's code of ethics defines standards of professional behavior and conduct, emphasizing the importance of honesty, integrity, competence and confidentiality in the provision of accounting services. By following these ethical principles, accountants can help prevent situations that lead to civil liability, such as providing incorrect information, professional negligence, or fraudulent conduct.

In addition, in cases of civil liability proceedings, the accountant's conduct can be evaluated in light of the professional code of ethics. If an accountant acts in accordance with established ethical principles, this can be considered as a mitigating factor in a tort action.

Therefore, the relationship between the accountant's civil liability and the accountant's code of ethics lies in the importance of complying with ethical standards to avoid situations that may result in legal liability and ensure an upright and responsible professional practice.

As for the jurisprudence on the civil liability of the accountant, it highlights the importance of compliance with professional standards, precision and accuracy in the provision of accounting services, the duty of communication and the legal consequences of negligence or professional misconduct. It seeks, in a more precise way, to analyze the trend

and direction of decisions related to the autonomy and responsibility of the accountant regarding the information provided for registration with the Board of Trade.

In view of the above, the relevance of the theme is justified by addressing the trilogy of studies that contemplates the accountant's civil liability, due to the information it generates and evidences, having as pre-established limits the expected consumer relationship (CDC), the Accountant's Code of Ethics and settled jurisprudence (BRASIL, 1990).

In view of the above, the importance of this theme is evident, since it explores the trilogy of studies related to the accountant's civil liability, centered on the information he generates and evidences. In this context, the limits pre-established by the consumer relationship provided for in the Consumer Protection Code (CDC), by the Accountant's Code of Ethics and by consolidated case law stand out.

In this case, the general objective of this article emerges as a general objective to analyze the accountability of accounting professionals in the face of Bookkeeping Acts Authenticated by the Board of Trade. With the goal of achieving this objective, it is necessary to:

- Understand the foundations of civil liability under the aegis of the doctrine and precepts of the CDC regarding the consumer relationship;
- Verify how the dictates of the accountant's code of ethics have contributed to mitigating situations that result in legal liability and ensuring an upright and responsible professional practice
- Analyze the trend and direction of decisions related to the accountant's autonomy and responsibility regarding the information provided for registration with the Board of Trade.

The methodology adopted is based on a basic and qualitative research approach, based on the Accountant's Code of Ethics and on bibliographic, legal and jurisprudential analysis. The objective is to provide a descriptive and formative evaluation of the topic in question.

PRECEPTS OF CIVIL LIABILITY

In order to further support the issue that we wish to address in this article about the civil liability of the accountant professional in the face of the information prepared and published by him, it is important to hover over the concept of liability. According to Rosenvald and Braga Neto (2024, p. 11) in civil law, liability is still defined in its classic

sense as: "obligation to repair damages that we have infringed due to our fault and, in certain cases determined by law; in criminal law, by the obligation to bear the punishment". In this context, and still following the line of the authors, it can be inferred that anyone who is subject to the obligation to repair or suffer the penalty is responsible, regardless of whether it is in the civil or criminal sphere.

In contemporary terms, Ehrhardt Júnior (2020, p. 303) states that the trend of civil liability more than points out the person responsible for the damage. For the author, legislators and law enforcers claim that it must be evidenced how it will be repaired. Therefore, the core of the concern in matters of civil liability is no longer man considered in isolation, but man collectively and socially considered. A fact that leads to understand that the limits of civil liability go beyond any sphere, be it criminal or civil.

In this line of opening and expanding the incidence of civil liability brought by the aforementioned authors, Cavalieri (2019) in his work Civil Liability Program, advocates that "liability has as its core element a voluntary conduct violated by a legal duty". Civil liability is a legal duty that arises later to repair the damage caused by the breach of a previous legal duty. Thus, it can be said that civil liability represents an obligation to compensate for a loss or damage caused to another person (CAVALIERI FILHO, 2019).

However, based on the Civil Code (BRASIL, 2002), it is opportune to understand the theory of objective civil liability as well as subjective liability. Subjective civil liability, based on fault, is provided for in articles 186, 187 and in the caput of article 927 of the Civil Code. On the other hand, strict civil liability, based on the theory of risk and summarized in presumed fault, can be found in several legal provisions, especially in the sole paragraph of article 927 of the Civil Code. According to Gonçalves (2017), the classification of civil liability based on the element of fault is subdivided into objective and subjective, and subjective civil liability has fault as its primary element, if there is no fault, there is no need to speak of liability.

Thus, it is suggested to divide it into different species, depending on where it comes from and what is the subjective element of this conduct. For Cavalieri (2019) it is possible to outline civil liability in two major groups, which are extracontractual and contractual. These, having in their essence the assumptions of subjective liability, namely: a) culpable conduct of the agent; b) the causal link; and c) the damage. Rosenvald and Braga Neto (2024, p. 943) state that classic civil liability was unaware of the causal link and was satisfied with fault and damage as triggering assumptions of the obligation to indemnify.

The texts of Rosenvald and Braga Neto, Ehrhardt Júnor and Cavalieri converge in their views on civil liability, agreeing that it goes beyond the spheres of Civil and Criminal

Law. They state that liability involves both the obligation to repair damages and the obligation to bear penalties, regardless of the civil or criminal context. Ehrhardt Júnior points out that civil liability today focuses on the collective and social, while Cavalieri reinforces the importance of understanding liability as a voluntary conduct that violates a legal duty, proposing its division into non-contractual and contractual liability, based on subjective liability.

This common perspective among the authors indicates that civil liability should be seen in a comprehensive way, concerned not only with the isolated individual, but with man in his collective and social context. The core of modern civil liability is, therefore, an integrative approach that considers the social and collective implications in the reparation of damages, promoting a broader and more inclusive justice, and the harmful act may come from companies, individuals or liberal professionals, such as accountants.

ACCOUNTANTS AND THE ACT OF REGISTRATION

The legal relationship between the accountant and his contractors, whether they are an individual, entrepreneur or business company, involves a series of responsibilities and obligations that must be strictly complied with to ensure the integrity and legality of the accounting information. The accountant, as a liberal professional, is responsible for the correct preparation and recording of accounting information, and must act with diligence, competence and ethics. According to Reale (2000), the legal relationship is the relationship of social life that seeks diverse and multiple ends, not only strictly legal, which are formed under legal models established by the State or that are inserted in a normative structure, so that the Law acts as an instrument for the realization, protection and realization of these ends.

The legal relationship between accountants and contractors is also governed by the Consumer Protection Code, since the accountant provides services of a technical-scientific nature and must ensure the quality and reliability of the accounting information provided.

The accountant may be held civilly liable for any damages caused to his contractors as a result of errors or omissions in the preparation of accounting information, and this liability is of a subjective nature, that is, it depends on proof of guilt (Article 14, paragraph 4 of the CDC). Thus, the provision of services by the accountant to his clients characterizes a legal consumer relationship, since it is possible to identify the subjects and the object of the relationship, that is, it is essential that there is in one of the poles of the relationship the consumer(s) and in the other the supplier(s) and, between both, the transaction of products or services (NUNES, 2017). Civil liability arises from this relationship.

It is important to consider that (CAVALIERI FILHO, 2019) argues that the Consumer Protection Code has as its primary objective the intention of "reestablishing balance and equality in consumer relations", since the consumer will always be the weak party in the consumer relationship. In addition, the institute of civil liability aims to repair the damages suffered by the injured party. In this way, there is a relationship of reciprocity between them and, together, they act in the protection, defense and reparation of the rights of the parties involved in the consumer relationship.

On the other hand, the poor quality of accounting information can bring numerous problems to the company and its stakeholders. Incomplete or imperfect accounting information can lead to misguided decisions, harming the company's management and potentially resulting in significant financial losses. In addition, the lack of clarity and precision in the information can generate distrust among investors, creditors and business partners, negatively impacting the company's reputation and making it difficult to raise funds (MOURA, ZILIOTTO and MAZZIONI, 2016).

Informational asymmetry, which occurs when there are divergences in the information available between different parties, is one of the main problems generated by the poor quality of accounting information. For example, an investor who does not have access to accurate information about a company's financial health may make poor investment decisions, leading to financial losses. Similarly, a lender may grant credit based on incomplete information, resulting in default risks (NASCIMENTO et al, 2012).

In addition, the poor quality of accounting information can lead to the incidence of fraud. Incomplete or imperfect information can be manipulated to hide the company's real financial situation, resulting in accounting fraud that can have severe legal consequences and undermine the confidence of markets and society in the integrity of financial statements (MOURA, ZILIOTTO and MAZZIONI, 2016).

The Civil Code in articles 1,179 to 1,184 shows that the registration of accounting information in the Public Registry of Mercantile Companies is a legal requirement that aims to ensure the transparency and legality of companies' accounting operations. According to the Civil Code, the entrepreneur and the business company are obliged to follow an accounting system based on the uniform bookkeeping of their books, in correspondence with the respective documentation, and to annually draw up the balance sheet and the economic result (BRASIL, 2002)

Also according to the Civil Code, mandatory books, such as the Journal and the Trial Balances of Journals and Balance Sheets, must be authenticated in the Public Registry of Mercantile Companies before being put into use (Art. 1.181). This authentication is

essential to ensure that the accounting books are maintained regularly and in accordance with the established standards, providing a solid basis for the analysis and verification of accounting information by the competent authorities and other stakeholders.

The requirement to register accounting information in the Public Registry of Mercantile Companies also aims to ensure the legality of accounting operations, prevent fraud and ensure the integrity of the financial information disclosed. Failure to comply with this requirement can lead to severe penalties and compromise the confidence of markets and society in the veracity of the company's financial statements.

However, the poor quality of accounting information generated by accountants and organizational managers can bring numerous problems to companies and their stakeholders. Incomplete or imperfect accounting information can lead to misguided decisions, harming the company's management and potentially resulting in significant financial losses. In addition, the lack of clarity and precision in the information can generate distrust among investors, creditors and business partners, negatively impacting the company's reputation and making it difficult to raise funds (MOURA, ZILIOTTO and MAZZIONI, 2016).

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The accountant has civil liability for this information, regardless of its quality, as the registration of accounting information in the Public Registry of Mercantile Companies is a legal requirement that aims to ensure the transparency and legality of the companies' accounting operations. According to the Civil Code, the entrepreneur and the business company are required to follow an accounting system based on the uniform bookkeeping of their books, in correspondence with the respective documentation, and to annually draw up the balance sheet and the economic result (Art. 1,179). (BRAZIL, 2002)

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The requirement to register accounting information in the Public Registry of Mercantile Companies also aims to ensure the legality of accounting operations, prevent fraud and ensure the integrity of the financial information disclosed. Failure to comply with this requirement can lead to severe penalties and compromise the confidence of markets and society in the veracity of the company's financial statements. Failure to comply with the requirements for registration of mandatory books in the Public Registry of Mercantile Companies can result in various penalties for the entrepreneur or business company.

According to the Civil Code, article 1,182, bookkeeping will be under the responsibility of a legally qualified accountant, and any irregularity in the maintenance and registration of accounting books may result in legal consequences (Brasil, 2002).

Penalties for not registering the mandatory books can include fines, the impossibility of issuing negative debt certificates, which can prevent the company from participating in public bids or obtaining financing, and even the opening of legal proceedings by creditors or investors harmed. In addition, the company may be subject to inspection by the competent authorities, resulting in audits and inspections that may reveal other accounting and financial irregularities.

The absence of registration of mandatory accounting books can also lead to the disregard of the company's legal personality in cases of legal litigation, causing the partners or managers to be personally liable for the company's obligations. This can have significant financial and legal consequences for those involved, compromising their reputation and personal assets

From this perspective, it is essential that the accountant maintains an ethical and transparent professional posture, ensuring the quality of accounting information and strictly complying with the legal requirements for registration and authentication of accounting books. In this way, it contributes to the protection of the interests of its contractors and to the trust and integrity of the accounting and financial market (CFC, 2019).

JURISPRUDENCE OF THE ACCOUNTANT'S CIVIL LIABILITY

The civil liability of liberal professionals is a recurring theme of great importance in the discussions of the Brazilian courts, especially in situations involving consumer relations. Regarding the performance of the accounting professional, the Court of Justice of Rio Grande do Sul highlighted that, generally, this activity is result-oriented, which implies subjective liability with presumed fault. This means that the accountant must prove that he did not act with fault.

In a specific case, the Court of Justice of Rio Grande do Sul held an accountant responsible for negligence in failing to collect the ICMS Information and Calculation Guides (GIA), resulting in the client's enrollment in the active debt. The client had hired the accountant to open a company, but due to the lack of habitation of the rented property, the location permit was not granted, making it impossible to qualify for the Simples Nacional and requiring the monthly presentation of the ICMS GIAs. The accountant's failure to inform these GIAs led to the enrollment in the active debt, characterizing negligence.

The reporting judge was based on article 14, paragraph 4, of the Consumer Protection Code (CDC), which establishes the subjective liability of liberal professionals, with an obligation of result, and concluded that the accountant was negligent in not following accounting and financial standards, causing losses to the client.

In another case, the Court of Justice of Sergipe held accountant liable who, in a consumer relationship, committed an unlawful act by not clearly informing about the costs of the service, disrespecting the consumer's basic right to adequate and clear information, according to article 6, item III, of the CDC. The accountant was hired to calculate the termination of the employment contract, but withheld 73% of the severance payments as fees without a written contract detailing the amounts due and the service provided. The practice was considered abusive and extremely disadvantageous to the consumer, violating the good faith that should guide legal relationships.

The reporting judge, based on article 6, item III, and article 51 of the CDC, decided that the accountant should indemnify the consumer in R$ 2,000.00, with default interest of 1% per month, and return the amount that exceeded 20% of the severance payments, considering this percentage as reasonable for the fees for the service provided. The application of article 42, sole paragraph, of the CDC, which deals with the double refund of undue charges, was not considered appropriate, as there was a provision of service, characterizing a charge above reasonable, but not undue.

It is concluded that it was the defendant's obligation, as an accountant, to be aware of accounting and financial standards, in order to fit the plaintiff's company, his client, in the

correct system of tax collection. By not having done so, he acted negligently and is held responsible for the resulting losses.

Finally, it is worth noting that the Court of Justice of Sergipe decided to hold accountant liable who, in the consumer relationship, committed an unlawful act (abusive conduct), not acting in good faith when she did not clearly inform about the costs of the service, disrespecting the basic rights expressed in the Consumer Protection Code, especially that of article 6, item III, which guarantees the consumer adequate and clear information, so that it culminated in an extreme disadvantage for the consumer37.

The case narrates a consumer relationship in which a consumer in a situation of fragility works in one pole and, in the other, an accountant hired to calculate the value of the termination of the plaintiff's employment contract.

According to the report, the accountant acted in bad faith when she withheld 73% of the plaintiff's severance payments, justifying that they would be her fees. There is no written contract in the records, however, for the provision of the service in which precise and clear information about the amounts due and the service to be performed would be included, thus violating one of the basic rights of the consumer to adequate and clear information.

The rapporteur relies on article 6, item III, of the CDC, to affirm that there was a violation of consumer rights, as well as on article 5138, of the same provision, to recall that the practice is abusive, since contractual clauses that establish unfair and unfair obligations, that are excessively disadvantageous to the consumer or contradict good faith or equity are null and void. Now, even if the contract made by the parties was oral, it is evidently abusive and extremely disadvantageous to charge 73% of the amount to which the plaintiff was entitled, as well as an act that is an attack on the good faith that should guide legal relations.

Finally, the rapporteur pointed out that, in addition to the undue retention of an exorbitant amount by the defendant, the amounts arising from labor termination are of a food nature. It was decided, therefore, that the accountant was liable, who was ordered to pay compensation of R$ 2,000.00, with default interest of 1% per month, in addition to the return of the amount that exceeded 20% of the severance payments, which is the percentage considered fair for the provision of the service.

It was also emphasized that the application of article 42, sole paragraph, of the CDC, which provides for the double refund of the excess amount in cases of undue collection, does not apply. This is because, although the charge was excessive, the service was provided, therefore not constituting an undue charge as specified in the legal provision, but rather a charge above reasonable.

FINAL CONSIDERATIONS

Throughout this article, it was possible to deepen the understanding of the accountant's civil liability, especially in relation to bookkeeping acts registered with the Board of Trade. The analysis revealed that the civil liability of accountants is a complex and multifaceted topic, covering legal, ethical and practical aspects that must be strictly observed by accounting professionals to ensure the integrity and legality of accounting information.

The dogmatics of civil liability establishes that any negligent, reckless or willful conduct that causes damage to third parties may result in an obligation to repair. For accountants, this translates into the need for diligent professional practice that complies with the standards established by the Code of Ethics for Accounting Professionals. Compliance with these ethical standards is essential not only to avoid situations that may result in legal liability, but also to maintain confidence in the accounting and financial market.

The consumer relationship, governed by the Consumer Protection Code (CDC), imposes an additional degree of responsibility on accountants, since the CDC adopts strict civil liability as a rule, with the exception of liberal professionals, where fault must be proven by the consumer. This highlights the importance of transparent and ethical performance by accountants, who must provide clear and accurate information to their clients and stakeholders to avoid any type of conflict or litigation.

The theoretical foundations presented by civil liability scholars, such as Rosenvald, Braga Neto, Ehrhardt Júnior and Cavalieri, reinforce the idea that civil liability goes beyond the civil and criminal spheres, encompassing a broader and more collective view. This integrative approach is crucial to understanding the responsibility of accountants, whose work impacts not only their direct clients, but also a wider range of stakeholders, including the tax authorities, investors, and financial institutions.

The case law analyzed demonstrates that Brazilian courts have recognized the importance of compliance with accounting standards and the liability of accountants in situations of negligence or misconduct. Exemplary cases show that failure to follow correct accounting procedures can result in severe penalties, reinforcing the need for rigorous and law-compliant professional practice.

Finally, it is imperative that accountants are always up-to-date and attentive to the legal and ethical requirements of their profession. The proper recording and authentication of accounting information are not only legal obligations, but also essential practices for maintaining transparency and trust in the market. By acting ethically and competently,

accountants not only avoid civil liability but also contribute significantly to the integrity of the economic and financial system.

Thus, it is concluded that the accountant's civil liability is an area of extreme relevance and complexity, which requires a constant commitment to ethics, legislation and the quality of accounting information. Success in accounting practice depends on the ability of professionals to act responsibly, ensuring the protection of the interests of their contractors and the trust of the market.

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AN UNFELT ABSENCE? ACCOUNTING INFORMATION AND SURVIVAL OF MICRO AND SMALL COMPANIES

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ABSTRACT

This study analyzes the negative effects of the lack of accurate accounting information and the inability of managers to make decisions based on available data on the performance and survival of micro and small enterprises. The research is exploratory and involved an in-depth analysis of articles and journals related to the subject, as well as a thorough study of the legislation that guides the release of credit for micro and small companies. To achieve the proposed objectives, structured interviews were conducted with managers of companies that were successful in their financial management, as well as with those that faced difficulties. The results revealed that these factors directly affect the obtaining of bank credit and the efficient management of the financial resources of these companies. A predominance of young managers was identified, with a low level of education and no specific training in the area, emphasizing the need for investment in training. Most of the companies belonged to the retail trade, framed in the tax regime of Simples Nacional, with a reduced team. The use of electronic spreadsheets and manual controls was observed, with limited use of computerized systems. The lack of formal methods for evaluating decisions and the lack of consideration of financial indicators in the contracting of credit were highlighted.

Keywords: Micro and small companies. Accounting information. Business survival. Bank credit. Evaluation of financial decisions.

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INTRODUCTION

Decision-making is a constant in everyday business. We can consider without any doubt that the success of a company is the result of good management associated with the ability to choose, decide on what is best, which is the path to follow towards a positive result based on up-to-date, reliable and timely accounting information available whenever necessary. In a company, internal (cost management) and external (financial statements) accounting information constitute a knowledge base that will enable the best possible decision-making.

Companies that have efficient management of their costs and financial statements will certainly be able to make more assertive and strategic decisions about how to reduce costs, restructure processes, increase productivity, improve tax planning, and assess the need to contract resources with third parties, especially loans from financial institutions.

In Brazil, micro and small enterprises (MSEs) play a strategic role in the economy. According to data from the Brazilian Micro and Small Business Support Service - SEBRAE, these companies represent about 99% of the total companies in the country, generate about 30% of the Brazilian Gross Domestic Product (GDP) and are responsible for more than 72% of the formal jobs created in the country in 2022. Considering these factors, accounting information is essential for micro and small companies in the decision-making process. This is because such information provides relevant data about the company's financial situation such as profitability, profitability, indebtedness, payment capacity, and cash flow. Therefore, the importance of accounting information in the decision-making process in micro and small companies is fundamental for efficient and sustainable business management.

However, two of the main obstacles faced by micro and small companies when seeking bank credits are the correct use of these new resources due to the absence of information and the lack of knowledge on the part of the manager for analysis of accounting information and decision making. Without adequate financial information, banks cannot assess the financial health of the company and its real ability to pay debts. This can make it difficult to obtain loans or lines of credit, as banks usually consider the company's financial situation when deciding whether or not to grant credit, and may even offer higher rates to compensate for the risk.

In addition, it is common for managers to find difficulty in clearly presenting the financial information requested by banks or even seeking accounting professionals to assist them in this matter. Even so, even if the company manages to obtain credit, the lack of accurate accounting information or the manager's inability to analyze and decide based on

the available data can hinder the efficient management of this resource due to an ill-informed financial decision, which can negatively affect the company's performance, most likely causing default with the creditor, even compromising its survival.

In this context, the following research question arises: **How can the lack of accurate accounting information and the manager's inability to analyze and decide based on the available data negatively affect the performance and survival of micro and small enterprises, especially with regard to obtaining bank credit and efficient management of financial resources?**

In view of the problem presented above, the present research has the general objective of investigating how the lack of accurate accounting information and the inability of the manager to analyze and decide based on the available data affect the obtaining of bank credit by micro and small companies. In particular, it is intended to investigate how these factors affect the ability of these companies to obtain bank credit and manage their financial resources efficiently. To achieve the general objective, it is necessary to develop the following specific objectives:

- Conduct a detailed literature review on the best financial management practices for micro and small companies, in order to provide recommendations for managers in relation to accounting and financial analysis.
- Identify, through interviews with managers of micro and small companies, the main difficulties faced in relation to accounting and financial analysis.
- Analyze the strategies used by the managers of successful micro and small companies in relation to accounting and financial analysis, in order to identify the good practices adopted.

The research is exploratory and will involve an in-depth analysis of articles and journals related to the topic, as well as a thorough study of the legislation that guides the release of credit for micro and small companies. To achieve the proposed objectives, structured interviews will be conducted with managers of companies that have been successful in their financial management, as well as with those that have faced difficulties.

The present research is relevant to the context of micro and small companies, since efficient financial management is one of the main factors for the success and survival of these organizations. The lack of accurate accounting information can lead to management errors and misguided decision-making, which can negatively impact the company's performance and financial health. In addition, the topic is also relevant for financial institutions, which have credit release as one of their main products, and for the

government, which is concerned with economic stability and the maintenance of companies in the market. In addition, the study is unprecedented and has few published works in the area, which makes its contribution to the scientific literature even more important. Finally, the search for credit and the release of financial resources are themes that are always present in society, which makes the study current and relevant for understanding the dynamics of the financial and business market.

The work is organized into six distinct sections, each playing a specific role in the development of the research. The first section provides a brief contextualization of the topic in question, providing the reader with an initial overview of the subject addressed. The second section is dedicated to the theoretical framework, where the main theories and legislation that support the research are explored, offering a solid foundation for the study. In the third section, the methodology adopted in the study is presented, describing in detail the procedures and approaches used in data collection and analysis.

This section also highlights the main theoretical bases that supported the analysis of the data obtained. The fourth section focuses on analysis and results, presenting the data collected and organized in spreadsheets or other forms of representation. This analysis aims to offer a more in-depth understanding of the results obtained, highlighting relevant trends, patterns, and insights. In the fifth section, the final considerations are presented, bringing together the main findings and conclusions derived from the analyses and results. This section provides an overview of the findings of the research, highlighting their relevance and potential implications. Finally, in the last section of the work, the bibliographic references that were consulted and used as sources of information throughout the study are listed. This list of references provides credit and allows the reader to consult the original sources for more details on the concepts and information covered in the work.

THEORETICAL FRAMEWORK

MICRO AND SMALL ENTERPRISES – MSES

Micro and small companies play a crucial role in sustaining the Brazilian economy, not only because they are responsible for a large portion of job creation, but also because they represent a significant number of establishments throughout the country. In fact, these companies play a key role in boosting the local economy, stimulating competition, fostering entrepreneurship, and promoting innovation. Therefore, it is crucial to support and strengthen the business environment for these companies, so as to ensure their growth and continued contribution to Brazil's economic development. Raifur et al (2014) describe that the classification of an entity as a micro or small company does not follow a single criterion,

and can vary from annual sales, gross or net revenue, size of assets or number of employees. In Brazil, the Statute of Micro and Small Enterprises, Complementary Law 123/2006, presents a methodology for classification, but official financial institutions and inspection agencies establish other criteria. It is important to emphasize that the correct definition of the classification is crucial for these companies to be able to enjoy the benefits and tax incentives intended for them, as well as for them to be supported by public policies aimed at the development of entrepreneurship in the country. Therefore, it is essential that clear and consistent criteria are established for the classification of micro and small companies, in order to ensure a fair and coherent approach to the treatment of these entities

Table 1 - Criteria for the classification of Micro and small companies.

	Critério de enquadramento	Valor da Receita	Número de empregados
Receita Federal	Microempresa	Receita bruta anual de até 360.000,00	
	Empresa de pequeno porte	Receita bruta anual entre 360.000,01 e 3.600.000,00.	
BNDES	Microempresa	Até 400 mil dólares	
	Empresa de Pequeno Porte	Entre 400 mil dólares a 3,5 milhões de dólares.	
RAIS TEM	Microempresa		De 0 a 19 empregados
	Empresa de Pequeno Porte		De 20 a 99 empregados

Source: Prepared by Raifur et al (2014) based on Complementary Law 139/2011, art. 3, BNDES and RAIS/MTE.

The Accounting Pronouncements Committee - CPC, in its technical pronouncement CPC PME (R1) – Accounting for small and medium-sized companies, describes SMEs as companies that:

- They have no public obligation of accountability; and
- Prepare general-purpose financial statements for external users. Examples of external users include owners who are not involved in running the business, existing and potential lenders, and credit rating agencies.

QUALITY OF ACCOUNTING INFORMATION AND THE MANAGER'S ABILITY TO UNDERSTAND

Understanding the concept of accounting information and its attributions is fundamental for business management. It plays a fundamental role for any organization, regardless of its size or sector of operation, being essential for financial management and strategic decision-making, allowing managers to have a clear and objective view of the financial health of the business at a given time. In addition, accounting information is also

important for complying with the company's tax and legal obligations, such as paying taxes and preparing financial statements for regulatory bodies, investors, and creditors. These stakeholders use accounting reports to evaluate the company's financial performance and make decisions about investments and loans.

Accounting's main objective is to provide relevant information through the preparation of reports, which include financial statements such as the balance sheet, income statement, and cash flow, among others. These reports provide crucial data on the company's financial situation, including assets, liabilities, revenue, and expenses. This comprehensive and accurate view of the financial situation is essential for managers to make informed and strategic decisions for the success and growth of the organization. According to Gimenez et al (2011), accounting plays a key role in capturing, recording and interpreting all of an organization's financial information. Its primary function is to generate reports that assist in the management of the business, in the evaluation of the company's financial performance and in the identification of opportunities for improvement, among other strategic decisions.

Accounting information is of fundamental importance in managers' managerial and strategic decision-making, in addition to being indispensable for complying with legal and tax obligations. In addition, it also plays a valuable role for external users, such as investors, lenders, and other stakeholders. These stakeholders use accounting information as a basis to assess the company's financial health and support their own decisions. According to Marion (2022), accounting information encompasses a set of financial data generated by a company's accounting. This data plays a crucial role when analyzing and monitoring the organization's financial situation, operational performance, and cash flow. Among the most relevant accounting information are the balance sheet, income statement, cash flow, explanatory notes, and other pertinent financial data. In short, accounting information is an indispensable resource that provides essential financial data for the company's internal management, as well as for transparency and external analysis by investors and other stakeholders. For Padoveze (2012), accounting information needs to meet two fundamental criteria to be useful to the business manager: quality of the information and the manager's competence to understand and use this information. The first criterion concerns the accuracy, reliability, and relevance of the accounting information to the business. This implies the accurate and consistent collection and recording of data, using well-defined accounting fundamentals and recognized quality standards. According to CPC 00 (R2) - Conceptual Framework for Financial Reporting, the financial statements must comply with qualitative characteristics such as relevance, materiality, faithful

representation, comparability, verifiability, timeliness and comprehensibility. These statements are intended to provide information about the company's financial position (balance sheet), its performance (income and comprehensive income), and its cash flows. Through this information, managers can identify economic and financial indices that are extremely useful 14 for business management, such as capital structure, liquidity, profitability, profitability, average terms, and the need for working capital, among others. The analysis of these ratios allows you to evaluate the company's financial performance, identify strengths and weaknesses, and make strategic decisions to improve business performance, considering the risks and opportunities involved. The second criterion relates the manager's competence to understand and use accounting information. In addition to the quality of accounting data, it is essential that the manager has the skill and technical knowledge to understand and apply them in their decision-making. This entails knowing accounting terminology and principles, as well as being able to interpret accounting reports and use them to evaluate the company's financial performance, identify problems and opportunities, and make strategic decisions.

In a survey, it was found that, despite the importance of accounting information in business decision-making, many users find it difficult to understand the financial statements due to the complexity of the terms used to evidence economic and financial events. For Dias Filho (2000), this lack of understanding has led to an inadequate interpretation of accounting information, compromising its effectiveness as a means of communicating economic events. The results of the survey highlight the need for greater clarity and simplification in the presentation of accounting information, in order to make it more accessible and understandable to users.

It is crucial to emphasize that accounting goes beyond merely meeting tax obligations. It plays a crucial role as a strategic tool for effective business management. Accounting offers valuable insights for financial planning, evaluating company performance, identifying growth opportunities, and making informed decisions. Therefore, it is critical for business owners to recognize the breadth of accounting's contributions and value its impact on the success and sustainability of their companies. Promoting a more comprehensive understanding of accounting, encouraging business owners to fully enjoy the benefits it offers, is essential for maximizing the efficiency and effectiveness of administrative processes, driving business growth and development. It is necessary to overcome the restricted view of accounting as mere tax compliance and highlight its strategic role in business management. As highlighted by Stroeher and Freitas (2006), it is a common situation that small business owners do not have adequate accounting knowledge to

understand the importance of accounting in their companies. In many cases, these entrepreneurs focus their concerns only on the tax information provided by accounting, associating the accountant exclusively with tax-related issues and looking for ways to avoid taxation. This limited perception ultimately results in the restricted view of accounting as a means of avoiding problems with the tax authorities, while other basic responsibilities of the administrative function, such as planning and control, are neglected.

In further research, Raifur et al. (2014) found that managers use accounting information as a basis for their decision-making. However, they often do not fully understand them, limiting themselves to the use of information within their level of understanding and restricting themselves only to that which is made available. This limitation can be attributed to a lack of familiarity with accounting terms, resulting in a narrow focus on tax requirements. It is important to recognize the importance of a comprehensive understanding of accounting information by managers. By having a deeper knowledge, they can explore the full potential of accounting information to inform their decisions. Understanding accounting terms and underlying concepts allows for a more thorough analysis and more effective use of accounting information to identify opportunities, evaluate financial performance, and make strategic decisions. Given this, it is crucial to promote the development of accounting skills among managers, offering 15 training and educational resources that facilitate the understanding of accounting concepts and technical terms. In addition, accounting professionals can play an important role in translating this information in a clear and accessible way, helping managers to fully utilize accounting information in their decision-making. By overcoming barriers to understanding, managers can broaden their vision and utilize accounting as a powerful tool to drive the success and growth of their organizations.

CREDIT LINES FOR MSES AND THE MANAGER'S DIFFICULTY IN MANAGING THE CONTRACTED RESOURCE

Credit lines play a key role in supporting Micro and Small Enterprises (MSEs), offering access to essential financial resources for investments in infrastructure, equipment, hiring employees, and other relevant areas. This boosts the growth of companies and, consequently, contributes to the country's economic development. However, it is important to highlight the challenges faced by SMEs when seeking credit in the financial market. According to a survey conducted by Sebrae in 2020, approximately 60% of MSEs sought financial resources to maintain their activities, but only 33% managed to obtain the desired amount. In addition, the process of obtaining credit is often bureaucratic and interest rates

can be high, which makes it even more difficult to manage the available resources. In this context, it is essential to promote measures that facilitate MSEs' access to credit, such as simplifying analysis and approval procedures, reducing bureaucracy, and creating credit lines with more favorable conditions. This would allow MSEs to fully harness the potential of these resources to invest in their activities and drive their growth.

In addition, it is essential for MSEs to seek expert guidance to assess their financial needs, develop a consistent business plan, and identify the most appropriate credit options for their needs. By establishing a solid relationship with financial institutions and maintaining an organized and transparent accounting history, SMEs can increase their chances of obtaining credit with more favorable terms. In this way, improving access to credit for SMEs, making it less bureaucratic and more accessible, will strengthen the business sector and stimulate economic growth, promoting an environment conducive to sustainable development.

In his study, Peixe (2019) highlights the difficulties faced by micro and small enterprises (MSEs) in the municipality of Pato Branco, Paraná, when seeking credit from 14 financial institutions. The main difficulties identified are related to the lack of financial planning and control, incomplete documentation and inadequate registration. The survey also revealed that delinquency negatively affects the granting of credit and that most SMEs without access to credit are doomed to closure. On the other hand, the companies interviewed stated that the need to seek loans stems mainly from the lack of financial resources, overdue accounts and lack of working capital. The criteria most cited by MSEs to decide on the most appropriate loan model are the amount needed and the desired term. These results indicate that SMEs face multiple difficulties in obtaining resources for working capital and investments, which leads them to seek loans from third parties, subjecting themselves to high interest rates and assuming liquidity risks that can compromise the financial health of companies. In addition, financial institutions also face challenges in granting credit to SMEs, mainly due to the risks of default. Given this scenario, the study suggests the need for more in-depth research to better understand the difficulties faced by MSEs in obtaining credit and explore possible solutions to this problem.

This analysis highlights the importance of supporting MSEs in the development of financial planning and control skills, in addition to guiding them in the proper preparation of documentation and registration with financial institutions. Additionally, it is essential to promote actions that encourage SMEs to maintain a healthy financial posture, avoiding default and increasing their chances of obtaining credit with favorable conditions. At the same time, financial institutions should seek strategies to mitigate the risks of default,

facilitating the granting of credit to SMEs in a responsible and sustainable manner. By overcoming the barriers faced in obtaining credit, MSEs will have better conditions for growth and development, contributing to the dynamism of the local economy and to the generation of jobs.

MANAGERIAL PRACTICES USED BY MICRO AND SMALL COMPANIES IN DECISION MAKING

Effective management is a constant challenge for micro and small companies. Often, these companies face the absence of management instruments and end up basing their decisions on empirical knowledge, intuition, and improvisation of managers. However, it is essential to recognize the importance of adopting sound management practices to drive the growth and sustainability of these ventures. Historically, it was believed that small businesses should follow the same management principles applied by large corporations. However, studies have shown that micro and small companies have their own particularities and face specific challenges, which requires a differentiated approach. The studies carried out by Silva et al. (2010), Carvalho and Lima (2011) and Anjos et al. (2012) on management instruments applied in micro and small companies deserve to be highlighted. The study by Silva et al. (2010) aimed to understand how accounting information is used by these companies. The results revealed that, regardless of size, most companies have the assistance of accounting professionals, and the most commonly available statements are the best known and least sophisticated. The research by Carvalho and Lima (2011) analyzed the management practices adopted by micro and small companies in the clothing sector in the city of Sousa/PB. The results indicated that the managers of these companies informally use internal controls to make decisions, such as accounts payable control, cash control and accounts receivable control. In turn, the study by Anjos et al. (2012) investigated how micro and small business owners perceive the usefulness of accounting information in obtaining credit from banks. The results showed that the use of accounting information, as well as the consultation of external accountants, is considered useful, especially those companies whose managers have more experience in the business field or a higher level of education.

The adoption of efficient management practices plays a fundamental role in the financial health of micro and small companies. A study conducted in the Alto Vale do Itajaí region of Santa Catarina, Brazil, revealed that many of these companies lack a structured approach to decision-making and do not properly use the available management tools. The results of the research (SANTOS et al 2016) indicated that decision-making in these

companies is centered on the owners, who base their decisions mainly on their personal experience and the advice of family members, neglecting the search for professional guidance from an accountant. In addition, it was found that most companies use operational controls, but do not make use of financial statements, and are unaware of the main costing methods. Essential managerial practices, such as strategic planning, budgeting, return on investment, and break-even point, are also unknown or neglected by managers, despite recognizing their importance.

Finally, in relation to the other managerial artifacts, it is found that less than 30% of the sample uses these instruments, with the exception of tax planning, which is used by 18 companies. Most of these companies are unaware of or do not use important artifacts, such as strategic planning and budgeting, which direct organizational strategies and actions. Similar results were observed by Andrade et al. (2003) and Panucci Filho and Almeida (2011). The research by Silva et al. (2010) indicated that most managers of micro and small companies do not use Accounting to monitor goals, measure performance and evaluate the financial impacts of their decisions, failing to take advantage of reports as management tools. Frezatti et al. (2012) state that the lack of availability of these artifacts in some organizations is due to the absence of discussion about the necessary infrastructure before their implementation.

These results reflect a simplistic and mistaken view of managers about the role of accounting, often associated with bureaucracy and tax collection. This view is justified by the specialization of accounting firms in tax aspects, failing to provide relevant information for business management. The accounting information made available is generally focused on tax and labor issues, not meeting managerial demands. The lack of basic controls, such as inventory control, accounts payable, and accounts receivable, raises questions about how industrial and commercial companies can neglect aspects that are so relevant to financial success.

The study also observed that accounting service providers only offer services related to legal and bureaucratic procedures, and managers do not see accountants as professionals capable of assisting them in the management of their businesses. On the other hand, there is also no significant interest on the part of accounting professionals in updating and expanding their scope beyond tax issues. Caneca et al. (2009) state that accountants who offer services related to management accounting have greater chances of satisfying their clients and obtaining competitive advantage. In view of these findings, it is crucial that accounting professionals, class entities and business associations become more actively involved in advising these companies. University extension programs and

other educational initiatives can offer courses and training in basic management practices, in order to improve the patrimonial control and management of these entities. In addition, it is essential for accounting service providers to adopt a more proactive approach and seek to get closer to business owners, demonstrating the usefulness of accounting information for strategic decision-making.

METHODOLOGY

DEFINITIONS, POPULATION AND SELECTED SAMPLE

The research had as its population the micro and small companies located in the municipality of Valparaíso de Goiás, in Goiás, Brazil. As already described in the introduction of this work, it is a research with a qualitative methodological approach because it aims to analyze the phenomena through descriptions, understandings and interpretations of the facts (MARTINS; THEÓPHILO, 2007) dedicating itself to the understanding of social phenomena with the main objective of understanding the meanings attributed, loaded with subjectivities, to people, their realities and contexts (NOGUEIRA, 2020). Within this methodology, the exploratory method was used through the application of structured interviews, in order to explore and comprehensively understand the research problem. The main objective was to obtain an initial and in-depth view of the topic under study. In addition, for the organization of the collected data and the calculation of the percentages related to these data, Excel spreadsheet software was used, providing a more accurate and efficient analysis.

The researcher holds the position of business manager for legal clients at a bank branch of a public institution with relevant performance in granting credit to companies in the region. As part of his routine activities, the professional conducts business visits to clients interested in obtaining credit from the bank, as well as those who have already obtained credit previously. The main objective of these visits is the on-site verification of the company's activities, its operational routines, quality of the facilities, competition and especially the application of a business interview in order to verify that the information provided to the bank (mandatory documentation for opening a checking account and evaluation of the granting of credit) is in accordance with the company's reality. During the visits, the business manager conducts interviews with the company's managers, focusing on the partners responsible for transactions in the checking account, contracting credit and other products and services offered by the financial institution. These interviews are conducted through an open questionnaire, where the manager formulates questions to the manager and records the answers in the questionnaire. Images of the most common

spaces of the companies such as administrative, financial, production, quality controls, inventories, service, machinery and equipment, vehicles, among others, are also recorded. The information collected (interview and images) is simultaneously recorded in a cell phone application that allows the interviewer to later analyze the results obtained in order to provide subsidies to the manager's perception of the client's profile, especially with regard to the granting of credit and payment capacity.

After the granting of the credit, new visits are carried out as well as new image collections so that it is possible to verify and evaluate the continuity of the company's activities and the proper use of the resources obtained, which demonstrates the maintenance of the ability to pay the contracted amount. It is important to note that, in accordance with Complementary Law No. 105, of January 10, 2001 (Bank Secrecy Law) and Law No. 13,709, of August 14, 2018 (General Law for the Protection of Personal Data), this survey will not include identifying information on companies and their partners.

The survey sample was composed of information collected from 176 companies during visits carried out between January and May 2023. This population represents the entire sample used in the study.

RESEARCH INSTRUMENT

After collecting data through a questionnaire applied to managers of micro and small companies, a study was carried out to identify relevant characteristics, such as the size of the company, sector of operation and time of existence, along with other important variables. In addition, the procedures adopted in decision making were investigated, using descriptive statistical analysis. This analysis allowed us to identify patterns and trends in the strategies used by managers to deal with delinquency.

Likewise, descriptive statistics were applied in the analysis of the management instruments used by managers. Aspects such as the ability to interpret the company's management information, the monitoring and evaluation of the impact of the use of credit, as well as the search for updates on best practices related to the contracting of credit and situations of delinquency were explored.

The structure of the interview allowed the collection of relevant information on the research theme, being structured in four distinct blocks of questions. Each block was carefully designed to address specific aspects related to the profile of the business and its manager, management, the need for bank credit and, finally, delinquency. The objective was to obtain a comprehensive understanding of the need and management of contracted credit, in addition to the payment capacity of companies. In the first block, consisting of ten

questions, we sought to obtain data about both the manager and the company. These questions were designed to identify profiles and demographic characteristics, establishing a connection with the information previously registered with the banking institution. In this way, it was possible to relate the answers obtained with the data of the manager and the company, allowing a more complete analysis.

The second block addressed the management of the business, the experience of managers, their ability to interpret accounting information and the competitive context faced. The five questions in this block explored relevant aspects related to the way the business is managed, considering the expertise of the managers, their ability to understand and use accounting information, in addition to analyzing the competitive scenario in which they are inserted.

In the third part of the questionnaire, we directed our attention to the manager's knowledge of the bank credit options available to the company. Through the six questions applied, topics such as the indicators used to assess the need for credit, the impacts arising from its use, planning for the management and application of resources, the risks involved and knowledge about rates, interest, terms and payment conditions were explored. These questions allowed the assessment of the manager's degree of familiarity with the different credit alternatives, as well as his ability to analyze the financial aspects and risks associated with obtaining credit.

PRESENTATION AND DISCUSSION OF RESULTS

BLOCK 1 – DEMOGRAPHIC DATA

Table 2 shows several aspects related to the interviewees' age, position held in the company, education and education. Initially, it is possible to observe that the majority of the interviewed group is under 35 years of age, representing 60.23% of the total. On the other hand, the remaining group corresponds to age groups over 36 years old, totaling 39.77%. As for the positions occupied, it was found that the position of managing partner presented the highest representativeness, covering 60.23% of the interviewees. However, the positions of Director and Coordinator had less representation, with the same percentage proportion of 9.96%.

With regard to the qualification of the interviewees, we noticed that the largest portion has a high school education, corresponding to 55.11% of the total. On the other hand, the lowest representativeness was observed in Higher Education and Graduate Education, totaling 11.93% and 6.82%, respectively. In the framework of Training in the

Company's Activity area, it was found that most of the interviewees (40.34%) do not have specific training in this area.

Finally, in relation to participation in management courses, it was found that the highest percentage concentration was found in the items "rarely" or "never". Thus, these data provide an overview of the demographic characteristics, positions held, education levels and participation in management courses of the group of interviewees.

Table 2 - Manager Profile

PERFIL DO GESTOR		
FAIXA ETÁRIA DO GESTOR	**Quantidade**	**%**
Inferior a 25 anos	35	19,89%
Entre 26 e 35 anos	71	40,34%
Entre 35 e 50 anos	53	30,11%
Superior a 50 anos	17	9,66%
Total	176	100,00%
CARGO DO ENTREVISTADO	**Quantidade**	**%**
Diretor	17	9,66%
Sócio gerente	106	60,23%
Supervisor	36	20,45%
Coordenador	17	9,66%
Total	176	100,00%
FORMAÇÃO EDUCACIONAL	**Quantidade**	**%**
Ensino fundamental	46	26,14%
Ensino médio	97	55,11%
Superior	21	11,93%
Pós graduação	12	6,82%
Total	176	100,00%
FORMAÇÃO NA AREA DE ATUAÇÃO DA EMPRESA	**Quantidade**	**%**
Não possui formação.	71	40,34%
Possui formação considerando treinamentos de curta duração na área.	52	29,55%
Possui formação em áreas do ramo da empresa.	35	19,89%
Possui formação em nível superior ou técnico na área.	18	10,23%
Total	176	100,00%
REALIZAÇÃO DE CURSOS DE GESTÃO	**Quantidade**	**%**
Frequentemente.	35	19,89%
Com pouca frequência.	34	19,32%
Raramente.	55	31,25%
Nunca.	52	29,55%
Total	176	100,00%

Source: survey data.

By analyzing Table 3, we can highlight some interesting characteristics of micro and small companies. In relation to the sector of activity, a varied distribution is observed among the different economic sectors. While 5.11% of the companies belong to the industrial sector, 41.48% are in the retail trade, 25% in the wholesale trade and 28.41% in the services sector. This distribution may be similar or differ compared to previous surveys, reflecting the particularities of the economic and business context in question. This data provides insights into the market segments most explored by micro and small companies.

With regard to the tax regime, it can be seen that most companies (96.59%) are taxed by the Simples Nacional, while only 3.41% opt for the Real Profit. This result is a common trend among micro and small companies, since the Simples Nacional is a simplified and more advantageous regime in terms of tax burden for many smaller

businesses. This preference for Simples Nacional may be related to the ease of tax administration and the tax benefits offered by this regime.

With regard to revenue, there is a predominance of micro-enterprises, representing 110 enterprises (62.5%) in this category, with revenues of less than R$360,000.00. Small companies total 52 (29.55%), with revenues between R$360,000.01 and R$4,800,000.00, while 14 companies (7.95%) are classified as medium-sized, with revenues above R$4,800,000.01. This distribution can be compared to other studies to verify whether there is consistency in the revenue ranges adopted and to help understand the profile of the companies surveyed.

Regarding the number of employees, it is noted that most companies have a reduced team, with up to nine employees, representing 141 companies (80%). Only 6 companies (3.41%) indicated having more than 30 employees. This distribution is similar to previous surveys that also highlight the predominance of micro-enterprises with lean teams. This characteristic may be related to the financial and operational capacity of these companies, which often need to optimize resources and adapt to a competitive business environment.

Regarding the longevity of the companies, measured by the time of incorporation, it can be seen that most of them have been in the market for a maximum of 5 years, totaling 107 companies (60.79%). The 2 to 5 year range concentrates 64 companies (36.36%), while 51 companies (28.98%) have 6 to 10 years of experience. By comparing the studies mentioned above, we can verify the evolution and behavior of companies over time. In the study by Moreira et al. (2013), for example, 51.4% of the companies surveyed had 10 or more years of existence, while 25.40% had up to 3 years of operation. In the study by Alves et al. (2013), it was evident that 55.1% of the companies were up to 5 years old. Based on these data, it is possible to infer that a considerable part of the companies surveyed has not yet reached the maturity stage, which usually occurs after five years of operation. This finding reveals a dynamic and challenging market context for the survival and growth of micro and small companies, which need to face obstacles and seek strategies to consolidate themselves in the market.

Table 3 - Company Profile

PERFIL DA EMPRESA		
RAMO DE ATIVIDADE	**Quantidade**	**%**
Industria.	9	5,11%
Comércio varejista.	73	41,48%
Comércio atacadista.	44	25,00%
Serviços.	50	28,41%
Total	176	100,00%
FATURAMENTO BRUTO ANUAL	**Quantidade**	**%**
até R$ 81.000,00.	38	21,59%
de R$81.000,01 a R$ 360.000,00.	72	40,91%
R$ 360.000,01 a R$ 4.800.000,00.	52	29,55%
acima de R$4.800.000,00.	14	7,95%
Total	176	100,00%
NÚMERO DE EMPREGADOS	**Quantidade**	**%**
Até 9 pessoas.	129	73,30%
10 a 20 pessoas.	27	15,34%
21 a 30 pessoas.	14	7,95%
acima de 30 pessoas.	6	3,41%
Total	176	100,00%
REGIME DE TRIBUTAÇÃO	**Quantidade**	**%**
Simples nacional.	170	96,59%
Lucro real.	0	0,00%
Lucro presumido.	6	3,41%
Lucro Arbitrado.	0	0,00%
Total	176	100,00%
TEMPO DE CONSTITUIÇÃO DA EMPRESA	**Quantidade**	**%**
Menos de 1 ano.	42	23,86%
Entre 2 e 5 anos.	64	36,36%
Entre 6 e 10 anos.	51	28,98%
Entre 11 e 20 anos.	19	10,80%
Total	176	100,00%

Source: Survey data

BLOCK 2 – BUSINESS MANAGEMENT

The second block of the questionnaire addressed the evidence of tools used for information management, the experience of managers in the company's sector, their perceptions about the ability to interpret management information and its use in decision making, in addition to their view in relation to the level of competition.

With regard to information management, the analysis reveals that 39.77% of managers use electronic spreadsheets, indicating a preference for digital tools that allow greater control and organization of data. In addition, 30.68% of managers opt for adequate manual controls, demonstrating a preference for more traditional methods. Finally, 19.89% of managers use computerized systems, which suggests a more advanced adoption of technology for information management. Regarding the managers' experience in the company's sector, there is a diversification in the answers. Most managers (37.50%) have between 3 and 5 years of experience, followed by 33.52% with between 5 and 10 years of experience. Managers with less than 3 years of experience represent a significant portion, totaling 19.89%. On the other hand, only 9.09% of managers have more than 10 years of experience, which may indicate a renewal and the entry of new professionals in the sector.

Regarding the evaluation of the effectiveness of the decisions made, it is noted that a significant portion of the managers (55.68%) do not have a formal evaluation method. However, they recognize the importance of evaluating their decisions. On the other hand,

27.84% of managers base their evaluation on the subjective perception of the results achieved. A small portion (4.55%) uses specific indicators and metrics to evaluate the impact of decisions, while 11.93% do not consider it necessary to carry out this evaluation. As for the level of competition, the analysis reveals that most managers (35.23%) say that there are no direct or potential competitors in the short term. In addition, 28.98% of managers consider the level of competition high, but not unfeasible for the business. On the other hand, 21.02% of managers perceive a low level of competition. A smaller portion (14.77%) sees competition as high, to the point of making the business unfeasible.

Table 4 - Business management

GESTÃO DO NEGÓCIO		
GESTÃO DAS INFORMAÇÕES GERENCIAIS	**Quantidade**	**%**
Não utiliza qualquer controle.	17	9,66%
Controles manuais adequados.	54	30,68%
Planilhas eletrônicas.	70	39,77%
Sistemas informatizados.	35	19,89%
Total	176	100,00%
EXPERIÊNCIA DOS GESTORES NO SETOR DE ATUAÇÃO DA EMPRESA	**Quantidade**	**%**
Inferior a 3 anos.	35	19,89%
Entre 3 e 5 anos.	66	37,50%
Entre 5 e 10 anos.	59	33,52%
Superior a 10 anos.	16	9,09%
Total	176	100,00%
CAPACIDADE DE INTERPETRAÇÃO DA INFORMAÇÃO	**Quantidade**	**%**
Altamente capaz e experiente em interpretar informações gerenciais.	8	4,55%
Confiantemente capaz, mas sempre buscando aprimorar minhas habilidades.	28	15,91%
Tenho habilidades limitadas, busco orientação para melhorar minha interpretação.	35	19,89%
Minha capacidade de interpretar informações gerenciais é limitada, procuro ajuda externa.	105	59,66%
Total	176	100,00%
EFICÁCIA DA DECISÃO	**Quantidade**	**%**
Utilizo indicadores e métricas específicas para avaliar o impacto das decisões e ajustar o curso, se necessário.	8	4,55%
Baseio minha avaliação na percepção subjetiva dos resultados alcançados.	49	27,84%
Não tenho um método formal de avaliação, entretanto considero importante avaliar as decisões tomadas.	98	55,68%
Não considero necessário avaliar a eficácia das decisões tomadas	21	11,93%
Total	176	100,00%
NÍVEL DA CONCORRÊNCIA	**Quantidade**	**%**
Concorrência elevada que pode inviabilizar o negócio.	26	14,77%
Nível de concorrência elevado, mas não inviabiliza o negócio.	51	28,98%
Não existem concorrentes diretos ou potenciais no curto prazo.	62	35,23%
Baixo nível da concorrência.	37	21,02%
Total	176	100,00%

Source: survey data.

BLOCK 3 – NEED AND MANAGEMENT OF CREDIT

The analysis of the answers related to the need and management of credit reveals relevant information about the familiarity of managers with the available bank credit options. Of the managers interviewed, 16.48% said they were completely familiar with credit options, indicating a good level of knowledge. In addition, 29.55% have some knowledge about the available options, while 39.77% admitted to having little knowledge and 12.50% said they had no knowledge about the credit options. These results demonstrate that there is a significant variation in the level of familiarity among managers, with a considerable portion still needing more information on the subject.

When it comes to the main financial indicators used in the assessment of the need to contract credit, the data reveal that 55.11% of managers do not consider financial indicators in this process. This percentage represents a significant portion, which suggests a lack of

careful analysis in decision-making related to taking out credit. On the other hand, 15.91% of managers use up to two financial indicators, while 20.45% use up to three indicators. Only 8.52% of the managers stated that they use all available indicators in the assessment of the need to contract credit. This number indicates a minority that takes a more comprehensive and thorough approach to financial analysis before deciding on taking out credit. These managers demonstrate a greater commitment to using all available tools to support their decisions, which suggests a greater likelihood of making more informed and strategic decisions.

The managers' ability to prepare a plan for the application of the resources obtained through credit for business improvements was also evaluated. The analysis revealed that 9.09% of managers have complete confidence in their ability to develop an efficient plan. However, most managers (39.20%) admitted to having little ability to develop a plan, while 26.70% have some skill, but need support. Another 25.00% of the managers stated that they did not have any ability to prepare a plan for the application of resources. These results highlight the importance of providing support and training to managers to improve their skills in the preparation of plans for the application of resources obtained through credit.

Regarding the risks involved in taking out credit and the way managers deal with them, the analysis shows that most managers (78.98%) are not aware of the risks involved. Among those who are aware of the risks, 3.98% mentioned the risk of excessive debt and the risk of default, and said they deal with them through careful analysis and financial planning. Another 7.95% of managers mentioned only the risk of default, closely monitoring cash flow. In addition, 9.09% of the managers mentioned the risk of excessive indebtedness and seek to limit the amount of credit contracted. These results highlight the need for managers to be aware of the risks involved in contracting credit and the importance of appropriate strategies to deal with them.

In terms of knowledge about interest rates, terms and payment terms commonly offered by banks, the analysis shows that there is a varied distribution among managers. While 25.00% of the managers stated that they have a good knowledge of this information, 43.18% have some knowledge and 21.02% have limited knowledge. However, 10.80% of the managers interviewed are not aware of this information. These results point to the need to improve managers' knowledge of interest rates, terms and payment terms offered by banks, in order to make more informed and advantageous decisions for the company.

Finally, in relation to the way managers monitor and evaluate the impact of the use of credit obtained in the company, the analysis reveals an unequal distribution. Only 5.68% of

managers said they perform regular financial analysis and monitor the results achieved, while 7.39% perform comparative analysis before and after the use of credit to identify its impact on financial results and the company's overall performance. On the other hand, most managers (48.86%) do not have a structured method to monitor and evaluate the impact, limiting themselves only to monitoring the cash flow after the use of credit. These results indicate the importance of implementing more comprehensive monitoring and evaluation methods to ensure a more accurate analysis of the impact of credit utilization on the company.

Table 5 – Credit needs and management

NECESSIDADE E GESTÃO DO CRÉDITO		
FAMILIARIDADE DO GESTOR COM AS OPÇÕES DE CRÉDITO BANCÁRIOS DISPONÍVEIS	**Quantidade**	**%**
Sim, estou completamente familiarizado.	29	16,48%
Sim, tenho algum conhecimento sobre as opções disponíveis.	52	29,55%
Não tenho muito conhecimento sobre as opções disponíveis.	70	39,77%
Não tenho conhecimento sobre as opções disponíveis.	22	12,50%
Total	173	98,30%
PRINCIPAIS INDICADORES FINANCEIROS UTILIZADOS NA AVALIAÇÃO DA NECESSIDADE DE CONTRATAÇÃO DE CRÉDITO	**Quantidade**	**%**
Somente até dois dos indicadores.	28	15,91%
Utilizo até três dos indicadores.	36	20,45%
Utilizo todos os indicadores.	15	8,52%
Não considero indicadores financeiros	97	55,11%
Total	176	100,00%
CAPACIDADE DE ELABORAR UM PLANO DE APLICAÇÃO DOS RECURSOS OBTIDOS POR MEIO DE CRÉDITO PARA MELHORIAS NO NEGÓCIO	**Quantidade**	**%**
Tenho total confiança na minha capacidade de elaborar um plano eficiente.	16	9,09%
Tenho alguma habilidade para elaborar um plano, mas preciso de suporte.	47	26,70%
Não tenho muita habilidade para elaborar um plano.	69	39,20%
Não tenho habilidade para elaborar um plano de aplicação dos recursos.	44	25,00%
Total	176	100,00%
RISCOS ENVOLVIDOS NA CONTRAAÇÃO DE CRÉDITO E COMO LIDA COM ELES	**Quantidade**	**%**
Risco de endividamento excessivo e risco de inadimplência. Lido com eles por meio de análise criteriosa e planejamento financeiro.	7	3,98%
Risco de inadimplência. Lido com ele monitorando de perto o fluxo de caixa.	14	7,95%
Risco de endividamento excessivo. Lido com ele buscando limitar o valor do crédito contratado.	16	9,09%
Não estou ciente dos riscos envolvidos na contratação de crédito.	139	78,98%
Total	176	100,00%
CONHECIMENTOS SOBRE AS TAXAS DE JUROS, PRAZOS E CONDIÇÕES DE PAGAMENTO COMUMENTE OFERECIDAS PELOS BANCOS	**Quantidade**	**%**
Sim, tenho um bom conhecimento sobre essas informações.	44	25,00%
Sim, tenho algum conhecimento sobre essas informações.	76	43,18%
Tenho conhecimento limitado sobre essas informações.	37	21,02%
Não tenho conhecimento sobre essas informações.	19	10,80%
Total	176	100,00%
COMO MONITORA E AVALIA O IMPACTO DA UTILIZAÇÃO DO CRÉDITO OBTIDO NA EMPRESA	**Quantidade**	**%**
Realizo análises financeiras regulares e acompanho os resultados alcançados.	10	5,68%
Realizo análises comparativas antes e depois da utilização do crédito para identificar seu impacto nos resultados financeiros e no desempenho geral da empresa.	13	7,39%
Monitoro apenas o fluxo de caixa após a utilização do crédito.	67	38,07%
Não tenho um método estruturado para monitorar e avaliar o impacto.	86	48,86%
Total	176	100,00%

Source: Survey data

FINAL CONSIDERATIONS

Based on the research carried out on financial management in micro and small enterprises, important considerations were identified related to the negative effects of the lack of accurate accounting information and the inability of managers to analyze and decide based on the available data. These impacts directly affect the performance and survival of these companies, especially with regard to obtaining bank credit and the efficient management of financial resources. When analyzing the demographic characteristics of the

interviewees, it was observed a predominance of young managers, under the age of 35, occupying managing partner positions. In addition, most had high school education as their level of education and did not have specific training in the company's area of operation. These data highlight the need to invest in training and training of managers, especially in the areas of accounting and financial management, to improve their ability to interpret and use accounting information.

Regarding the characteristics of micro and small enterprises, a varied distribution was found among the economic sectors, with retail trade being the most predominant. Most of the companies interviewed were included in the Simples Nacional tax regime, indicating a preference for a simplified and advantageous regime in terms of tax burden. As for revenue, micro-enterprises prevailed, with a reduced team of employees. These characteristics highlight the challenges faced by these companies, which need to optimize resources and adapt to a competitive environment to ensure their survival and growth.

The analysis of the tools used for information management revealed a preference for electronic spreadsheets and manual controls, evidencing a combination of traditional and digital methods for data control and organization. However, it is important to note that a significant portion of managers do not use computerized systems, which can limit their ability to access accurate and real-time financial information. In addition, a diversification in the experience of managers was observed, with a considerable portion having less than 3 years of experience in the company's sector. This highlights the importance of providing support and training to managers to enhance their skills in interpreting and utilizing management information. The evaluation of the effectiveness of the decisions made by the managers revealed that a significant portion does not have a formal evaluation method, suggesting a lack of careful analysis in decision-making, especially in relation to the contracting of credit. In addition, most managers do not consider financial indicators when assessing the need to take out credit, which can result in less informed and strategic decisions. These results highlight the importance of promoting a culture of financial analysis and evaluation among managers in order to improve the management of financial resources and obtaining credit.

In summary, financial management in micro and small businesses faces significant challenges related to the lack of accurate accounting information, limited ability of managers to interpret and use this data, lack of specific training in accounting and financial management, and the need to optimize resources and adapt to a competitive environment. It is recommended to invest in training managers, promote the use of computerized systems to control financial information, implement formal methods for evaluating decisions

and encourage careful analysis in the contracting of credit. These actions can contribute to more efficient and sustainable financial management in micro and small companies.

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ALLELOPATHIC EFFECT OF *Senna obtusifolia* ON SEED GERMINATION OF VEGETABLES *Lactuca sativa* AND *Beta vulgaris*

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ABSTRACT

Allelopathy refers to the effects that one organism can cause on another directly or indirectly, and can favor or suppress everything from seed germination to seedling development. The allelopathic action is specific, that is, each plant, both living and decomposing, exerts inhibition only on certain species. These compounds, produced in various parts of plants, such as leaves and roots, can be released by exudation, volatilization, leaching or decomposition of waste. Its effects are varied, including inhibition of germination, impaired growth, and, in extreme cases, death of recipient plants. Although allelopathy can have positive or negative effects, its impact is specific depending on the plants involved.

In horticulture, recent studies demonstrate the potential allelopathic effects on crops such as lettuce and sugar beets. For example, extracts of Nicotiana tabacum and Eucalyptus grandis have shown inhibitory effects on the germination of lettuce and broccoli seeds. Species such as Senna obtusifolia, a weed common in several agricultural areas, stand out for their potential to inhibit crop development due to the release of allelochemicals. Studies such as the impact of Senna obtusifolia on vegetables are essential to better understand these mechanisms and develop more sustainable agricultural practices, promoting greater productivity and cost reduction in agroecosystems.

Keywords: Senna obtusifolia, Allelopathy, Lettuce, Beetroot.

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INTRODUCTION

Allelopathy refers to the effects that one organism can cause on another directly or indirectly, as a result of chemical substances that are released into the environment (MOLISH, 1937; PEIXOTO, 1999). These allelopathic substances, known as allelochemicals, are implicated in a wide variety of effects on plants. These effects include delay or complete inhibition of seed germination, paralyzed growth, injury to the root system, chlorosis, wilting and even death of plants (CORREIA, 2002).

The allelopathic action is specific, that is, each plant, both living and decomposing, exerts inhibition only on certain species of weeds or cultivated plants (LORENZI, 1984). In allelopathy, the plants that produce the allelochemicals and that cause the allelopathic effect, whether positive or negative, are called donors, while the plants to which the allelochemicals are directed and that, therefore, suffer the allelopathic effects are called receptors.

In horticulture, the effect of allelopathy has gained notoriety in recent years. Goetze and Thomé (2004) studying allelopathy of extracts of *Nicotiana tabacum* and *Eucalyptus grandis* proved that extracts made from fresh and dried leaves of these species showed a strong inhibitory effect on the germination of lettuce, broccoli and cabbage seeds.

Senna obtusifolia is a weed popularly known as mata-pasto, this species has assumed great relevance as a weed, as it is present from intensive cultivation soils, to pastures, orchards and vegetable gardens (SILVA & SANTOS, 2010) and because they compete for water, light and nutrients, affecting the growth, development and productivity of crops.

The identification of allelopathic species and the knowledge of the mechanisms by which they exert their effects on the environment can offer new and important alternatives from the economic and productive point of view, as they will enable the reduction of the consumption of agricultural inputs, such as herbicides, in addition to being able to increase crop productivity due to less competition with weed species. as well as optimize its management.

Considering the incipience of studies on this theme, this work aims to evaluate the allelopathic activity of *Senna obtusifolia* on the germination of lettuce (*Lactuca sativa*) and beet (*Beta vulgaris*) seeds.

ALELOPATHY

The etymology of the word allelopathy arises from two Greek words allelon, which has the meaning of "from one to the other" and pathós which means "to suffer"

(FERREIRA; AQUILA, 2000). In the agricultural sciences, the best definition of the term allelopathy was given by Molisch (1937), he defined it as the influence of one individual on another, either harming or favoring. The same author suggests that the effect is carried out by biomolecules (called allelochemicals).

The location of allelochemicals covers different parts of the plant, such as leaves, branches, roots, and their release is done by leaching, volatilization, root exudation, decomposition of residues, among others (FERGUSON; RATHINASABAPATHI; CHASE, 2013). For Rodrigues et al., (1993) the main ways in which allelopathic substances are released into the environment is through the decomposition of waste, volatilization, leaching and exudation produced by a plant and released into the environment. For Rizvi et al., (1992) this influence can be either in the aqueous phase of the soil or in the substrate, or by gaseous substances volatilized in the air that surrounds terrestrial plants.

Other authors also gave their concepts to allelopathy, for Rice (1984) the term refers to "any direct or indirect harmful or beneficial effect that one plant (including microorganisms) exerts on another by the production of chemical compounds released into the environment". In fact, this is a good definition. For Soares and Vieira (2000), allelopathy is a process by which products of the secondary metabolism of a given plant are released, preventing the germination and development of other relatively close plants. So we can conceptualize in a general way that allelopathy is the mechanism in which plant species interfere or influence the development of others, whether this influence is positive or negative.

Allelochemicals are a subset of secondary metabolites, not necessary for the growth and development of the producing organism. These play an important role in shaping interactions between communities, such as in agroecosystems, where they have a determinative effect on crop growth and next season's crops. In addition to these effects, allelochemicals can also contribute to disease and pest resistance and subsequently confer competitive advantage (LI et al., 2010).

For Waller (1999) it is in the secondary metabolism that most of the allelochemicals are produced, as they represent some protection for plants against microorganisms or even some benefit in their development. Allelochemicals can undergo modifications depending on the cover to be incorporated or maintained on the soil surface (FERREIRA; AQUILA, 2000). In other words, as for the allelopathic effect on a crop, we must think that the plant remains, whether mulch or straw from a predecessor crop, because of the chemicals they expelled into the environment can influence a successor crop, and can influence in a way

that favors growth, or prevents it. This mechanism can be seen in horticulture, grain cultivation or forest species.

In several branches of agricultural sciences, the effects of allelopathy in horticulture, fruit and vegetable cultivation have been studied. In horticulture, for example, Goetze & Thomé (2004), studying the allelopathic effect of extracts of *Nicotiana tabacum* and *Eucalyptus grandis*, proved that extracts made from fresh and dried leaves of these species showed a strong inhibitory effect on the germination of lettuce, broccoli and cabbage seeds. Bendin et al., (2006), studying the allelopathic effect of *Eucalyptus citriodora* extract on tomato seed germination, observed that the extracts did not present inhibitory effects on germination at the concentrations tested, but realized that the extracts with 3% concentration presented negative effects on germination speed.

Lucchesi and Oliveira (1988), still in the 80's, studying the possible allelopathic properties of cabbage (*Brassica oleracea* L.) demonstrated the inhibitory effect on the germination of tomato seeds, in the highest concentrations of the extract obtained from cabbage leaves. In fruit growing, studies on allelopathy have also stood out in the Brazilian scenario, especially in the control of weeds, such as Neto Filho & Carvalho (2011) who, verifying allelopathy as an alternative for weed control in citrus, detected that among the covers evaluated, *Brachiaria decumbens* and *Canavalia ensiformis* were the most efficient with weed control rates higher than 75%.

Evaluating different vegetation covers in the development of peach, Rufato et al., (2007) found that the covers, with the exception of forage turnip, increased the development of peach plants. In olericulture, Mauli et al., (2009), studying the allelopathic effect of leucaena on soybean and invasive plants, identified the negative interference of the extracts in the root length of viola chord, in the percentage of germination and in the root length of guanxuma and picão-preto. But they did not find negative interferences in the parameters analyzed for soybean seeds.

DONOR PLANTS AND RECIPIENTS

In allelopathy, the plants that produce the allelochemicals and that cause the allelopathic effect, whether positive or negative, are called donors, while the plants to which the allelochemicals are directed and that, therefore, suffer the effects of allelopathy are called receptors. There are some studies in Brazil pointing out which plants have the greatest allelopathic potential in agricultural systems.

In their study, Cremonez et al., (2013) consider that the species with the greatest allelopathic potential in Brazil are nutsedge (*Cyperus rotundus*), lemongrass (*Cymbopogon*

citratus), eucalyptus (*Eucalyptus* sp.), *Coleus barbatus*, *Jatropha curcas*, *Bidens pilosa*, castor bean (*Ricinus communis*), Pinus (*Pinus Taeda* and *Pinus elliottii*), Papaya (*Carica papaya*) and Safflower (*Carthamus tinctorius*). Donor plants are not necessarily competitors, as they involve the reduction or removal of some environmental factor necessary for another plant in the same ecosystem, such as water, light and nutrients (REZENDE et al., 2003).

Many researches have been developed to verify the vulnerability of weeds under the allelopathic effect of some species. Among them, vegetables are generally fundamental for the maintenance of family farming, providing a balanced diet for the family and a regular source of income (MAYER, 2009). In Brazil, according to the first Agricultural Census of family farming (IBGE, 2006), there are 23,089 agricultural establishments that produce carrots and 21,937 agricultural establishments that produce beets.

CULTURE FROM ALFACE

Lettuce (*Lactuca sativa* L.) is a leafy vegetable that is most consumed in Brazil (TRANI et al., 2005). Its center of origin is the Asian region. In mid-4,500 BC it was already known in ancient Egypt and arrived in Brazil in the sixteenth century, through the Portuguese. It has a fleshy stem in which the leaves attach themselves in the shape of a rosette. They can be smooth or curly, presenting a wide variety of leaves, colors, sizes and textures, according to the cultivar (FILGUEIRA, 2008).

It is an annual plant, originally from a temperate climate, belonging to the Asteracea family. Practically all lettuce cultivars develop well in mild climates, especially in the vegetative growth period. The occurrence of higher temperatures accelerates the crop cycle and, depending on the genotype, can result in smaller plants because tasseling occurs earlier (HENZ & SUINAGA, 2009).

The cultivation of this vegetable is of great importance in the economic and social spheres, given that they have high productivity and the high added value allows the generation of income in small areas, contributing to the social inclusion of needy families (FILGUEIRA, 2008). According to Resende et al., (2007) in Brazil, lettuce is grown from north to south because it is the main salad consumed by the population in Brazil, both for its flavor and nutritional quality and for the reduced price for the consumer.

Lettuce cultivation is carried out intensively and is generally practiced by family farmers, usually generating five direct jobs for each hectare cultivated (COSTA & SALA, 2005). Although lettuce is cultivated throughout Brazil, in the northeast region, production is

low, compared to other regions with a mild climate, not meeting domestic demand, given the growing consumption of the vegetable and its low production (QUEIROGA et al. 2001).

The main factors that contribute to the low production in the Northeast, when compared to the rest of the country, is the lack of research on cultivars adapted to the region, the lack of technical information on the development of the vegetable, to favor management under these conditions (GRANGEIRO et al., 2006).

Bom Jesus in Piauí is a hub city in grain production and has stood out on the national scene in soybean agribusiness, but when it comes to olericulture and horticulture, the city does not show the same results. Only a small part of vegetables is sold by merchants who produce or buy from productions in the vicinity of the municipality of Bom Jesus itself, in small areas of cultivation or even in backyards, that is, from family farming units.

This situation contrasts with the extensive areas of land with good soils for horticultural cultivation, in addition to the rich concentration of groundwater in the southern region of the state of Piauí, where the municipality of Bom Jesus is located.

CULTURE OF BETERRABA

The beet crop (*Beta vulgaris* L.) is a tuberous, annual and herbaceous vegetable, originally from North Africa and southern Europe, belonging to the Amaranthaceae family (formerly Chenopodiaceae), as well as chard and true spinach (EMBRAPA, 2016). There are three types of beets: the sugar beetroot used for the production of sugar, the forage used for animal feed and the one whose roots are consumed as a vegetable, being the best known in Brazil, this one stands out for having a high iron content, both in the roots and in the leaves (SOUZA; LORENZI, 2008).

It is a vegetable with a sweet taste and a strong red color (VASCONCELOS, 2009). Such coloration is due to a pigment, also occurring in the leaves, veins and petioles. The tuberous part has a globular shape, developing almost at the surface of the soil. The so-called "seeds" are actually clusters of tiny cork fruits, the aglomeruli. Each fruit has an ovule, which originates a botanical seed. The root system is of the pivoting type, and the main root reaches a depth of 60 cm, with few lateral branches. Beets are not tuberous roots like carrots, which makes transplanting seedlings to the bed optional (FILGUEIRA, 2007).

The plant is typically biennial, requiring a period of intense cold to pass the reproductive stage of the biological cycle, when the emission of the floral tassel occurs, with seed production. In the vegetative stage, there is the development of elongated leaves around a tiny stem and the tuberous part is usable. Heat is a limiting factor for most

cultivars (FILGUEIRA, 2007). According to Tivelli et al. (2011), as there are no well-adapted national varieties of beets, when grown under high temperature and rainfall, poor internal coloration may occur, with the formation of lighter colored rings, reducing the concentration of pigments in the roots, favoring the occurrence of the 'leaf spot' disease (*Cercospora beticola*), which can cause a reduction in the production of this vegetable.

There are few cultivars planted in Brazil, and the seeds are imported from the United States or Europe. The traditional Early Wonder cultivar, of which there are some differentiated selections marketed by seed producing companies, has become a quality standard. It is precocious, with globular roots and purplish color, internally and externally. The leaves are erect, elongated, of uniform size and dark green in color, which lend themselves to the preparation of bunches in some selections. These leaves are also edible, being richer in nutrients than the beet itself. It is an appropriate cultivar for the autumn-winter crop, not adapting well to the spring-summer crop (FILGUEIRA, 2007).

In Brazil, the largest producers of the vegetable are found in the states of São Paulo, Minas Gerais and Rio Grande do Sul. In the Northeast, its cultivation is lower, since high temperatures tend to decrease pigmentation and subsequently its quality (GRANGEIRO et al, 2007).

WEEDS AS A MECHANISM OF ALLELOPATHIC PLANTS

The term weed does not refer to any known biological function. Plants that currently cause damage to human activities, human health and the environment, when occurring outside their geographical distribution area or in population sizes above the carrying capacity of the environment, have several designations compatible with their biological function, such as: parasitic plant, invasive exotic plant, pioneer plant, climbing plant, among others (PITELI, 2015).

All these plants have a common character: their undesirability in the place, time and form in which they occur (PITELLI, 2015). They are considered undesirable due to the problems they cause to agricultural production, production costs, the maintenance of the integrity of environmental reserves, the increased risks of accidents on highways, railways and waterways, the integrity of aquatic environments and the generation of electricity, among other important interferences.

These species are characterized by having rapid development, being able to reach their maturity in a short time. Seed production is high, however, this is not the only means of reproduction of these invasive plants; some species also have reproductive capacity

through bulbs, tubers, rhizomes and rooting (KARAM, 2008) which makes it difficult to control them.

Weeds need the same factors required by the crop for their development, that is, water, light, nutrient and space, establishing a competitive process when crop and weeds develop in the same place (VASCONCELLOS, 2012). It is of great importance in agricultural production due to its direct effects on crops, such as the high degree of interference (joint action of competition and allelopathy) and indirect effects such as increased production costs, difficulty in harvesting, depreciation of product quality, in addition to hosting pests and disease agents.

Currently, this mechanism of allelopathic plants has been used to replace the use of insecticides, nematicides and especially herbicides. Many research studies have been developed in Brazil and around the world to verify the effect of allelochemicals of some plants on others.

In a study carried out in Rio Grande do Sul, Ferreira & Áquilla (2000) noted that there are some species that form almost pure groups, keeping the other species apart. The same authors suggest tips for developing work in this segment, such as: collecting soil, litter, plant debris, proceeding to more controlled experiments, in beds and/or greenhouse.

In the literature, there are reports of the allelopathic effect of weeds in cultivated species such as: Allelopathic effect of *Senna obtusifolia* and *Commelina benghalensis* on the twinning and morphological characteristics of root and stem of tomato seedlings (Alencar et al., 2022), the allelopathic effect of Tirirca (*Cyperus haspan*) (DEOMEDESSE et al., 2019) and Assa-peixe (*Vernonia polysphaera*) in lettuce (NISHIMUTA et al., 2019), Assapê grass on corn (SANTOS et al., 2019). Allelopathic effect of aqueous extracts of *Solanum paniculatum* on the germination and initial growth of lettuce (ROCHA et al., 2018).

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UNVEILING MASCULINE SILENCE: REFLECTIONS ON IDENTITY AND CARE

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ABSTRACT

This article investigates male discourses surrounding the construction of gender identity and care, using as a basis the narratives presented in the documentary "The Silence of Men". The research explores how normative discourses, perpetuated since childhood, contribute to the formation of emotional barriers in men, making it difficult to express feelings and open up to vulnerability. The impacts of hegemonic masculinity and how this structure affects both men and their interpersonal relationships are analyzed, addressing topics such as gender violence, emotional repression, and resistance to care. The study also highlights initiatives to deconstruct hegemonic patterns, emphasizing the importance of reflective practices and the active involvement of men in the ethics of care. The qualitative methodology, based on content analysis, allowed the identification of three thematic categories: discourses on being a man, violence and hegemonic masculinity, and protagonists and practices of care. The results point to the need to rethink masculinities from a critical perspective, promoting care as an essential component for gender equity and emotional well-being.

Keywords: Man. Masculinities. Silence. Gender. Care.

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INTRODUCTION

Since childhood, men are socialized to play social roles that require emotional control and the silencing of their feelings. This socialization occurs through normative discourses frequently reproduced by family members, friends, and teachers, such as: “men don’t cry,” “real men have to be brave,” and “men who are men like women.” Such discourses contribute to the construction of emotional barriers, making it difficult to identify and express feelings, as well as to communicate about the emotional impact of these experiences and their implications for interpersonal relationships. The hegemonic masculinity model, marked by youth, heterosexuality, cisgender, whiteness, strength, and virility (Rodriguez, 2020), is socially normative and considered the most honorable way to be a man (Connell, 2013). This pattern encourages male domination over women and subordinate masculinities, that is, marginalized expressions of masculinity, such as those of non-white, non-heterosexual men or those who deviate from traditional standards of strength and power (Connell, 2013). Hegemonic masculinity, in interaction with patriarchy and machismo, defines which individuals are socially recognized as “legitimate men”. Kimmel (1998) highlights that masculinities are social, dynamic, and contextual constructions, inserted in power relations that reinforce inequalities of gender, race, ethnicity, sexuality, and age, with sexism and homophobia as expressions of this process. According to Castro (2018), the construction of a democratic society requires that education reduce inequalities, dismantling both subordinated feminine identities and toxic masculinities produced by machismo. Although the model of masculinity encourages aggressive, virile behavior and disregard for characteristics associated with femininity, it also affects men themselves, reflected in the high rates of traffic accidents and homicides, while women, disproportionately, face domestic violence and harassment at work.

In addition, it is necessary to question phallocentrism, a belief that permeates men's socialization processes, positioning them as "natural dominators". This perspective disregards other forms of gender expression, rendering invisible masculinities that are not structured based on virility and violence, but that manifest themselves around weaknesses and vulnerabilities (Medrado, 2014).

Bell Hooks (2020) highlights that, at the beginning of the contemporary feminist movement, there was an anti-male policy, in which women's anger was channeled as a form of liberation. This anger arose in response to how men benefited from patriarchy to exercise sexism, even when they participated in struggles for social justice, such as workers' rights, the rights of the poor, and racial equality. However, when the debate

involved gender policies, the hypocrisy and selective bias of these discourses became evident, which ended up reinforcing male domination over women.

Furthermore, it is worth noting that one of the central challenges was to recognize that men were not solely responsible for the problem and that it was necessary to understand the role of women in maintaining and perpetuating sexism. The author emphasizes the importance of male participation in feminism, not only as allies but as active agents in the fight for equality, which can contribute to the redefinition of male identity. This involvement promotes a policy of care that values self-esteem and self-love, both for oneself and in relationships with others, considering that every culture of domination tends to attack these aspects, conditioning the construction of a sense of identity to the subjugation of others (Hooks, 2020).

According to Harding (2019), even though men enjoy privileges due to patriarchy, it is possible to develop and apply reflective actions that consider experiences not based on the depreciation of women and men socially perceived as “feminine”. Another relevant aspect to be highlighted is the self-silencing of groups of men who perform dissident masculinities. From Butler's (2019) perspective, these men do not align with the "heterosexual matrix", as they do not fit into the field of cultural intelligibility that naturalizes certain bodies, genders, and desires. This includes, for example, homosexual and bisexual men, black men, trans men, the poor, and those who present gender expressions considered “effeminate”. Given the above, the Brazilian documentary The Silence of Men (2019), directed by Ian Leite and Luiza de Castro and produced by Instituto Papo de Homem, stands out as an important reference in discussions about hegemonic masculinity. The work explores the experiences of men in the process of constructing their identities, addressing themes such as performances of masculinity since childhood, the experiences of black and trans men in the context of masculinities, fatherhood, gender violence, male aggression, and emotional restriction.

According to Guilherme Valadares (2019), editor-in-chief of PapodeHomem, the production of the documentary The Silence of Men was motivated by the realization that men rarely share their fears and insecurities, a silence reflected in contexts such as domestic violence, the absence of women in positions of power, harassment and high rates of suicide, homicide, and incarceration.

The documentary highlights how men can engage in a policy of care through reflective groups, discussion groups, and social movements. However, in Brazil, male therapeutic groups based on psychologizing and spiritualist approaches are also emerging (Filho, 2022). Many men still resist the deconstruction of hegemonic masculinity,

perpetuating the cycle of non-care, since care is socially associated with the feminine. This resistance is rooted in a gender structure sustained by heteronormativity, machismo, and patriarchy, which reinforce ideals of strength, virility, and invulnerability (Machin et al., 2011).

Although some activities seek to question the underlying processes and subjection involved in male gender performance, changing attitudes requires reflective practice, as collective lament alone does not transform gender-based power relations. Filho's (2022) study also highlighted the participants' limited knowledge of feminism and their agendas aimed at building a “new man”. Given this, this article analyzed male discourses on masculinities, based on the experiences portrayed in the documentary The Silence of Men, investigating: what elements make up the discourses on the construction of male identity. What initiatives have men adopted to deconstruct hegemonic masculinity? And how can they engage in an ethics of care?

METHODOLOGY

This study is characterized as qualitative research, whose data collection was carried out based on the analysis of the discourses presented in the documentary The Silence of Men (2019). The accounts present in the documentary were transcribed using the Transcriptor platform and subsequently submitted to a content analysis of a categorical-thematic nature, as proposed by Bardin (2016).

Content analysis, in this context, involved the segmentation of the material into units of meaning, followed by the categorization of excerpts based on conceptual similarities. This approach allowed the identification of discursive patterns and the construction of thematic categories, considering the social representations of masculinity and emotional care.

The analytical process was conducted in three stages: (I) Pre-analysis – organization of the collected material and constitution of the corpus of analysis; (II) Exploration of the material – coding, and categorization of relevant discursive excerpts; and (III) Treatment of results, inference, and interpretation – reflection on the emerging meanings, integrating the categories created into the theoretical discussion on masculinities and care.

Data treatment was aided by NVivo 14 software, a tool that facilitated the coding and organization of data into thematic categories, enabling a more systematic and rigorous analysis. The main categories resulting from this analysis were: (a) discourses on being a man; (b) violence and hegemonic masculinity; and (c) protagonisms and care practices.

This methodological approach allowed us to explore the perceptions and experiences of the participants, contributing to a critical understanding of the processes of

construction of masculinity and the possibilities of deconstructing hegemonic patterns through reflection and care.

RESULTS AND DISCUSSION

The qualitative analysis of the discourses presented in the documentary The Silence of Men allowed us to identify different aspects related to the experiences and perceptions of masculinity. The participants' statements were grouped into three thematic categories, which emerged from the content analysis: (a) discourses on being a man; (b) violence and hegemonic masculinity; and (c) protagonisms and care practices. Each of these categories will be presented and discussed below, in conjunction with theoretical references on gender, masculinities, and care.

DISCOURSES ON BEING A MAN

This category refers to the discourses that express the participants' perceptions about the meaning of being a man. Participant A describes his experience as a black man and highlights the efforts he made to achieve an ideal of masculinity based on whiteness. He also emphasizes that this parameter proved to be unattainable in his process of identity construction.

> So I had a series of theories and beliefs about what I thought a man should be. It is very common for us to hear or feel that we, as black men (in my case, still with light skin), need to be better than others to get somewhere. If you are not ten times better than the white boy in your class, you will not get anywhere near where he is. So, for a long time, I tried to build a vision of what it would be like to be an increasingly better man, to understand that my aspiration at that time was to become a white man, to try to be a man that I would never become (Participant A).

Your speech highlights essential aspects of masculinity and the process of becoming aware. The first point highlighted is that black men are often perceived as the 'other', not being fully recognized by hegemonic masculinity. The second aspect addresses the relationship of inequality marked by ethnic and gender parameters, in which blackness is positioned as undesirable and associated with a place of 'inferiority'. In this context, black men face the need to strive to surpass white men, whose privileges, historically and socially conferred, guarantee greater access and inclusion in various spaces.

Bell Hooks (2022) highlights that black men, in our society, are often stereotyped by sexism and racism, being seen as lacking intellectual abilities. From this perspective, the body is overvalued to the detriment of the mind, since the white supremacist capitalist imperialist patriarchy portrays them as 'not very intelligent', 'idiots', and 'slow'. The black man who reflected excessively was, therefore, perceived as a threat in the context of a

racist society. Given this, the identity construction of black men is permeated by the racism produced by whiteness, so their Ego Ideal is also mediated by this process. Souza (2021, p. 41) states that the black subject 'is born and survives immersed in an ideology imposed on him by the white person as an ideal to be achieved and which endorses the struggle to realize this model'. The author also highlights that in the construction of the White Ego Ideal, the fundamental rule imposed on the black subject is denial, that is, the rejection and attempt to eliminate any 'black stain' in his identity.

Furthermore, it is possible to identify in the speeches of participants B, C, and D the presence of attributes such as virility, competition, effort, and provision, which reinforce the hegemonic place of man. The figure of the provider refers to the man as the main person responsible for the financial support of the family, while the woman is destined to take care of 'household chores' and motherhood. This sexual division of social roles dialogues with the perspective of Zanello (2018), who describes the 'loving and maternal device' as central to female subjectivity. The love device, in particular, acts as a mechanism for disempowering women and empowering men, protecting them psychologically, since, culturally, women are expected to desire to conquer and maintain a loving relationship. If they do not meet these expectations and remain single, women are socially rejected, which can lead to psychological suffering.

> To be a man, you have to be virile, you have to be competitive (Participant B).
>
> Men have to be in the fields, they have to take care of the cattle, and they have to go to the plow (Participant C).
>
> Men go out to work and provide for the family, while women stay at home washing dishes, taking care of the children, and cleaning the house (Participant D).

In this context, motherhood, associated with the care women provide for their children and household chores, is a benefit for men, as it reinforces the division that positions women in the private sphere and men in the public sphere. This logic helps to explain why so many women abandon their projects to dedicate themselves to their partners' goals. Men, on the other hand, are challenged by the device of effectiveness, which refers to gender performances linked to sexual and labor virility. Sexual virility is related to the demonstration of potency, the conquest of multiple partners, and the affirmation of attributes such as being 'unbreakable' and 'alpha male'. Labor virility, on the other hand, concerns productive performance, especially in the field of work, requiring being employed, providing financially, competing with other men, and resisting to maintain the social status of dominator (Zanello, 2018).

The following is the participant's speech:

> Since childhood, men have to forge a masculine identity that is based on strength, on lack of sensitivity, it is as if the emotional part, the affective part could not come to the surface, right? (Participant E)

Participant E associated the concept of masculinity with notions of strength and lack of sensitivity. His speech highlights how the emotional restriction present in the male identity makes the expression of sensitive and affectionate aspects interpreted as signs of fragility and, therefore, negative. However, when this emotional dimension manifests itself through violence and aggression, as in public physical confrontations between men, the male status is reaffirmed, being perceived as a sign of authority and dignity, especially when associated with strength. These performances of masculinity are also observed since childhood when boys interact with each other in fighting games (Bola, 2020).

Participant E also reports:

> And this creates a straitjacket within the male universe, right? As if men often grow up with all their emotions locked away. To me, this explains a lot about why men have to compete all the time or put their lives at risk all the time for honor. Or do you understand? To prove that they are men, to not take offense, right? So, the codes that we are passing on and living in society are extremely threatening to men, because men kill themselves and they kill others.

This positioning leads us to reflect on the possibilities of male subjectivation that are not necessarily legitimized by hegemonic masculinity. However, do men reflect on these issues? Are they concerned about how hegemonic performance can repress and imprison their emotions? From this perspective, 'not thinking' is associated with the field of the unreflective and unshakable, a strategy that seeks to obscure identity fragility and preserve the status quo (Teperman et al., 2020).

Participant E also highlights that men often put themselves in risky situations in an attempt to maintain their honor, aiming to suppress any evidence of emotional vulnerability. The man considered honorable is the one who exercises control and submits to social law, which implies occupying a position of dominance over others (Machado, 2004).

Men engage in violent behavior against themselves and others, which is directly associated with the risky situations in which they are frequently inserted. The Epidemiological Bulletin of the Ministry of Health (2021) revealed a higher risk of death from violent causes among men in the last ten years, while women have a higher prevalence of suicidal ideation and attempted suicide (Borges et al., 2010; Nock et al., 2008). In the case of men, there is a greater lethal intent and a pattern of aggressiveness that manifests itself in the use of more lethal methods, such as firearms and sharp objects, in addition to

influences from economic instability. On the other hand, women tend to use less lethal means, such as self-intoxication and poisoning, which, although serious, are more likely to be reversed when care is provided quickly and effectively (Stone et al., 2016; Fisher et al., 2015).

VIOLENCE AND HEGEMONIC MASCULINITY

This category highlights one of the aspects mentioned in the documentary: violence as a consequence of the impact of hegemonic masculinity. Among the main themes addressed by the participants, violence directed at women, black men, and the LGBTQIA+ community stood out.

In one of the reports, participant F pointed out that the lack of emotional openness and the difficulty in recognizing and expressing one's feelings often result in the use of aggression and violence, directed at both other men and women and even one's children.

> I think that being able to identify few feelings, not being able to name what one feels is one of the reasons that lead many men to use violence as a language. This language will permeate the relationship with him, but with other men, with women, and with children (Participant F).

Violence manifests itself as a mechanism to guarantee domination in human relationships, making dialogue and the construction of genuine exchanges difficult. In the context of gender relations, this dynamic becomes even more rigid, since the symbolic instrumentalization of subjects generates patterns of thought and behavior that crystallize both genders in fixed and essentialist positions (Arendt, 2008). In addition, the violence resulting from the hegemonic male model is culturally perpetuated and reinforced by persuasion devices and institutional structures (Connell; Messerschmidt, 2013). Violence against women, in this scenario, is used as a way to legitimize male power and virility. However, there are expressions of hegemonic masculinities that are not limited to violence and toxic practices (Santos et al., 2021).

The following statement by Participant G is related to the concept of marginalized masculinity, as described by Connell (1995):

> But without a doubt, I think some experiences are more specific, right? As an example, the first police raid, for example, that I took was my birthday, in 2004, I will never forget, a gun to my head, I was leaving a concert, going to the house of a friend who had a birthday on the same day as me. The pain is understanding that I blame a place that regardless of how I am, how much I study, how handsome I am, how well dressed I am, how smelly I am, how cool I am, that comes before me, right? That comes before me (Participant G).

According to the author, marginalized masculinity refers to the relationship between ethnic groups and subordinate social classes, manifesting itself when hegemonic masculinity exercises power over other groups. This marginalization is intrinsically connected to other social markers, such as race and class. In this context, black men become targets of marginalization by the dominant group of white men and by the structure of whiteness, with police approaches being a recurring experience of violence and pain. Regardless of individual achievements, blackness continues to be perceived as a 'stain' on the standards of hegemonic masculinity.

This violence is also expressed symbolically, especially in the construction of the racial identity of the black subject. This dynamic is related to colorism, in which the darker a person's skin, the fewer rights, 'privileges', and social access they have, unlike those who approach the ideals of whiteness (Cruz; Baliscei, 2020). The genocide of the black population is part of this problem, since hegemonic masculinity sustains structures of violence directed at this population, especially against young black men, who are often targets of police stops (Silva, 2020).

In this context, another population that is frequently targeted by violence is the LGBTQIA+ community, since hegemonic expectations of masculinity impose that men must be heterosexual, reinforcing normative standards of behavior and identity. This social pressure, mentioned by Participant H, contributes to marginalization and aggression directed at those who do not conform to these ideals, highlighting how hegemonic masculinity operates in the exclusion and repression of dissident identities.

> I think that living in fear is almost a standard for anyone who is part of any minority. Whether it is a woman who does not go out on the street without fear of being harassed, a gay man who is afraid of suffering violence, or a black man who goes out on the street and someone thinks he is a mugger. People do this not because of other trans people, people do this because this norm of being a man, of being a woman is what kills us, right? This anger, this hatred that kills trans people, that violates gays, that violates lesbians, that violates women, is all of this that violates society (Participant H).

Both homophobia, misogyny, and racism represent instrumentalized expressions of violence, resulting from the imposition of compulsory heterosexuality, an ideal that sustains traditional masculinity (Carvalho, 2012). According to Louro (2019), this dynamic becomes even more complex for subjects whose interests or desires diverge from the heterosexual norm, often resulting in silence, dissimulation, or segregation. Since the dominant representation of masculinity is linked to heterosexuality, this norm is often accompanied by rejection and violence against homosexuality, manifesting itself explicitly in homophobia. Homoaffectivity, in this context, is culturally associated with the 'feminine world', being

represented as synonymous with fragility, sentimentality, and permissiveness. Finally, violence directed at women stands out, as reported by participant I:

> I think that every woman has a story of violence to tell, every woman has several stories of violence to tell, violence that happened at home, violence that happened in the workplace, and violence that happened online. Almost sixty percent of cases occur when the woman says she wants a divorce or says she wants to break up with her boyfriend or girlfriend, but he doesn't accept it, and unfortunately, his way of reacting to this is with violence (Participant I).

This violence manifests itself in various contexts, whether in the domestic or professional environment and is often expressed through sexual harassment. The control exercised by men also stands out, as mentioned by the participant, especially in contexts of relationship breakdowns, in which aggressive reactions replace dialogue. These dynamics contribute to the high rates of femicide, in which men are the main perpetrators. Although there have been legal advances in tackling gender-based violence, such achievements are still insufficient to transform the daily reality of violence faced by women.

According to Russel (2011), femicide is motivated by gender inequality, resulting from structural inequalities that sustain violent masculinities and make the murders of women socially intelligible. Among the arguments frequently used to justify such crimes are the 'legitimate defense of honor' and 'killing for love' (Pimentel et al., 2006; Eluf, 2021).

In romantic relationships, the structure of violence is legitimized when the woman's separation or attempted breakup becomes inconceivable to the aggressor, leading him to murder as an extreme form of control. From this perspective, jealousy emerges as a reaction elaborated from a sex-gender system based on female morality and monogamy but is interpreted differently when it comes to men (Maffioletti et al., 2022).

PROTAGONISM AND CARE PRACTICES

This category is related to the moments when men highlighted care as a possibility of rethinking masculinity, or when they associated it with the educational process aimed at forming new perspectives on being a man. This approach emphasizes male protagonism in the deconstruction of hegemonic masculinity, highlighting the importance of vulnerability and emotional openness in the development of healthier and more equitable relationships.

The first report to be addressed is that of Participant J, who mentioned emotional openness as a way for men to recognize and express their weaknesses:

> Emotional openness has to do with you saying, man, I'm afraid of not being competent at my job. I'm afraid of losing my partner, my father is very sick and I don't know how to react to him, I don't know what to say and I have a lot of things bottled up here that I can't say. This is emotional openness and I don't need to do it by crying or saying that I'm a poor guy (Participant J)

When discussing masculinity, it is interesting to note that male discourses often refer to emotional restraint as a central characteristic. However, in the documentary analyzed, an emphasis on the importance of emotional openness can be seen. Participant J highlighted the value of men revealing their weaknesses, allowing them to be symbolized and thus enabling the construction of other forms of expression of masculinity, far from the hegemonic standard. However, in his speech, a resonance of this hegemonic model can still be observed when he states: 'I don't need to do this by crying'. But what if this man ends up crying?

Reflecting on emotional openness also implies considering it as a central aspect of men's health. The feminist reading of gender and health, since the 1960s, has significantly transformed the field of human and social sciences, as well as natural and health sciences, driven by the protagonism of women's and feminist social movements (Medrado, 2008). However, men tend to avoid contact with their fragilities, since they often associate illness with weakness, which makes it difficult for them to express their anxieties and makes them more resistant to reporting emotional symptoms (Silva; Melo, 2021).

The following is a story from Participant K:

> When you choose to talk about what's inside, you won't be less of a man for it. When a friend chooses to do this, your father, your son, your brother, I don't make light of it. Ask him why he's saying this, and what he feels (Participant K).

Participant K also highlights that attitudes focused on caring in relationships between men and with others do not imply a loss of masculinity. However, sensitive and caring behaviors often trigger questions about male identity, making these men targets of 'jokes', teasing, and bullying, especially through pejorative expressions such as 'faggot' and 'woman', which reflect the maintenance of hegemonic stereotypes. Such reactions often come from the dominant social group, aiming to disqualify alternative forms of male expression.

In the study by Oransky and Fisher (2009), when operationalizing the construct of masculinity, it was identified that social provocation — manifested by jokes and jokes between men — seeks to test the capacity to tolerate discomfort as part of the process of male affirmation.

Participant K also emphasizes the importance of questioning the motivations and feelings underlying these provocations, bringing an empathetic dimension essential to the construction of care practices. This approach breaks with individualism, in which men prioritize only their desires and pleasures, and promotes insertion into a relational ethic

focused on care. A transformation in this sense was reported by one of the participants when describing how his attitudes began to change when he became a father:

> From what my father raised us, he always said if we didn't do it whatever he told us to do. The beatings rolled. We didn't have the freedom to sit down with him like that. Dad, I want to talk to you. We didn't have that. When he sat down to talk, he already had the board in his hand. He gathered the boys and my brothers so that one would beat the other. Today you're going to cut the board to beat whoever did something wrong. So all of this had a consequence that oppressed me until I heard my wife say, "I'm pregnant." Okay, I'm going to want good things for my son. I'm not going to want what my father did to me. (Participant L).

It is essential to reflect on the extent to which paternal care extends to the exercise of fatherhood, especially considering that, in many contexts, men still delegate the role of caring exclusively to women, a practice often 'naturalized' as belonging to the female gender. However, the concept of active fatherhood, increasingly debated, differentiates the 'father who helps' from the 'father who cares'. The first limits his/her participation to basic care, such as changing diapers or bathing, while the second is fully and affectionately involved in raising the child, seeking to develop emotional bonds and actively participating in family and domestic responsibilities, such as cleaning the house, preparing meals, taking the children to school, scheduling medical appointments and sharing daily tasks. This balanced division aims to reduce the burden and inequalities between family members. In this context, the father becomes the protagonist of care, whether alongside his/her partner or even independently, as occurs in the cases of 'solo fathers' in single-parent families (Moura, 2021).

One of the participants associated care with more active participation in fatherhood, as highlighted in the following report:

> Rethinking masculinity starts with rethinking what our care for others is. I gave an example in a group of black fathers a while ago where the guys were talking, and complaining about their partners and then I asked a question there, I asked a question. I said, listen, you know, your daughter is five years old, five years old. Do you know how many pairs of your daughter's panties are in her drawer? Then the guy got worried, but what does that question have to do with it? No, someone has to know. And so when I ask this when I ask these questions, I also ask myself. I also find myself in this position of I don't know how many pairs of panties my daughter has in her drawer. (Participant M).

In this context, participant M brought up a provocative reflection when he questioned paternal involvement, asking if one of the caregivers knew how many panties his daughter had. This question aimed to encourage the other participants to reflect on the level of men's involvement in raising their children, instead of just complaining about their partners. This provocation exposes a reality in which men take little responsibility for raising their children, something noticeable by the lack of discussions or experiences in which they have talked to

their children about everyday and intimate topics. Men's concern about exercising paternity often only manifests itself when this role is formally called upon, usually in specific and specific situations. However, rethinking paternity as a way for men to become emotionally involved and establish closer ties with partners and daughters is essential to deconstructing hegemonic masculinity. This includes expanding the dimension of care as an integral part of the male experience.

However, care is still culturally naturalized as a feminine attribution, while men are often encouraged to adopt an emotionally distant and 'cold' posture. This emotional distance is linked to the fear that emotional involvement and the expression of vulnerabilities may be perceived as a threat to masculinity, highlighting the need to rethink these social norms.

Active fatherhood refers to the emotional involvement of men in all phases of reproductive planning, pregnancy, childbirth, postpartum period, and child development, to strengthen healthy bonds between caregivers and their children. This concept has gained notoriety, especially on social media, and has been disseminated by individual and collective actions of men or groups who share information about raising and providing physical (bathing, sleeping, changing diapers, feeding) and emotional (managing tantrums, understanding the stages of development) care for children, based on affectionate attitudes and non-violent communication, respecting child well-being. In this sense, active fatherhood is not limited to a search for equality between maternal and paternal roles, but promotes a broader perspective of equity, considering all subjects involved in family dynamics (Moura; Damasceno, 2021). Working on active fatherhood implies breaking with paradigms since both men and women can exercise it. This approach is associated with a disposition of 'attitude', readiness, and proactivity that are essential in the exercise of the paternal role (Brasil, 2018; Silva, 2019).

However, rethinking masculinity must go beyond the experience of fatherhood, since gender relations are shaped since childhood, and redefining them is an essential step to breaking the historical association between masculinity, aggression, and machismo. However, patriarchal and machista ideology still operates as a guiding structure in the construction of male identities (Rangel et al., 2017).

The discussion about masculinity, however, is plural and intersectional, crossed by social markers such as economic class, ethnicity, gender (cis/trans), religion, and geographic location. It is essential to listen to the voices of these men so that their effective inclusion in the dimension of care occurs, promoting the deconstruction of hegemonic patterns that sustain masculinities (Gaspodini et al., 2017).

Another subject who participates in the documentary asks why no one prepares for fatherhood:

> And here's a question I raise, why doesn't anyone prepare for fatherhood? It seems like a divine light will come when the child is born and will illuminate our being and us, right? From that moment on, you are a father, right? But love is not built overnight, a relationship is not built overnight. To take care of a child, you need to connect on an emotional level, and for that, you need to get in touch with emotions that perhaps you, as a man, have never allowed yourself [...] (Participant N)

Loving investment in a relationship and in caring for children is not limited to providing material resources, such as money and food, nor to simply playing the role of 'man of the house' or acting as a provider. More than that, participant N expresses his understanding that love implies connecting emotionally and overcoming the emotional barriers that many men face. This difficulty in identifying and expressing emotions may be related to a condition known as alexithymia, which impairs the ability to recognize and understand one's feelings and those of others, negatively impacting the development of empathy.

In the Western context, there is no culturally established connection between masculinity and fatherhood, unlike women, who are immediately associated with the ability to bear and care for children. Motherhood, in this sense, is typified by direct involvement in care, while the father figure occupies a predominantly symbolic space. This model is sustained by patriarchy, which promotes a cultural silence around discussions about male roles in care and parenting.

As a consequence, both paternity and masculinities become unreflective, since accessing territories related to care requires dealing with vulnerability — an aspect often rejected by men since emotional fragility is seen as a threat to the status quo and the maintenance of male privileges (Teperman et al., 2020).

Building emotional bonds, being loving, and caring, and promoting both self-care and care for others clash with the expectations imposed by hegemonic masculinity. In this model, such characteristics are often associated with the feminine and, therefore, seen as threats to the ideal of masculinity, being avoided or repressed.

This context also raises the need to question male responsibility when mentioning the concept of 'protection'. What, in fact, do men seek to protect when assuming this role? Is fragility perceived as a risk of 'loss of masculinity'? Many men who take on the role of 'protectors' end up reproducing patriarchal logic, in which the father figure delegates responsibility for care and emotional and domestic tasks to women. Participant O highlighted that there are three dimensions often associated with fatherhood: protection,

procreation, and provision. Although these aspects are not irrelevant, he emphasizes the importance of expanding this understanding, arguing that the man-father — and, by extension, other men — should also be actively involved in the dimension of care, breaking with the idea that this responsibility is exclusively female.

> So in the past, there were three pillars. The pillar of protection, procreation, and provision. So the transformation into active fatherhood means leaving behind the issue of simple protection and moving on to care. So it is no longer a father who comes in and solves things. Now we have a father who takes care. So it is a father who is no longer sporadically present, but is present, no longer has a passive attitude, and has an active attitude (Participant O)

Portraying the three aspects mentioned, reinforced protection The idea that men are responsible for protecting their families and communities is based on a gender construct that associates masculinity with strength, courage, and the ability to face dangerous situations. This expectation imposes significant pressure on men, who need to demonstrate resilience and emotional control. Protection also extends to the emotional realm, in which men must provide stability and security in their family and emotional relationships.

Procreation, in turn, is associated with the traditionally established role that men must fertilize a woman, contributing to the perpetuation of the species. This conception reinforces the expectation of sexual potency and the generation of offspring as central elements of male identity.

Provision, on the other hand, refers to the role of men as financial providers for the family, often represented by the concept of 'head of the family', a construct historically naturalized by patriarchy, which associates male value and identity with the ability to financially support the family nucleus.

On the other hand, the participant also highlights the importance of care as an essential function in the paternal experience. According to Ayres (2001), care involves an intersubjective relationship between two or more people, aiming to minimize suffering and promote well-being, considering the knowledge and practices necessary for this task. Therefore, care should not be understood as an exclusively female responsibility, but rather shared among all family members, including men, so that it is comprehensive and effective. Assigning care only to women limits the male experience, resulting in men who neglect both caring for others and themselves or who delegate this function entirely to third parties (Ribeiro et al., 2017).

CONCLUSION

There is a growing concern among some men to deconstruct hegemonic masculinity, seeking to reflect critically on their attitudes and the impacts they generate on themselves and others. The documentary The Silence of Men illustrates this reality and is part of a feminist perspective, by highlighting men who strive to promote gender equality and equity. However, this discussion needs to be expanded and deepened in different contexts, since most men still do not demonstrate an active commitment to taking responsibility for this care movement.

The construction of healthy masculinities is viable, as long as paths that go beyond blaming or victimizing men are recognized. To achieve this, it is essential to effectively implement public policies, with the leading involvement of professionals in health, education, and other areas, in addition to significant action by society and the State in redefining masculinities.

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TRENDS IN THE PRODUCTION OF KNOWLEDGE ABOUT AUDIOVISUAL EDUCATIONAL TECHNOLOGIES FOR PREGNANT WOMEN

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ABSTRACT

Despite the improvements in the health sector in recent decades, studies still show important numbers of maternal deaths related to avoidable causes related to pregnancy, childbirth and puerperium. The objective of this study is to identify the trend of theses and dissertations available in the Catalog of Theses and Dissertations of the Coordination for the Improvement of Higher Education Personnel on audiovisual educational technologies for pregnant women in prenatal care. This is a documentary, descriptive and exploratory study, using as a search strategy the combination of the terms "educational technology" AND gestation OR audiovisual OR video. After applying the inclusion and exclusion criteria, the research corpus was composed of seven studies, three theses and four dissertations. The studies show concern with emerging themes related to humanized childbirth and prevention of obstetric violence. The development of educational technologies involves important validation and evaluation processes. Two studies brought educational technologies aimed at health promotion in the face of hypertensive syndromes and for the context of oral health of pregnant women. In general, the population has been increasingly looking for quick information, with little reading and many visual resources, with emphasis on the reproduction of short videos that are on the rise on social networks today. It was considered that there is still a gap in the evaluation of educational technologies with a target audience in order to provide reliability and improve the use of the technology or product with specific audiences or from different contexts according to its proposition.

Keywords: Women's Health. Gestation. Educational technology. Video.

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INTRODUCTION

The reduction of maternal mortality represents a current and important challenge for health systems worldwide. This is a commitment that has been present on the agenda of the United Nations (UN) since the Millennium Development Goals (MDGs), which were in force from 2000 to 2015 (UN, 2015, Motta; Moreira, 2021) and in 2015, the new global agenda was ratified for the Sustainable Development Goals (SDGs). Among these goals, the reduction of maternal mortality was redefined as SDG Target 3.1, which aims to reduce the global maternal mortality rate to less than 70 deaths per 100,000 live births by 2030 (UN, 2015).

Despite improvements in the health sector in recent decades in relation to maternal mortality, data from 2017 show that approximately 810 women die per day in the world from causes considered preventable related to pregnancy and childbirth, with significant differences in rates between developed and developing countries (WHO, 2019). Among the causes of maternal death, in first place in Brazil are gestational hypertensive syndromes (GHS), which represent a set of clinical conditions that occur during pregnancy and the postpartum period, being the most prominent complications in this period. Among the main GHS are chronic arterial hypertension, preeclampsia, gestational hypertension and preeclampsia superimposed on chronic hypertension. These conditions can lead to deleterious maternal complications, such as liver, heart and kidney damage, in addition to significantly increasing the risks of placental abruption, premature birth and even maternal and fetal death. Therefore, it is considered that monitoring and proper management of hypertensive syndromes are essential to protect the health of the mother and baby (Brasil, 2022).

In this context, it is understood that it is crucial to qualify health services, especially integrating prenatal care and childbirth care for pregnant women, in addition to ensuring access to teams qualified to deal with obstetric emergencies, due to their avoidable nature. It is also recommended to increase the focus on conditions that pose risks during pregnancy, emphasizing the importance of educational and preventive health measures (Santos; Santos, 2023). When considering the context of maternal and neonatal mortality, which is a public health problem and a serious complication of labor and birth, the importance of good prenatal care and health promotion and education actions, planned from pregnancy, as effective preventive measures to face this problem is highlighted (Freitas *et al.*, 2024).

In the practice of popular health education, the use of educational technologies facilitates the consolidation of care, promoting the implementation of political-pedagogical

actions aimed at disease prevention, health promotion and recovery through the integration of multiple knowledge (Freitas *et al.,* 2024). Educational technologies are useful and significant tools in the teaching process in the context of nursing care, facilitating the development of health education and promoting knowledge and well-being to the population, giving them the ability to develop a critical awareness of their health-disease process (Nietsche, 2000).

Educational interventions that reach women in diverse social, economic, and demographic contexts offer numerous opportunities to translate necessary and accurate information. It is noteworthy that it is important to consider the use of audiovisual technologies in the face of the various contexts of the female population, such as illiterate or semi-illiterate women, in order to facilitate understanding of a given topic (Almeida *et al*., 2022).

In view of the problem, the following guiding question is to review: what is the trend of knowledge production of theses and dissertations on audiovisual educational technologies for pregnant women in prenatal care? It is intended to meet the objective of identifying the trend of theses and dissertations available in the Catalog of Theses and Dissertations of the Coordination for the Improvement of Higher Education Personnel (CAPES) on audiovisual educational technologies for pregnant women in prenatal care.

METHOD

This is a documentary, descriptive and exploratory study, carried out between June 20 and July 4, 2024 and updated in December 2024 based on the analysis of the productions (theses and dissertations) available in the Catalog of Theses and Dissertations of the Coordination for the Improvement of Higher Education Personnel (CAPES). Documentary research is understood as the study based on primary documents, which support the object of study in question (Gil, 2010). The search was carried out *online*, using the strategy that combined the following exact and alternative descriptors associated with the Boolean operators AND and OR: "educational technology" AND gestation OR audiovisual OR video. The "Health Sciences" filter was applied in the Large Knowledge Area field. The inclusion criteria were: theses and dissertations that involved the theme of the use of educational technologies in video or audiovisual format for pregnant women in prenatal care. The exclusion criteria were: studies not found in full *online* after four search attempts, namely: in the CAPES thesis and dissertation database, in the depository library, in the Google tool, *and not released by the author after contact or without response. There was no time frame.*

The initial search resulted in 7039 productions, of which 610 were linked to the large area of Health Sciences, of these, 594 were not on the theme, six did not correspond to videos or audiovisual technologies, one did not correspond to the target audience and two were not found in full, after the attempts described above. The analysis of the documents began by extracting the information from each study, namely: title and year of defense, Higher Education Institution (HEI) and graduate program, method, type of technology and theoretical-methodological framework used. The results and discussions of each research were also thoroughly analyzed. It should be added that the quantitative data referring to the characterization of the documents were analyzed with absolute (n) and relative (%) frequencies, in addition, the qualitative results were grouped according to approximation and similarity, enabling the organization and presentation. Furthermore, these were discussed in the light of the literature related to the theme. As this is a documental analysis study, the approval of the Research Ethics Committee is waived, however, the ethical principles were respected, maintaining the veracity of the results and citation of authorship.

RESULTS

In total, seven studies were included to outline the *corpus* of the research. Chart 1 is presented below, containing the identification, titles, and type of studies that were analyzed in the present study. Then, it organized the results of the review.

Chart 1 - Identification (ID) and titles of Brazilian theses and dissertations on Audiovisual Educational Technologies for pregnant women.

ID	Title	Kind
E1	Validation of an educational video for the knowledge, attitude and practice of pregnant women in preparation for active childbirth	Thesis
E2	Animated infographic as a tool for empowering women in the labor and birth process	Thesis
E3	Paths to Normal Childbirth: construction of an Educational Technology for pregnant women	Dissertation
E4	Development and validation of educational technology for pregnant women about dental prenatal care	Dissertation
E5	When to go to the maternity ward? Educational technology for primiparous women about the signs of labor and obstetric risk.	Thesis
E6	Development of educational technology to prepare pregnant women and companions in the prevention of obstetric violence in public health units	Dissertation
E7	Construction and validation of the content of an audiovisual educational technology for pregnant women with hypertensive syndromes	Dissertation

Source: Survey results (2024).

CHARACTERIZATION OF THESES AND DISSERTATIONS ON EDUCATIONAL TECHNOLOGIES FOR PREGNANT WOMEN IN PRENATAL CARE

Regarding the main characteristics of the analyzed productions, of the seven selected studies, three (42.8%) identified themselves as theses and four (57.2%) as dissertations, and of these, two (28.6%) were from Professional Master's Degrees and two (28.6%) from Academic Master's Degrees. In total, the studies presented 32 (100%) descriptors. Among the most frequent descriptors cited in the studies, the term "educational technology" had the highest frequency (18.6% (n=06). The variations between "childbirth", "obstetric delivery", "normal delivery", "humanized delivery" and "beginning of labor" represented 15.6% (n=05) of the descriptors. The terms "obstetric nursing" and "prenatal care" accounted for 6.2% (n=02) each. The other terms that appear only once, such as "health education", "health promotion", "violence", "oral health", "gestational hypertension", "pregnancy complication", "high-risk pregnancy", "women's health", "empowerment", "social network", "educational film and video", "qualitative research", "sexual and reproductive rights", "pregnant woman" and "emotions" represented 46.8% (n=15) of the total terms. The analysis of the geographic distribution of the studies shows that almost half of the production on the theme is concentrated in the Northeast region, with 42.8% (n=3) of the total studies, followed by the North and Northwest, both with 14.3% (n=1) production in Pará and Manaus. The productions of the Southeast and South regions represent 14.3% (n=1) each. With regard to the area of knowledge according to the author's education, nursing had a predominance of 85.7% (n=6) and dentistry of 14.3% (n=1).

It is noteworthy that only two theses assumed a theoretical or methodological framework in their research, namely: Theoretical framework based on Foucault and Freire in the same thesis. The following thesis assumed the theoretical framework of the Complexity Paradigm and the methodological framework of the Grounded Theory. Regarding the year of publication and method of the studies, Table 1 is presented below.

Table 1 - Characterization of the year of publication and the method of Brazilian theses and dissertations on audiovisual Educational Technologies for pregnant women in prenatal care.

Year of Publication	N	%
2016	01	14,3
2019	01	14,3
2020	01	14,3
2022	02	28,6
2023	01	14,3
2024	01	14,3
Method		
Methodological	05	71,4
Quasi-experimental	01	14,3
Qualitative-descriptive	01	14,3

Source: Survey results (2024).

An important chronological distribution of research in the last five years and the predominance of methodological studies for the construction or validation of technologies are observed. Also, it can be identified that only two theses validated the educational technology with the target audience, one dissertation validated an educational video with expert judges and another dissertation validated the content of the educational technology also with judges. The other studies concluded the production stage of the material, without validation.

TYPE, PURPOSE AND CONTENT OF THE TECHNOLOGIES ANALYZED

Regarding the type of technology, most authors defined and/or worked with digital educational technologies, audiovisuals of the animated video type (E1, E3, E4, E5, E6, E7), one study developed an animated infographic. Among the studies, these addressed issues about health education and health promotion without significant theoretical deepening of the concepts. In addition, only two studies (E4 and E7) developed technologies with themes aimed at promoting the health of pregnant women with hypertensive syndromes and the benefits and importance of dental prenatal care, the others worked on preparation for childbirth, prevention of obstetric violence and the opportune moment to seek maternity care (E1, E2, E3, E5, E6). Discussions about the concept of educational technology (ET) proposed by Nietsche were present in all studies. The concept of technologies defended by Merhy was also highlighted when directed to health education actions.

Regarding the elaboration of technologies, type and content, four studies consulted the target audience before the construction of the technology, through interviews (E1, E2, E3, E7). The studies (E4, E5, E6) defined content and type of technology, based on literature reviews.

According to the objectives and content of each technology developed, studies E1, E3 and E5 brought similar themes in their proposal. The E1 study aims to promote active childbirth. The script of the video was conceived from a previous study, with pregnant and puerperal women to show the entire process from the beginning of pregnancy, including conception, the three trimesters of pregnancy, preparation for childbirth, simulation of childbirth. E3 and E5 highlight the central theme involving respectively the search for information for empowerment and recovery of autonomy in choices for normal delivery, as well as the identification of signs of labor and obstetric risk, favoring decision-making related to the opportune moment to seek motherhood. At E3, the participants also participated in the choice of *the design*, color and *layout* of the technology.

The thesis (E2) sought to develop an animated infographic that presented the feelings of women about their births and the influence of society on the perception of these feelings, and based on individual interviews, the content of the infographic was obtained through content analysis.

In E4, for the construction of the animated video about dental prenatal care, its content was based on a literature review and the script portrays a pregnant woman with dental problems. Thus, the study aims that the knowledge acquired through technology can influence the change in behavior of pregnant women in order to encourage their adherence to dental prenatal care and also to healthier habits, with regard to oral health.

Studies E6 and E7 brought different but important aspects for maternal and neonatal health. The first, with content based on the integrative literature review, brings reflection for an autonomous, active and conscious performance of the woman and the companion during pregnancy, labor and delivery, sharing knowledge about the physiology of childbirth, good practices for safe obstetric care, the rights of women, companions and newborns, as well as informing about their rights and the characteristics and nuances of obstetric violence. The second study mentioned (E7) aimed at educating and promoting the health of pregnant women with hypertensive syndromes. In this case, the content emerged from semi-structured interviews with the target audience and literature reviews, elucidating situations of the daily life of pregnant women, as well as the guidelines for a healthy pregnancy in the face of gestational hypertension and its complications.

DISCUSSION

Research has demonstrated the importance of early capture and an adequate number of prenatal consultations in order to prevent avoidable deaths and improve labor and birth conditions. A retrospective study conducted with data from women who died, living in municipalities that are part of the coverage area of the Regional Health Department of Ribeirão Preto, found 36 maternal deaths, most of which occurred in women aged 20 to 29 years. The leading causes of death were hypertension, infection, and hemorrhage (Tintori *et al.,* 2022).

Early diagnosis and appropriate management of hypertensive conditions, such as preeclampsia and eclampsia, can reduce maternal mortality. The need for public health policies and strategies focused on education and improving access to prenatal care is also highlighted (Santos and Almeida-Santos, 2023). These complications can result in serious consequences for maternal and child health. Peraçoli *et al.* (2023) suggest that interventions to mitigate the severity of gestational hypertension include the incorporation of

about 140 minutes of physical activity per week and the use of specific medications, starting at an appropriate gestational age.

According to the results of this research, one of the studies aimed to educate and promote the health of pregnant women with hypertensive syndromes with the help of an ET. The content of the study was developed based on semi-structured interviews with the target audience and literature reviews, addressing the daily situations of pregnant women and providing guidance for a healthy pregnancy in the face of gestational hypertension and its complications (E7).

Also, in the face of the social and political transformations of pregnancy and childbirth care, humanized care has growing potential, with a view to respecting and valuing women's choices, their sociocultural origins, and their health demands (Benet *et al.,* 2018). It is understood that the care and guidance provided in prenatal care to prepare for childbirth, linked to an educational technology (ET), becomes more effective when compared to the care routinely used in isolation(E1).

For Nietsche (2005), educational technology is a field that goes beyond the use of digital equipment and tools in the educational environment. For her, it involves the integration of methodologies, pedagogical strategies and technological resources in order to promote a more effective and meaningful learning environment. This statement is in line with the use of soft technologies in health care, which for Merhy (2002), the effectiveness of health care depends on an adequate combination between these different technologies, with a special focus on soft technologies, which are fundamental for humanization and quality of care.

In this sense, the conscious use of educational methods and strategies with an emancipatory/liberating character, in which the patient can be seen as a "conscious body", a subject who brings with him a history and his knowledge process, involves intercommunication and intersubjectivity in the construction of knowledge in health is extremely relevant for the construction of new ET (E3).

In the study by Borges *et al* (2020), a limiting factor highlighted on the use of ET is related to the insufficient use of effective educational tools that help in the process of community guidance by the professional, along with low professional adherence to develop educational and health promotion attitudes.

Because the understanding of health for pregnant women may differ from clinically established disease processes, the social determinants of health may influence health experiences and perceptions. For example, social and economic disadvantages, which may restrict opportunities for certain health practices, such as healthy eating and physical

activity (Palmer *et al*., 2020).

To improve the effectiveness of health promotion initiatives in antenatal care, health professionals must also take into account the significance and priorities of health from the perspective of patients themselves. Research needs to investigate how women value and define their own health during pregnancy and qualitative studies can help close the gap between pregnant women and their health providers, promoting a mutual understanding of health (Epstein et al., 2023).

Currently, studies on ET for pregnant women have been covering a variety of tools, such as mobile applications, educational videos, online programs, and other digital platforms. The literature review conducted by Brito *et al.* (2024) shows that these technologies help increase pregnant women's knowledge about topics related to pregnancy, childbirth, and postpartum care, in addition to reducing anxiety and stress.

In general, the population has been increasingly looking for quick information, with little reading and many visual resources, so the reproduction of short videos is on the rise on social networks at the moment. With simple language, visual resources prepared specifically for the topic to be discussed and the ease of its dissemination through social networks, it guarantees all women the possibility of accessing them and understanding the content (E2, E7).

Teixeira *et al.* (2023), for example, developed a project at the Jenny de Andrade Faria Institute, in Belo Horizonte-MG, with the objective of providing quality virtual information to pregnant women while waiting for prenatal care. The project transformed the time and space of the waiting room into an educational moment, addressing topics such as the rights of pregnant women, parturients and postpartum women, as well as doubts about breastfeeding. The videos, lasting between 5 and 10 minutes, presented information in an explicit and didactic way, facilitating the women's understanding. Technological products have become an essential part of care practice, and emerge as highly innovative playful tools, due to their versatility (Carvalho *et al.*, 2023).

The content built for an ET should address real situations and use explicit and accessible language to encourage people's participation in the educational process. In the meantime, it is understood that educational materials need to be carefully designed and validated before being made available to the target population. Validation confers greater credibility to ET and sustains nursing practices and research (Rosa *et al.,* 2019).

Therefore, nursing has been improving in terms of creating, validating, and evaluating products and processes based on the understanding of human praxis, with the objective of solving practical problems. This path highlights the interconnection between

theory and practice, as well as the interpretation and application of contemporary propositions that promote social transformation (Salbego *et al.*, 2023).

In view of this discussion, it should be noted that the present review demonstrated that only two theses concluded validation of the ET with the target audience. Such a process can be carried out through usability studies, which is a safe, dynamic, feasible and effective practice, allowing the evaluation of educational technologies to identify errors and improve both technology and content. This ensures greater interest and adherence to educational technology by the target audience (Soares *et al.*, 2023). Usability must consider the complexity of the interactions between the user, the context of use, and the functional characteristics of the technology, so that it is effective, easily accessible, secure, and capable of improving learning (Carvalho *et al.*, 2023).

Therefore, the limitation of this review is the number of studies found, which may have been caused by the use of a single national source of data. Another important factor is that the studies that evaluated ET with a target audience did not use a specific or validated instrument for this. In addition, it is suggested to expand the study with other studies not associated with theses and dissertations only.

FINAL CONSIDERATIONS

The present review study provided an overview of the production of knowledge in recent years related to theses and dissertations about audiovisual educational technologies for pregnant women. Most of the studies in this review deal with issues related to the parturitive context of women and families, with emerging themes such as obstetric violence and the right to positive experiences through humanized childbirth.

It is observed that there is still a gap in the evaluation of ET with a target audience in order to provide reliability and improve the use of the technology or product with specific audiences or from different contexts according to its proposition. Audiovisual resources have shown themselves to be attractive in modernity, due to their interactivity and easy handling. In this case, this review instigates the possibility of new research, aiming at the expansion of knowledge related to the production of technologies in various subjects that permeate women's health in the face of pregnancy, childbirth and postpartum.

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DEVELOPMENT OF A SYSTEM FOR IDENTIFYING THE QUALITY OF DIESEL OIL PRODUCED BY AN OIL INDUSTRY

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ABSTRACT

Diesel oil is the most widely used fuel in the Brazilian highway system. Controlling the technical specification parameters of this oil is of utmost importance for the oil industry, and the color and appearance of the product are some of the main parameters in this process. This paper presents an application of the median in digital image processing, the objective of which is to identify, among the various images of the diesel color scale, the appropriate quality or not of the oil produced. For this purpose, samples of diesel oil with their respective color gradations, ranging from 1.0 (lightest) to 8.0 (darkest), with variations in brightness, contrast, and saturation, were used. To analyze the performance of this identification, the median values of each of the following components were used: Y, YDifference, Cb, Cr, R, G, and B, as well as a comparison threshold for each of them, to classify the test sample as approved or failed oil. According to experimental results, using the YDifference, Cb, and Cr components, the accuracy, precision, and sensitivity (recall) were all equal to 100% and the false negative rate was equal to zero. Using YCbCr, a false negative rate of zero and an accuracy of 99.48% were also obtained. In the case of RGB, the false negative rate was less than 1% with precision and sensitivity equal to 99.07%.

Keywords: Digital Image Processing. Image Subtraction. Median.

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INTRODUCTION

Because the global energy matrix still depends largely on fossil fuels, oil, and its derivatives will remain essential for many years to come for the movement of various sectors of the economy and society, ranging from the food industry to the fuels used in a country's road system. Given this global scenario of dependence, oil refining is essential to guarantee Brazil's energy independence. (NATIONAL PETROLEUM AGENCY, 2005). Oil refining is focused on the production of derivatives such as gasoline, kerosene, liquefied petroleum gas (LPG), and diesel oil, among others. This activity is directed according to the derivative with the greatest existing demand; in the case of the Brazilian road matrix, this derivative is diesel oil.

According to Brasil et al. (2011), diesel oil is composed of paraffinic, naphthenic, and aromatic hydrocarbons, with a predominance of paraffinic and naphthenic hydrocarbons with chain sizes of 10 to 25 carbon atoms and a distillation range commonly between 150°C and 400°C. To obtain diesel oil, petroleum is refined by a separation process called atmospheric distillation, which consists of separating hydrocarbon fractions present in petroleum-based on the difference in their boiling temperatures.

To be used in industry, diesel oil produced by an oil refinery must follow technical specifications standardized by the Brazilian regulatory agency, in this case, the National Petroleum Agency (ANP). Among these parameters, the color and appearance of diesel oil are of fundamental importance in the final specification of this derivative, since once it is non-compliant, in most cases the other parameters such as density and distillation will also be non-compliant. In a refinery, the quality control of the color of diesel oil is done manually and subjectively, by visually checking a sample of the oil during the routine of a technician operating the process unit and comparing it with a standard previously learned by him. This method causes many errors of interpretation and losses in the millions of dollars to the sector that stores the derivatives, due to the failure to immediately identify a color standard that is inadequate for storage.

Having a quality control system for the color of the diesel oil produced and making this information available to the controlling agents of the supervisory system is of fundamental importance for the operational continuity of a refinery and reducing the probability of financial losses due to the storage of diesel oil that does not meet technical specifications. Given this, this work demonstrates the development of a diesel oil quality identification system, using concepts and applications of digital image processing through the MATrix LABoratory (MATLAB) tool (BACKES, Junior, 2016) whose objective is to signal

to a process control and supervision system that the diesel oil produced at the time exceeded the maximum permitted color limit.

THEORETICAL FRAMEWORK

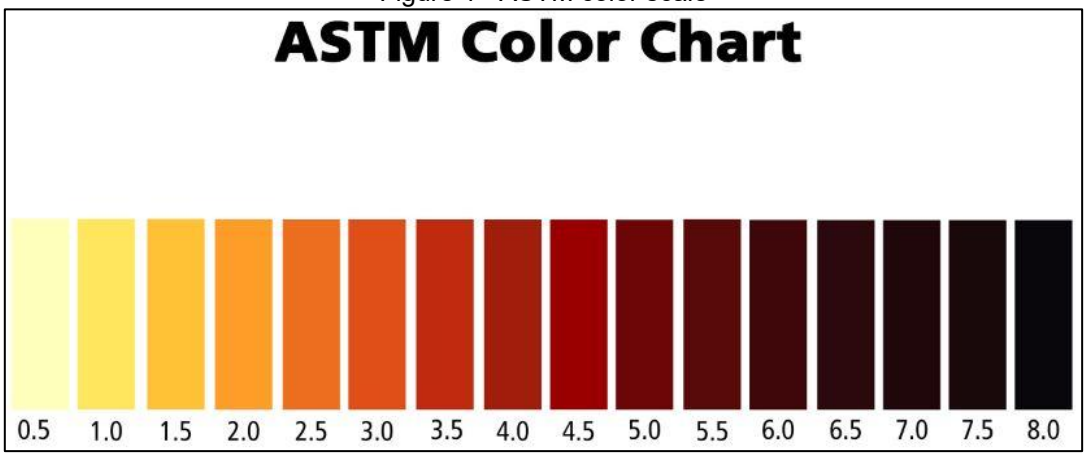
This section presents the bibliographic survey of works related to the diesel oil color scale, digital image processing, image subtraction, and application of the median in digital image processing. For this, searches were made in the IEEE Xplore, Engineering Village, and Research Gate literary databases.

DIESEL OIL COLOR SCALE

Among the various technical specifications of diesel oil, the ASTM (American Society for Testing and Materials) color comes from the American standard D 1500 and D 6045 for identifying appearance. The unit is dimensionless and divided into levels of 0.5. The Brazilian standard ABNT NBR 14483 grades these levels from L0.5 to L8.0. According to the TELUB website, “The ASTM color scale, also called "mineral oil color value", is primarily used for the classification of petroleum products such as lubricating oils, heating oils, and diesel fuel oils. The color of mineral oils is constantly checked during the process to determine when they have been refined to the required level. Color is also used to confirm that the correct oil or fuel is used for its intended use and that no contamination or deterioration in quality has occurred.

The determination of the color of petroleum products is primarily used for manufacturing control purposes and is an important quality characteristic since the color is easily observed by the user of the product.” (2022). Figure 1 shows the ASTM color standard adopted by the D 1500 and D 6045 methods described above.

Figure 1 - ASTM color scale



TELUB

NBR 14483 also describes in its appendix A the characteristics of the Colorimeter instrument and complementary devices used to compare the color of the oil sample with the pre-existing standard seen in figure 1. Among the recommendations are the need for adequate lighting and colored glass standards (figure 2) which describe, for each color level, the RGB chromaticity coordinate and the luminous transmittance suitable for comparison..

Figure 2 - Table of colored glass patterns

Cor ASTM	1) Chromaticity coordinates (USC System)			Light transmittance 2) (CIE standard source C)
	r	g	b	Tw
0.5	0.462	0.473	0.065	0.86 ± 0.06
1.0	0.489	0.475	0.036	0.77 ± 0.06
1.5	0.521	0.464	0.015	0.67 ± 0.06
2.0	0.552	0.442	0.006	0.55 ± 0.06
2.5	0.582	0.416	0.002	0.44 ± 0.04
3.0	0.611	0.388	0.001	0.31 ± 0.04
3.5	0.640	0.359	0.001	0.22 ± 0.04
4.0	0.671	0.328	0.001	0.152 ± 0.022
4.5	0.703	0.296	0.001	0.109 ± 0.016
5.0	0.736	0.264	0,000	0.081 ± 0.012
5.5	0.770	0.230	0,000	0.058 ± 0.010
6.0	0.805	0.195	0,000	0.040 ± 0.008
6.5	0.841	0.159	0,000	0.026 ± 0.006
7.0	0.877	0.123	0,000	0.016 ± 0.004
7.5	0.915	0.085	0,000	0.0081 ± 0.0016
8.0	0.956	0.044	0,000	0.0025 ± 0.0006

1) The tolerance for chromaticity coordinates is ± 0.006.

2) Commission Internationale de l'Eclairage (International Commission on Illumination).

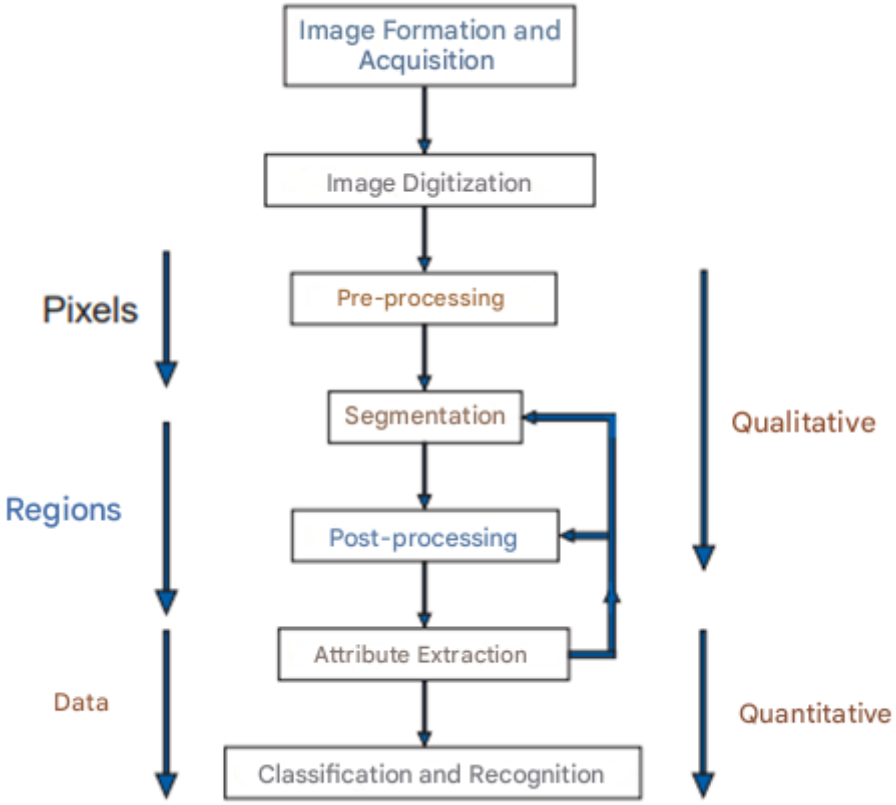
NBR 14483

DIGITAL IMAGE PROCESSING

Digital Image Processing is a set of procedures related to the manipulation and analysis of images through the computer (QUINTANILHA, 1990). These procedures include the input of digital data, enhancement, statistical analysis, and generation of outputs, which can be images in grayscale or color.

An image processing system consists of several stages, such as: image formation and acquisition, digitization, pre-processing, segmentation, post-processing, feature extraction, classification and recognition (ESQUEF et al, 2003), as illustrated in the figure.3.

Figure 3 – Stages of a PDI system



Source: (ESQUEF et al, 2003)

Given that the present work deals with the manipulation of image-type signals, digital image processing fits as the main basis for this research. The main steps used in this work are the following: acquisition of static (in file) and dynamic test images, using a video camera; pre-processing to obtain the color components Y, YDifference, Cb, Cr, R, G, B; obtaining the median of each color component and using a comparison threshold to classify the images of diesel oil tests as approved or failed.

IMAGE SUBTRACTION

Image subtraction is a process by which the digital numerical value of a pixel or entire image is subtracted from another image. This can be used to detect changes between two images to detect moving objects in a video scene (SINGLA, 2014; ZHAO, 2022). Furthermore, temporal image subtraction can be used to emphasize the change interval of patient tomography images to aid in the investigation and diagnosis of lung cancer, that is, to perform the segmentation of candidate nodules (TANAKA et al, 2017).

Another application of image subtraction is in image segmentation using the technique called background image subtraction (BENRAYA; BENBLIDIA, 2018; PANDEY, 2022). In this case, a reference image of the scenario is stored in the system containing, for example, the average values of the image elements. This reference image is used to

classify each image element as belonging to the background image or the object (foreground image). For this comparison, the current image is subtracted from the average reference image. Then, the resulting difference image is compared with a predefined threshold. Image elements whose differences are above the threshold are classified as belonging to the object, otherwise as belonging to the background or reference image.

In this work, image subtraction is used to detect differences in brightness information between the images of the test samples and the image of the reference sample.

APPLICATION OF THE MEDIAN IN DIGITAL IMAGE PROCESSING

The median m of a set of n elements is the value such that half of the n elements of the set are below m and the other half are above m. When n is odd, the median is the central element of the ordered set. In cases where n is even, the median is calculated by the arithmetic mean of the two elements closest to the center. (FILHO; NETO, 1999)

One of the applications of the median in digital image processing is in the implementation of spatial filters of statistical ordering whose response is based on the ordering of the pixels contained in the area of the image encompassed by the filter. In this case, the value of the central pixel is replaced by the value determined by the ordering result, that is, by the median of the gray levels in the neighborhood of that pixel (the original pixel value is included in the median calculation). Median filters are popular because, for certain types of random noise, they provide excellent noise reduction capabilities, with less blur than linear smoothing filters of similar size. Median filters are particularly effective in the presence of impulse noise, also called salt and pepper noise because of their appearance of overlapping black and white dots in an image (GONZALEZ; WOODS, 2002). An example of the application of the median filter in the image preprocessing stage is presented by Silva et al. (2019) in which the authors address the processing and analysis of medical images. In the thesis work presented by D'AVILA (2019), the median filter was used in the analysis of chromatographic profiles. An algorithm was developed as an alternative to the manual process, which is imprecise, for analyzing the presence of substances in plants. In this way, it was possible to reduce the time spent on analysis, find the centers of the stains according to their distribution, and compare the colors according to their exact values, in contrast to the visual method that uses the subjectivity of the analyzer.

In this work, the median is used as a measure of the brightness intensity of the color components in the YCbCr and RGB planes of the reference and test images of the diesel oil samples.

METHODOLOGY

The methodological aspects of the research carried out are discussed below, describing the procedures necessary to evaluate the application of image subtraction and the median in identifying the quality of diesel oil. The purpose of this study was to conduct applied research. To achieve the proposed objectives and better appreciate this work, a qualitative and quantitative approach was used. To understand the problems in the study area, exploratory and bibliographical research was carried out (GIL, 2019). The following are the materials used throughout the research, as well as the methodological procedures, are written.

MATERIALS

This section presents the environment in which this work was developed and the data set used in the validation and testing of this system.

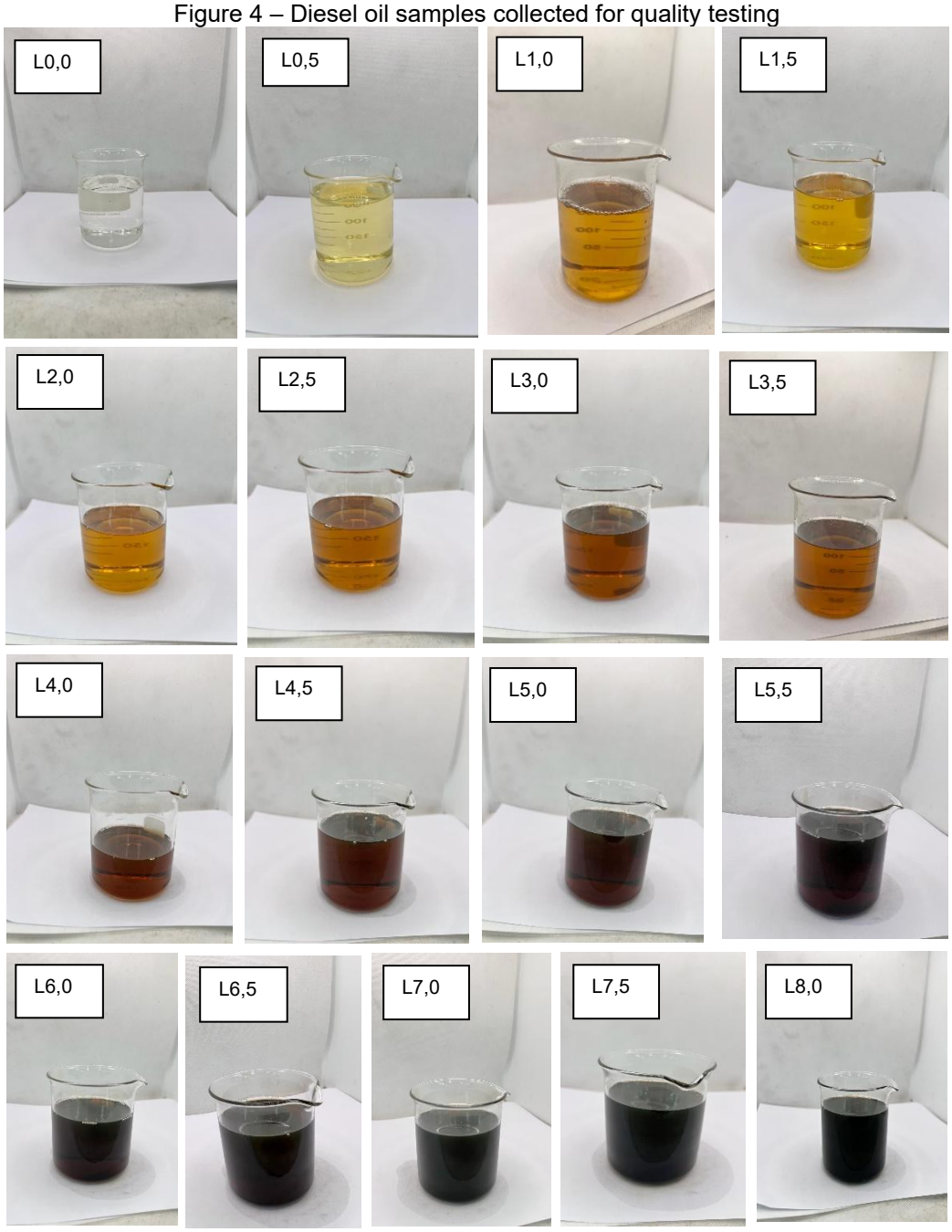
Development environment

The hardware used in this research has the following configuration: 11th Gen Intel(R) Core (TM) i5-11400H Processor @ 2.70GHz 2.69 GHz; RAM 16.0 GB (usable: 15.7 GB); 64-bit operating system, x64-based processor; Matlab® software version 2022b; 1 TB SSD HD.

Dataset

The data set of this study is formed by images with samples of diesel oil with varied aspects, that is, different color gradations as illustrated in Figure 04. Samples with aspects L0.0 to L3.5 (lighter) are considered as oil of acceptable or approved quality and those with aspects of L4.0 to L8.0 (darker) are considered as oil of disapproved quality..

Figure 4 – Diesel oil samples collected for quality testing

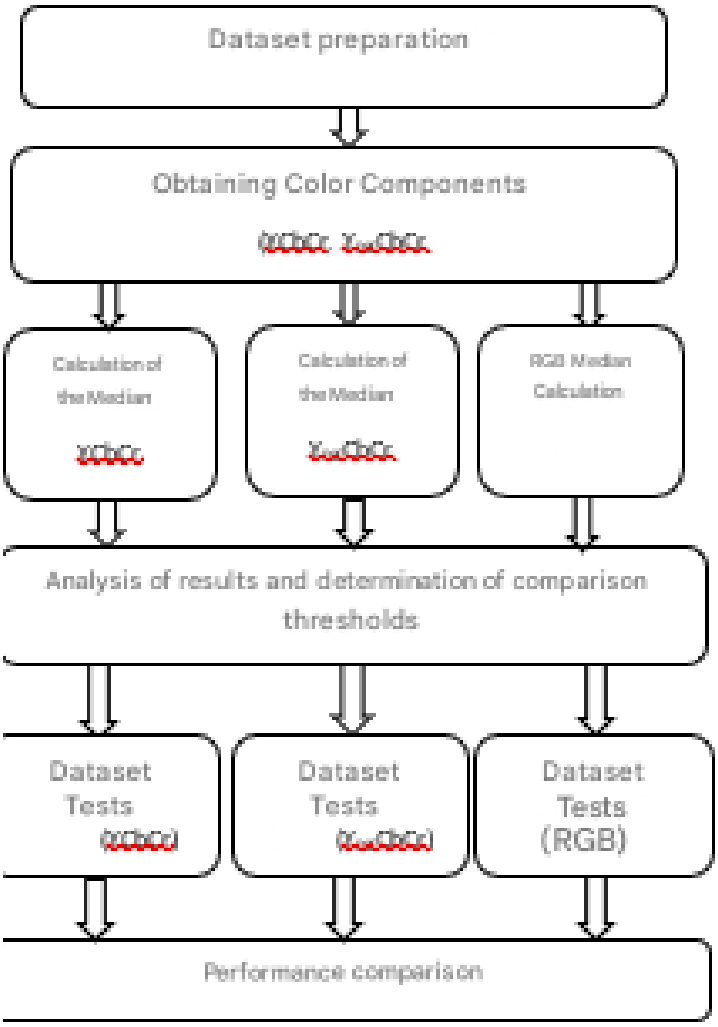


Source Authors

METHODS

The block diagram in Figure 05 presents the steps of the methodology used in the development of this work, namely: preparation of the data set, obtaining the color components, calculating the median, analyzing the results and determining the comparison thresholds, testing the data set in the color planes, and comparing performance. Each of these steps is described below.

Figure 5 – Methodology used in system development



Source: Authors.

Dataset Preparation

The dataset preparation consisted of obtaining reference and test images from the images with the diesel oil samples illustrated in the previous section. They were edited using the Windows 11 photo editing program, where the images were cropped in the oil region of each sample (L0.0 to L8.0). From these images, others were obtained with variations in brightness, contrast, and saturation. In total, the dataset was prepared with 192 images. Figure 6 illustrates some images obtained after cropping and variation in brightness, contrast, and saturation.

Figure 6 – Images used for validation and testing



Source: Authors.

Obtaining the Color Components

For each standard image (L0.0 to L8.0), the color components were obtained in the YCbCr and RGB planes. In addition, the difference images between the Y component of the standard image L0.0 and all the other Y components of the other images (L0.5 to L8.0) were obtained. At the end of this step, the images of the following components were obtained: Y, YDifference, Cb, Cr, R, G, B.

Calculating the Median

From the images of the color components obtained in the previous step, the median values for each of these images were calculated. At the end of this step, 17 median values corresponding to the 17 standard images (L0.0 to L8.0) were obtained for each of the components (Y, YDifference, Cb, Cr, R, G, B).

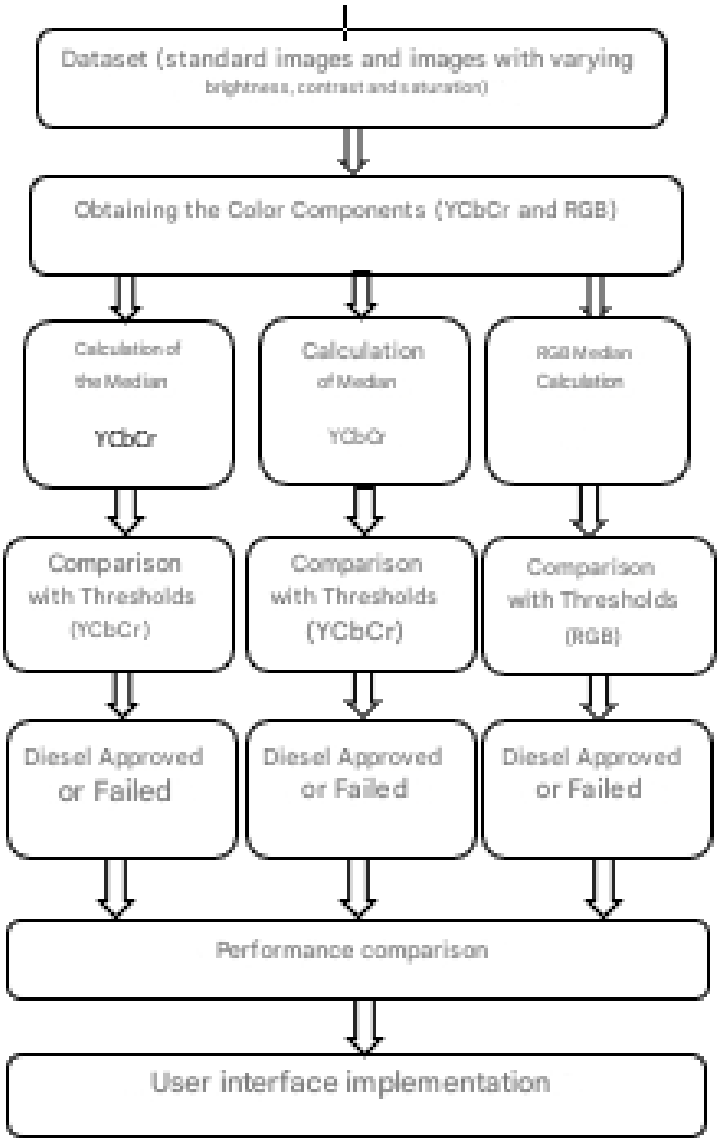
Analysis of results and determination of comparison thresholds

Based on the median values obtained in the previous step, the results were analyzed. The objective of this step was to evaluate the behavior of the diesel oil samples in each of the components (Y, YDifference, Cb, Cr, R, G, B) to verify the variation of the median values according to the colors of the diesel oil samples. From this analysis, it was possible to establish comparison thresholds for each of the components (Y, YDifference, Cb, Cr, R, G, B) with the cutoff point being the L4.0 sample, from which the oil is considered to have failed.

Data set testing

In the testing step, the previously prepared data set was used to evaluate the performance of the algorithm implemented in identifying samples with approved or failed diesel oil. Figure 7 illustrates the flowchart of the algorithm developed to automatically perform the tests on the diesel oil samples. Each of these steps is described below..

Figure 7 – Flowchart of the algorithm developed for the ..... tests.



First, the images of each of the diesel oil samples were read, both the standard ones (L0.0 to L8.0) and those with variations in brightness, contrast and saturation. Then, the components Y, YDifference, Cb, Cr, R, G, B were obtained and the median for each of them was calculated. In the next step, the median values were compared with established thresholds to determine whether the sample under analysis would be approved or rejected, as illustrated in equations 1, 2 and 3.

$$\text{Sample} = \begin{cases} \text{Diesel Failed, if} \\ (\text{Ymediana} < \text{Limian, E} \\ \text{Cbmedian} > \text{Threshold E} \\ \text{Crmedian} < \text{Threshold}) \\ \text{Approved Diesel,} \quad \text{Otherwise} \end{cases} \tag{1}$$

$$\text{Sample} = \begin{cases} \text{Diesel Failed, if} \\ (\text{Ydifmediana} > \text{Threshold E} \\ \text{Comedian} > \text{Threshold E} \\ \text{Crmedian} < \text{Threshold}) \\ \text{Approved Diesel,} \quad \text{Otherwise} \end{cases} \tag{2}$$

$$\text{Sample} = \begin{cases} \text{Reapproved Diesel,} \\ \text{if (Rmedian} < \text{Threshold, AND} \\ \text{Gmedian} < \text{Threshold, AND} \\ \text{Bmedian} > \text{Thresholds)} \\ \text{Approved Diesel,} \quad \text{Otherwise} \end{cases} \tag{3}$$

Performance comparison

In the performance analysis stage, the results obtained from the tests of images with diesel oil samples with variations in brightness, contrast and saturation were analyzed. The metrics used in the validation and testing were the following: Accuracy, Precision and Sensitivity. To present these metrics, the following terms are previously defined:

a) True Positives (VP): failed diesel oil correctly identified as failed;

b) True Negatives (TN): approved diesel oil correctly identified as approved;

c) False Positives (FP): approved diesel oil wrongly identified as failed;

d) False Negatives (FN): failed diesel oil wrongly identified as approved;

Accuracy (FERRARI; SILVA, 2017) is defined in equation 4 and, in this context, it evaluates the percentage of correct answers in identifying diesel oil with failed quality.

(4)
$$ACC = \frac{VP + VN}{VP + VN + FP + FN}$$

Precision (SOKOLOVA; LAPALME, 2009), shown in equation (5), expresses in this context the ratio between the number of diesel oil samples that were correctly identified

over the sum of all samples identified as having approved quality. Thus, it expresses the model's ability to avoid false positives..

$$Precisão = \frac{VP}{VP + FP} \quad (5)$$

Recall or sensitivity (SOKOLOVA; LAPALME, 2009), shown in equation (6), is a metric that determines, in this context, the rate of diesel oil samples correctly identified as diesel of failed quality.

$$Sensibilidade = \frac{VP}{VP + FN} \quad (6)$$

Furthermore, in the oil industry, a false negative indication, i.e., diesel oil of disapproved quality mistakenly identified as approved, generates enormous losses for the company. Therefore, in this work, the false negative rate (FNR) score is a measure that in this context expresses the rate of bad diesel oil mistakenly identified as approved. The FNR is defined according to the equation (7).

$$\text{FNR} = \frac{FN}{FN + VP} \quad (7)$$

All stages of validation and testing were carried out automatically, including the generation of performance evaluation metrics.

In this work, the null hypothesis was also evaluated, stating that the results between the YCbCr and RGB color spaces for identifying rejected diesel oil samples are similar (KING; ECKERSLEY, 2019). To assess this null hypothesis ($H0$), the Chi-square test (χ^2) (HOWELL, 2011) was used, calculated from 2 × 2 contingency tables. A significance level of 0.05 was adopted for this inference. The null hypothesis ($H0$) indicates that there is no difference between the analyzed color spaces regarding the identification of rejected diesel oil samples.

User Interface Implementation

After the validation and analysis of the results in the previous stages, a user interface was created that uses a video camera to capture the test sample image. The video camera used was the Logitech webcam Pro9000 with a resolution of 640 x 480.

RESULTS

This chapter presents and discusses the following results: comparison threshold values, diesel oil quality identification, and user interface.

COMPARISON THRESHOLD VALUES

Table 01 presents the median values for each component (Y, YDifference, Cb, Cr, R, G, B) obtained for images L0,0 to L8,0.

Table 01: Median values for each color component

L	Y	YDif	Cb	Cr	R	G	B
0,0	177	0	126	129	188	188	186
0,5	166	9	99	139	192	177	117
1,0	117	62	71	164	174	111	1
1,5	134	45	61	159	186	138	1
2,0	114	64	72	165	172	106	0
2,5	95	82	82	164	149	81	1
3,0	71	106	96	160	115	50	0
3,5	82	95	90	161	131	64	0
4,0	53	124	112	152	82	30	10
4,5	50	126	119	146	69	28	21
5,0	47	130	124	141	55	28	27
5,5	37	139	128	130	29	22	26
6,0	41	138	127	132	36	26	27
6,5	35	144	128	130	25	20	22
7,0	44	135	128	127	31	33	33
7,5	35	143	130	127	21	22	27
8,0	24	154	129	126	5	10	11

As per the obtained results, for component Y, starting from sample L3,5, the brightness intensity values decrease to below 83. For component Ydif, intensity increases to values above 95 from sample L3,5. For component Cb, intensity increases to values above 90 from sample L3,5. For component Cr, intensity decreases to below 161 from sample L3,5. For components R and G, there is a reduction in intensities below 131 and 64, respectively, starting from sample L3,5. For component B, values above zero are observed for this same sample. Thus, comparison thresholds for each color component were derived, as illustrated in Table 02.

Table 02: Threshold values for each color component

Component	Thresholds
Y	80
Ydif	110
Cb	100
Cr	155
R	120
G	55
B	5

RESULTS OF DIESEL QUALITY IDENTIFICATION

Table 3 presents the results obtained from testing all images in the dataset, i.e., with variations in brightness, contrast, and saturation, totaling 192 images.

Table 3 – Performance analysis metrics

Color Space	ACC (%)	Precision (%)	Recall (%)	False Negative Rate (%)
RGB	98.96	99.07	99.07	0.00925
YCbCr	99.48	99.08	100.00	0
YDif CbCr	100.00	100.00	100.00	0

The best result was obtained using the Ydif, Cb, and Cr components, with accuracy, precision, and sensitivity (recall) all equal to 100%, and the false negative rate was zero. Using YCbCr, a false negative rate of zero and an accuracy of 99.48% were also achieved. In the case of RGB, the false negative rate was below 1%, with precision and sensitivity equal to 99.07%.

In Table 4, the confusion matrix for the RGB color space is presented. According to the results, one false positive and one false negative were generated, meaning that one sample that should have been rejected was approved, and another that should have been approved was rejected. This led to an error rate different from zero. The test image that generated the false negative was L4,0, and the one that generated the false positive was L3,0, both with saturation variation.

Table 4 - RGB Confusion Matrix

	Predicted Identification
Real Identification	Approved Diesel
Approved Diesel	107
Rejected Diesel	1

In Table 5, the confusion matrix for the YCbCr color space is presented. According to the results, one false positive was generated, meaning that approved diesel oil was mistakenly identified as rejected. The test image that generated the false positive was L3,0, with saturation variation.

Table 5 - YCbCr Confusion Matrix

	Predicted Identification
Real Identification	Approved Diesel
Approved Diesel	108
Rejected Diesel	1

In Table 6, the confusion matrix for YDif CbCr is presented. According to the results, no false positives or negatives were generated. This is the ideal situation for the oil industry, as all samples were correctly identified (approved or rejected).

Table 6 - YDif CbCr Confusion Matrix

	Predicted Identification
Real Identification	Approved Diesel
Approved Diesel	108
Rejected Diesel	0

Chi-Square Test (χ^2)

Table 7 presents the results of the Chi-square tests conducted between the YCbCr and RGB color spaces. The adopted significance level was 0.05, and since the p-value obtained in all cases was higher than the significance level, the null hypothesis was accepted, indicating that no statistically significant differences were found in identifying rejected diesel oil samples between the YCbCr and RGB color spaces.

Table 7 – Chi-Square Test Results (χ^2)

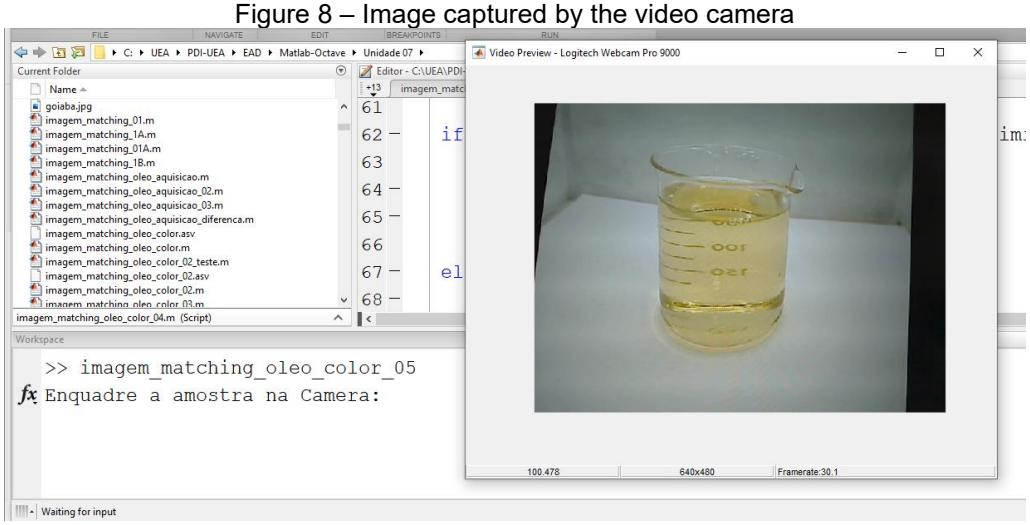
Color Spaces	(p-value)
YCbCr x RGB	0.562
YDifCbCr x RGB	0.156
YDifCbCr x YCbCr	0.316

USER INTERFACE

For the implementation of the User Interface, a video camera, the Logitech webcam Pro9000 model, was used with the following specifications and settings: resolution 640 x 480, Brightness = 128; Contrast = 32; Saturation = 28.

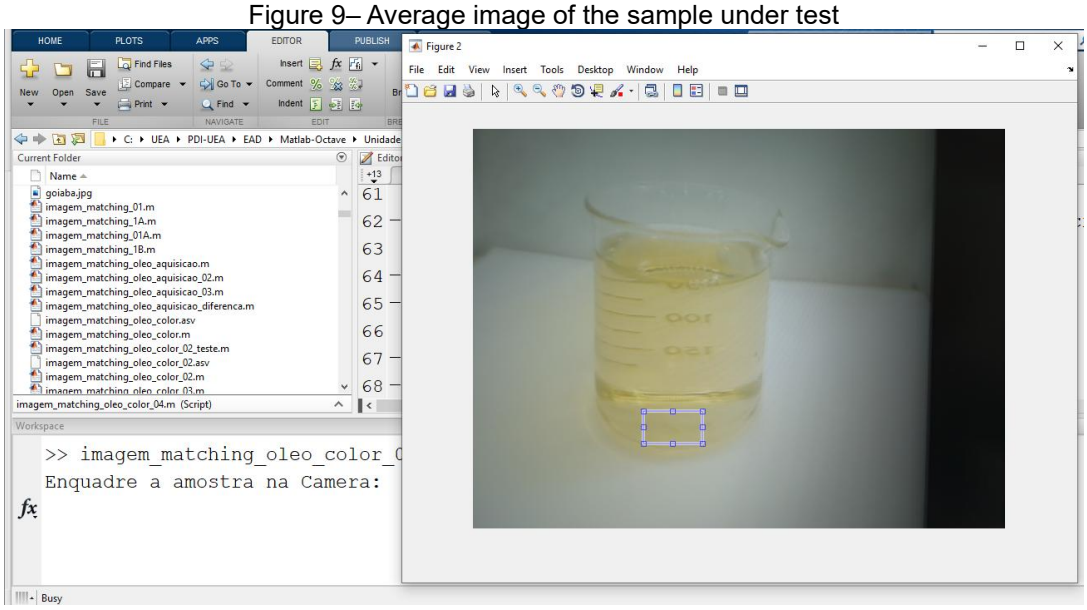
When the user runs the script in Matlab, the following message appears: “Frame the sample in the Camera,” as shown in Figure 8. The captured frame sequence is displayed so the user can position the sample image within the camera's field of view. At the bottom of the image, the resolution (640 x 480) and frame rate (30 fps) are shown.

Figure 8 – Image captured by the video camera



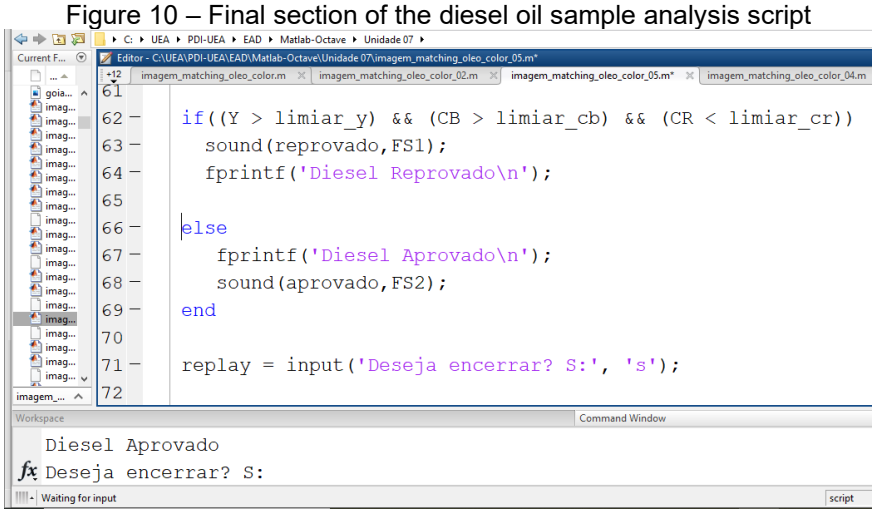
Once the sample image is positioned, the user presses the “ENTER” key and the script captures 30 frames to obtain the average image, which aims to reduce noise from the image capture process. Figure 9 illustrates the average image of the sample under test..

Figure 9– Average image of the sample under test



When the script finishes calculating the average image, it waits for the user to select a small area of diesel oil in this image, which is displayed on the screen. When doing so, the script highlights the selected area, as shown in Figure 9. When the user finishes selecting the diesel oil area, the user must double-click so that the script captures the selected area and proceeds with the analysis of the sample. At the end of the analysis, a voice message and text are emitted informing whether the sample is approved or rejected, as shown in Figure 10. The script then asks if the user wants to end or continue analyzing other samples. When typing “Y”, the script is terminated, as shown in Figure 10..

Figure 10 – Final section of the diesel oil sample analysis script



CONCLUSION

The main objective of this work was to present the application of the median in the identification of diesel oil quality. Thus, we sought to analyze three approaches using the median as a measure of the intensity of the Y, YDifference, Cb, Cr, R, G, B components. The work investigated the performance of each approach using test images on a scale of L0.5 to L8.0 with variations in brightness, contrast and saturation.

According to experimental results, using RGB, the false negative rate was less than 1% with precision and sensitivity equal to 99.07%. In this case, one false positive and one false negative were generated, that is, one of the samples that should have failed was approved and another that should have been approved was rejected. Although the false negative rate is less than 1%, this can cause disruptions in the diesel oil production process, since a false approval can cause losses to the industry, as well as a false rejection can generate unnecessary alarms.

Regarding the YCbCr color plan, a false negative rate of zero and an accuracy of 99.48% were also obtained. In this case, a false positive was generated, that is, approved diesel oil was wrongly identified as failed. The best result obtained was using the Ydif, Cb and Cr components, in which the accuracy, precision and sensitivity (recall) were all equal to 100%, and the false negative rate was equal to zero.

Analyzing the statistical inference results with the Chi-square test, no statistically significant differences were found in relation to the identification of failed diesel oil samples for the YCbCr and RGB color plans. However, considering that the use of the Ydif, Cb and Cr components did not generate false positives or negatives for the tested data set, this approach is suggested in future work that intends to implement a system for identifying the quality of diesel oil in the production process integrated with a supervisory system to assist in decision making. Regarding the video camera used to acquire images of the test

samples, a resolution of 640 x 480 was used, which can be easily found on the market. If the hardware used to process the images is capable of processing 30 frames per second, in less than 2 seconds, the system will be able to identify the quality of the oil produced, which would be enough to activate the supervisory system in the refinery's production process.

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THE IMPORTANCE OF FAMILY PLANNING IN PRIMARY HEALTH CARE

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ABSTRACT

Family planning is a fundamental strategy in primary health care (PHC), being essential for the promotion of sexual and reproductive health, the reduction of maternal and infant mortality rates, and the strengthening of gender equity. This integrative review aimed to analyze the scientific evidence on the importance of family planning in PHC, identifying its benefits and challenges. Twenty studies published between 2010 and 2023 were reviewed, and eight studies were selected in the PubMed, Scopus, and SciELO databases, using descriptors related to the theme. The results showed that the offer of diversified contraceptive methods, associated with sex education and qualified counseling, contributes significantly to the reduction of unplanned pregnancies and complications related to maternal and child health. In addition, these actions favor female empowerment and expand access to educational and professional opportunities. However, obstacles persist, such as scarcity of resources, lack of training of health teams, regional inequalities in access to services, and cultural and religious barriers that hinder adherence to

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contraceptive methods. Continuous training of health professionals, the strengthening of public policies, and the development of culturally sensitive strategies are essential measures to improve the effectiveness of family planning actions. It was concluded that the effective integration of family planning in PHC is essential to ensure informed reproductive choices, reduce social inequalities and improve the quality of life of populations, and it is necessary to carry out future studies that evaluate intervention models and public policies in different regional contexts.

Keywords: Family planning. Primary health care. Reproductive health. Unplanned pregnancies. Gender equity.

INTRODUCTION

Family planning is an essential component in primary health care, playing a key role in promoting sexual and reproductive health, reducing maternal and infant mortality rates, and strengthening the autonomy of individuals and families in decision-making about reproduction. This practice involves access to effective contraception, sexual and reproductive health education, and psychological support, allowing people to plan whether they want to have children, when, and how many they want to have. In addition, family planning contributes to the prevention of unplanned pregnancies, unsafe abortions, and sexually transmitted infections (STIs), directly impacting quality of life and social well-being.

The effective implementation of family planning is aligned with the United Nations (UN) Sustainable Development Goals (SDGs), especially SDG 3, which aims to ensure healthy lives and promote well-being for all at all ages, and SDG 5, which seeks to achieve gender equality and empower all women and girls. Through public policies and health programs aimed at offering family planning services, it is possible to reduce social inequalities, promote gender equality, and ensure better health conditions for the population.

In primary care, family planning plays a strategic role, being the main gateway to the provision of accessible and quality health services. The availability of various contraceptive methods, individualized counseling, and health education are essential to prevent unplanned pregnancies, reduce the risks associated with early pregnancy, and minimize complications resulting from STIs. However, despite their relevance, several challenges still compromise the effectiveness of these services, such as inequalities in access, low training of health professionals, cultural barriers, misinformation, and social stigmas related to the use of contraceptive methods. These obstacles make it difficult for the population to adhere to family planning practices, especially in vulnerable communities.

The relevance of this study lies in the need to understand and highlight the importance of family planning as an essential component of primary health care. Although the benefits of this practice for public health are widely recognized, significant challenges persist in its implementation, especially in contexts of social and economic vulnerability. The lack of investment in sex education, the lack of equitable access to contraceptive methods, and cultural and religious barriers become obstacles to the effectiveness of family planning policies, compromising the reproductive health and well-being of the population.

Given this scenario, it is essential to gather and analyze the available scientific evidence to understand the positive impacts of family planning on public health and to identify the main difficulties faced in its implementation. This analysis will make it possible to

subsidize strategic actions and more effective public policies, promoting universal access to reproductive health services and contributing to the reduction of health inequalities. Thus, this study seeks to offer a solid knowledge base for health professionals, managers, and public policy makers, emphasizing the importance of strengthening family planning as an indispensable strategy for the promotion of integral health and social development.

The present study aimed to review in an integrative manner the scientific evidence on the importance of family planning in primary health care, highlighting the positive impacts of this practice on the health of the population and the main limitations observed in its implementation.

METHODOLOGY

This study consists of an integrative literature review with the objective of systematically gathering and analyzing the available evidence on the importance of family planning in primary health care. To ensure the quality and transparency of the process, the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were followed, which guide the selection, analysis, and presentation of scientific studies. The search for articles was carried out in the PubMed, Scopus and SciELO databases, recognized for the relevance and scope of publications in the areas of health and biomedical sciences. The survey covered publications from January 2013 to December 2023, considering the evolution of family planning practices and policies in the last ten years.

The following descriptors were used, combined with Boolean operators (AND and OR) to optimize the search: "family planning", "primary health care", "public health", "reproductive health services" and "contraceptive methods". The combination of these terms allowed the identification of studies that addressed family planning in a broad way, including aspects related to the provision of services, access, barriers, and impacts on public health.

Original studies (quantitative, qualitative, or mixed) and systematic reviews published between 2013 and 2023, in Portuguese, English, or Spanish, that directly addressed the benefits, challenges, or implementation strategies of family planning in the context of primary health care were included. Studies exploring the relationship between family planning and the promotion of sexual and reproductive health, the reduction of maternal and child mortality, or access to contraceptive methods were also considered. Studies that dealt exclusively with public policies unrelated to primary care, studies focused on family planning in hospital contexts or specialized outside primary care, opinion articles, editorials,

abstracts of scientific events, unpublished dissertations, and duplicate studies among the databases consulted were excluded.

Twenty studies published between 2010 and 2023 were reviewed, and eight studies were selected. The selection of studies occurred in three stages. In the first, the initial screening was performed by reading titles and abstracts to exclude studies that did not meet the inclusion criteria. Then, the selected articles were read completely to confirm eligibility. Finally, the included studies were analyzed in terms of objectives, methodology, main results and conclusions. The extracted information was organized in a descriptive way to facilitate the comparison and interpretation of the data.

The data collected were analyzed qualitatively and descriptively, allowing the identification of patterns, benefits, challenges, and gaps related to family planning in primary health care. This approach made it possible to broadly understand the positive impact of this practice on public health, as well as the difficulties faced in its implementation, providing subsidies for the formulation of public policies and more effective professional practices in promoting reproductive health and strengthening primary care.

RESULTS AND DISCUSSIONS

The analysis of the eight included studies showed the relevance of family planning as a strategic pillar in primary health care (PHC). In developing countries, the supply of contraceptive methods in PHC has resulted in a 30% to 40% reduction in unplanned pregnancy rates (Silva et al., 2021). In Brazil, family planning assistance within the scope of PHC represents a set of essential actions to guarantee the right to reproductive health of users of the Unified Health System (SUS). However, several obstacles hinder the full implementation of these services. A study carried out in Fortaleza (CE) pointed out that the population's lack of knowledge about family planning is related to the scarcity of care, the lack of reception by health professionals, the inefficiency of public policies, and the population's lack of interest (Rocha et al., 2021).

In addition, sex education, combined with easy access to family planning services, has a direct impact on the reduction of maternal and infant mortality, especially in regions of greater socioeconomic vulnerability (Oliveira et al., 2022). In Brazil, the expansion of access to contraceptive methods and the qualification of health teams have contributed to the improvement of these indicators (Brasil, 2013).

The role of PHC professionals is central, especially in individualized counseling and continuous monitoring of families. Well-trained health teams promote greater adherence to the use of contraceptive methods and strengthen patient confidence (Fernandes et al.,

2023). However, the scarcity of resources, such as the unavailability of contraceptive supplies and inadequate infrastructure, is a recurrent limitation in low-income regions (Pereira et al., 2020). A study published in the journal Ciência & Saúde Coletiva highlights that family planning care continues to be marked by the lack of contraceptive methods in public services and the insufficient training of health professionals (Pinto et al., 2018).

Another relevant point is the need to overcome cultural and religious barriers that still interfere with the acceptance of family planning services in some communities. Strategies such as awareness campaigns and the involvement of local leaders have been shown to be effective in increasing adherence and decreasing resistance to modern contraceptive methods (Rodriguez et al., 2021). In the Brazilian context, studies indicate that the perception of the effectiveness of family planning in promoting gender equality and women's autonomy is still limited, requiring educational actions and the confrontation of cultural barriers (Coutinho et al., 2019).

Despite the challenges, family planning integrated with PHC plays a key role in promoting gender equity, allowing women to have greater control over their reproductive choices and, consequently, more educational and work opportunities (González et al., 2023). According to the Ministry of Health, expanding women's and men's access to information and contraceptive methods is essential to ensure the exercise of reproductive rights in Brazil (Brasil, 2013). To this end, it is necessary to maintain the supply of contraceptive methods in the public network and to train health professionals to adequately guide contraceptive choices throughout life (Pinto et al., 2018).

In summary, the results analyzed reinforce the importance of family planning in PHC as a fundamental strategy for promoting reproductive health, reducing maternal and child mortality, and strengthening gender equity. However, challenges such as the unavailability of contraceptive methods, the lack of training of health professionals, and cultural barriers still need to be overcome to ensure the effectiveness of these actions in the Brazilian context.

CONCLUSION

Family planning in primary health care (PHC) has undeniable benefits for the health of the population, contributing to the reduction of maternal and infant mortality rates, the control of unplanned pregnancies, and the promotion of gender equality. These actions are essential to guarantee the right to reproductive health and improve the quality of life of individuals and families. However, several challenges still compromise the effectiveness of these services, such as the scarcity of financial and human resources, inequality in access

to health services, and the persistence of cultural and religious barriers that hinder adherence to contraceptive methods.

Among the limitations of this study, the temporal and geographic restriction of the publications analyzed stands out, focusing on studies published between 2013 and 2023 and, for the most part, focusing on the Brazilian context. This delimitation may have limited the identification of successful international experiences or new approaches implemented in other regions. In addition, the predominance of qualitative studies and the scarcity of robust quantitative data make it difficult to generalize the results, compromising a more comprehensive assessment of the effectiveness of family planning policies in PHC.

Another limiting factor was the absence of studies that longitudinally evaluate the impact of family planning actions over time, making it difficult to analyze sustainable results and understand how changes in public policies affect reproductive health.

To maximize the benefits of family planning, it is crucial to invest in the continuous training of health teams, ensuring adequate training on contraceptive methods and counseling sensitive to the cultural specificities of the communities served. It is also necessary to expand access to contraceptive supplies, ensure the availability of adequate infrastructure, and promote educational campaigns that involve local leaders to reduce cultural resistance.

Future research should explore successful intervention models in different regional and international contexts, with a focus on implementing innovative and sustainable strategies. Longitudinal studies and broader quantitative analyses are also needed to assess the long-term impact of family planning policies on primary care. In addition, it is essential to investigate how socioeconomic, cultural, and political changes influence adherence to family planning services, allowing adjustments in public policies to ensure their effectiveness and sustainability.

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COMPARATIVE ANALYSIS OF HEMODIALYSIS AND PERITONEAL DIALYSIS IN RENAL FAILURE

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ABSTRACT

End-Stage Renal Disease (ESRD) is characterized by the irreversible loss of kidney function, requiring renal replacement therapies such as Hemodialysis (HD) or Peritoneal Dialysis (PD) to maintain patients' health and quality of life. This systematic review compares HD and PD regarding quality of life, survival outcomes, and cost-effectiveness. A comprehensive search was conducted in PubMed and SciELO databases for studies published between 2014 and 2023, using keywords such as "Peritoneal Dialysis," "Hemodialysis," and "End-Stage Renal Disease." Of the 37 initially identified articles, 15 met the inclusion criteria. Findings indicate that PD improves aspects of quality of life, particularly mental health and the impact of kidney disease, as reported by Zazzeroni et al. (2017). However, HD offers superior control of hemodynamic disturbances, making it preferable for patients with severe comorbidities, such as diabetes and cardiovascular diseases. Regarding survival, studies by Mousavi et al. (2015) and Rigoni et al. (2016) revealed no significant differences in early treatment years, although mortality is higher among diabetic and elderly patients on PD, as highlighted by Yang et al. (2015). Additionally, PD demonstrated greater cost-effectiveness, especially in resource-constrained settings, according to Chang et al. (2016). The review underscores the importance of individualizing treatment decisions based on clinical factors, patient preferences, and available infrastructure. While PD offers advantages in quality of life and cost-effectiveness, HD remains more suitable for patients with severe comorbidities. Further research is needed to refine treatment protocols and improve outcomes for ESRD patients.

Keywords: Peritoneal Dialysis. Hemodialysis. End-Stage Renal Disease. Quality of Life. Survival Outcomes. Cost-Effectiveness.

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INTRODUCTION

End-Stage Renal Disease (ESRD) represents the most severe stage of chronic kidney disease, defined by the progressive and irreversible loss of kidney function. This condition results in the inability to eliminate waste products, regulate fluid balance, and maintain electrolyte homeostasis, leading to life-threatening complications such as severe hypertension, pulmonary edema, and arrhythmias. ESRD frequently stems from common chronic conditions like diabetes mellitus, systemic arterial hypertension, chronic glomerulonephritis, and vascular diseases. For these patients, renal replacement therapies, including Hemodialysis (HD) and Peritoneal Dialysis (PD), are critical for survival and play an integral role in maintaining health and quality of life (Universidade Aberta do SUS, 2024).

Hemodialysis (HD) is a widely used modality that involves the filtration of blood through an artificial membrane outside the body. It effectively removes toxins, corrects electrolyte imbalances, and stabilizes fluid overload. However, the procedure requires vascular access through an arteriovenous fistula or a central venous catheter, which introduces risks such as infections, clot formation, and vascular damage. Additionally, HD sessions are conducted in clinical settings on a fixed schedule, often causing disruptions to patients' daily lives. Its intermittent nature also contributes to hemodynamic instability, characterized by fluctuations in blood pressure and weight, and accelerates the decline of residual kidney function. Despite these challenges, HD is particularly advantageous for patients with severe comorbidities, offering precise and rapid management of critical electrolyte disturbances (Gonçalves et al., 2015).

Peritoneal Dialysis (PD), in contrast, utilizes the peritoneum as a natural semipermeable membrane for dialysis. Through the infusion of a dialysis solution into the abdominal cavity, waste products and excess fluids diffuse from the blood into the solution, which is then drained. PD is a continuous process that can be performed at home, offering patients greater autonomy and a more stable lifestyle compared to HD. Furthermore, PD has been associated with better preservation of residual kidney function, improved control of anemia, and fewer fluctuations in blood pressure. However, it carries unique risks, such as the development of peritonitis and catheter-related infections, which require rigorous hygiene and patient education. Certain clinical conditions, such as extensive abdominal adhesions or severe obesity, may also limit its feasibility (Gonçalves et al., 2015).

Both dialysis modalities have their distinct advantages and limitations, which can significantly influence patient outcomes. Recent studies suggest that PD may improve certain aspects of quality of life, particularly mental health and the ability to maintain social and professional activities. Its cost-effectiveness further enhances its appeal, particularly in

low-resource settings. HD, on the other hand, is generally more effective in managing patients with severe comorbidities, such as cardiovascular disease and diabetes, due to its ability to quickly address acute hemodynamic issues. However, it may impose a greater burden on patients' daily lives due to the need for frequent clinic visits and its more intrusive nature (Chang et al., 2016; Zazzeroni et al., 2017).

Survival outcomes between HD and PD are a topic of considerable debate. While studies have shown no significant difference in survival rates during the first few years of treatment, certain populations, such as diabetic or elderly patients, may experience higher mortality rates with PD. Furthermore, HD may be a safer option for individuals with extensive vascular disease or severe hemodynamic instability. Conversely, PD appears to offer long-term advantages for certain groups, such as children and patients awaiting kidney transplantation, due to its less invasive nature and preservation of vascular access (Xue et al., 2019; Yang et al., 2015).

Given the complexity of ESRD and the diverse profiles of affected patients, the choice between HD and PD must be individualized. Factors such as comorbidities, age, lifestyle, and healthcare infrastructure play crucial roles in determining the most suitable modality for each patient. Additionally, patient preferences and their ability to adhere to the specific demands of each therapy are critical considerations in ensuring successful outcomes. The importance of personalized treatment strategies is particularly pronounced in vulnerable populations, where a mismatch between patient needs and the chosen modality can lead to suboptimal results (Gonçalves et al., 2015).

This systematic review aims to provide a comprehensive comparison of HD and PD, focusing on quality of life, survival rates, and cost-effectiveness. By analyzing recent evidence, this study seeks to inform clinical decision-making and support the development of individualized approaches to dialysis, ultimately improving outcomes for patients with end-stage renal disease.

METHODOLOGY

This study utilized a systematic review approach to compare Hemodialysis (HD) and Peritoneal Dialysis (PD) in patients with End-Stage Renal Disease (ESRD), focusing on outcomes such as quality of life, survival rates, and cost-effectiveness. The objective was to synthesize evidence from contemporary research to support clinical decision-making and improve patient care strategies for ESRD.

The literature search was conducted in the PubMed and SciELO databases, employing a combination of Medical Subject Headings (MeSH) terms and free-text

keywords. The descriptors used included "Peritoneal Dialysis," "Hemodialysis," and "End-Stage Renal Disease." Boolean operators "AND" and "OR" were applied to refine the search strategy, ensuring the inclusion of relevant studies. The search encompassed articles published between 2014 and 2023, providing a comprehensive view of recent clinical advancements.

INCLUSION CRITERIA

The following inclusion criteria were applied:

1. Peer-reviewed studies comparing HD and PD outcomes in patients with ESRD.
2. Articles analyzing quality of life, survival rates, or cost-effectiveness of HD and PD.
3. Studies published in English, Portuguese, or Spanish to ensure linguistic accessibility and reliability in data interpretation.
4. Research employing robust methodologies, such as clinical trials, cohort studies, or systematic reviews, providing quantitative or qualitative data.

EXCLUSION CRITERIA

Studies were excluded based on the following criteria:

1. Research focusing exclusively on one modality without comparison to the other.
2. Articles not addressing outcomes related to quality of life, survival, or cost-effectiveness.
3. Studies lacking sufficient methodological detail or presenting duplicate data.
4. Publications in languages other than English, Portuguese, or Spanish.

SCREENING AND SELECTION

The initial search yielded 37 articles, which were screened based on their titles and abstracts. After applying the inclusion and exclusion criteria, 15 studies were deemed eligible and included in the final analysis. These selected studies provided a diverse representation of geographic regions and patient populations, ensuring a comprehensive evaluation of HD and PD outcomes.

DATA EXTRACTION AND ANALYSIS

Key variables extracted from the selected studies included:

1. Patient outcomes such as quality of life, survival rates, and cost-effectiveness.
2. Factors influencing the choice of dialysis modality, including patient age, comorbidities, and treatment availability.

3. Methodologies used in the studies, including sample size, follow-up duration, and statistical analyses.

Special attention was given to studies highlighting vulnerable populations, such as elderly patients and those with diabetes, as well as those addressing economic considerations in resource-limited settings. By synthesizing findings from the selected timeframe, this review provides a robust evaluation of HD and PD outcomes, emphasizing the importance of individualized treatment strategies.

This systematic review underscores the complexity of managing ESRD and the need for a patient-centered approach to dialysis therapy, integrating clinical, economic, and patient preference factors to optimize outcomes.

RESULTS

The comparison between Hemodialysis (HD) and Peritoneal Dialysis (PD) in patients with End-Stage Renal Disease (ESRD) reveals diverse outcomes and challenges in managing this critical condition. These modalities not only differ in their mechanisms but also in their impact on patient quality of life, survival rates, and cost-effectiveness. The reviewed studies demonstrate a wide range of findings influenced by patient characteristics, comorbidities, and geographic variations, reflecting the complexity of determining the optimal dialysis approach.

Key findings from the analysis show that HD excels in controlling hemodynamic stability and managing severe comorbidities, while PD often improves mental health and overall quality of life, especially in pediatric and younger populations. However, the outcomes for vulnerable groups, such as diabetic and elderly patients, highlight the need for careful modality selection to reduce risks and improve survival. Economic evaluations further emphasize PD's cost-effectiveness, particularly in resource-constrained settings, while maintaining comparable survival outcomes to HD in many scenarios.

The results underscore the critical importance of individualized treatment plans, integrating clinical factors, patient preferences, and healthcare infrastructure. The findings from the 15 reviewed studies provide valuable insights into the advantages and limitations of both modalities, aiming to inform clinical decisions and optimize outcomes for patients with ESRD.

The detailed findings of the reviewed studies are summarized in the table below:

Author, Year	Study Title	Study Summary
Zazzeroni et al., 2017	Meta-Analysis on Quality of Life in HD and PD	Meta-analysis highlighting discrepancies in quality of life outcomes between HD and PD. PD patients reported better mental health and reduced disease impact, while HD patients scored higher in physical health domains.
Chuasuwan et al., 2020	Quality of Life in HD vs. PD: A Systematic Review	Systematic review showing PD patients experience improved quality of life, particularly in areas such as physical functioning and reduced disease burden compared to HD.
Mousavi et al., 2015	Survival Analysis in HD vs. PD Patients	Comparison of survival rates in HD and PD patients, finding no significant differences during the first three years of treatment.
Rigoni et al., 2016	Time-to-Transplantation and Mortality in Dialysis Patients	Study showing PD patients have a higher chance of transplantation, with no significant differences in mortality compared to HD.
Yang et al., 2015	Mortality in Southeast Asian Patients on HD and PD	Study revealing increased mortality rates in Southeast Asian PD patients, especially those with diabetes or cardiovascular conditions, highlighting risks in vulnerable populations.
Makkar et al., 2015	Comparison of Quality of Life and Mortality in Indian Dialysis Patients	Comparison of Indian dialysis patients, showing that PD improved both physical and psychological quality of life, while also reducing mortality rates compared to HD.
Kim et al., 2015	Impact of Dialysis Modality on Elderly Patient Outcomes	Analysis of elderly patients showing better depression scores in PD patients, though younger patients generally had better survival rates regardless of modality.
Xue et al., 2019	Mortality in Diabetic Patients on HD vs. PD	Meta-analysis focused on diabetic ESRD patients, showing significantly higher mortality rates in PD patients compared to those on HD, emphasizing the importance of comorbidity considerations.
Alhusaini et al., 2019	Quality of Life in Pediatric Patients on HD and PD	Study on pediatric patients showing PD significantly improved social interaction,

		overall satisfaction, and reduced complications compared to HD.
Mazighi et al., 2022	Pediatric HD vs. PD: Survival and Quality of Life	Pediatric-focused study finding PD offered better survival and fewer complications, making it the preferred modality for children with ESRD.
LÃ³pez-Oliva et al., 2014	Pre-Transplant Dialysis Type and Patient Survival	Study on dialysis type prior to transplantation showing PD patients had better long-term survival rates, though dialysis modality did not affect graft survival.
Chang et al., 2016	Economic Analysis of Dialysis Modalities	Economic analysis showing PD was more cost-effective than HD, with no significant differences in life expectancy, especially relevant in resource-limited settings.
Zazzeroni et al., 2017	Meta-Analysis on Quality of Life in HD and PD	Meta-analysis highlighting discrepancies in quality of life outcomes between HD and PD. PD patients reported better mental health and reduced disease impact, while HD patients scored higher in physical health domains.
Chuasuwan et al., 2020	Quality of Life in HD vs. PD: A Systematic Review	Systematic review showing PD patients experience improved quality of life, particularly in areas such as physical functioning and reduced disease burden compared to HD.
Mousavi et al., 2015	Survival Analysis in HD vs. PD Patients	Comparison of survival rates in HD and PD patients, finding no significant differences during the first three years of treatment.
Rigoni et al., 2016	Time-to-Transplantation and Mortality in Dialysis Patients	Study showing PD patients have a higher chance of transplantation, with no significant differences in mortality compared to HD.

Source: The authors of the study

DISCUSSION

The comparison between hemodialysis (HD) and peritoneal dialysis (PD) reveals a range of outcomes regarding quality of life, survival rates, and cost-effectiveness, reflecting the complexity of managing end-stage renal disease (ESRD). These variations are

influenced by numerous factors, including patient characteristics, comorbidities, geographic location, and healthcare infrastructure, which underscores the need for individualized treatment approaches.

Quality of life outcomes vary significantly between the two modalities. Zazzeroni et al. (2017) highlighted differences in mental and physical health metrics among patients undergoing HD and PD. PD patients generally reported better mental health and perceived a lower disease burden, likely due to the autonomy provided by home-based treatment and the continuity of daily activities. However, HD was found to provide better physical health outcomes, which may be linked to its superior management of fluid and electrolyte imbalances. This finding aligns with Chuasuwan et al. (2020), who observed that PD patients consistently reported higher satisfaction in terms of disease impact and physical functioning, further emphasizing the modality's potential to improve certain aspects of quality of life.

In terms of survival, the findings remain inconclusive. Mousavi et al. (2015) and Rigoni et al. (2016) reported no significant differences in survival rates between HD and PD within the first three years of treatment. Rigoni et al. additionally noted that PD patients were more likely to undergo transplantation, suggesting an advantage for this modality in facilitating transplant eligibility. However, Yang et al. (2015) identified a higher risk of mortality among Southeast Asian PD patients with comorbidities such as diabetes and cardiovascular disease, highlighting the variability in outcomes based on regional and clinical factors.

Studies focusing on specific populations further illustrate the complexities in choosing between HD and PD. Makkar et al. (2015) demonstrated that Indian PD patients experienced improved physical and psychological quality of life and lower mortality rates compared to those on HD. Similarly, Kim et al. (2015) found that elderly PD patients reported better mental health outcomes, such as reduced depression scores, but their survival was lower compared to younger PD patients, indicating that age plays a critical role in treatment success. Xue et al. (2019) added that diabetic patients on PD had significantly higher mortality rates than those on HD, underscoring the need for careful selection of dialysis modality for patients with complex comorbidities.

Pediatric patients also present unique considerations. Alhusaini et al. (2019) observed that children on PD reported better quality of life, particularly in social interaction and overall satisfaction. This finding was corroborated by Mazighi et al. (2022), who emphasized that PD offers fewer clinical complications and better overall outcomes in

pediatric ESRD patients. These studies suggest that PD may be the preferred modality for this age group, providing a more favorable balance of quality of life and clinical safety.

Cost-effectiveness is another crucial factor in the discussion of dialysis modalities. Chang et al. (2016) highlighted that PD is more cost-effective than HD, particularly in resource-limited settings, with no significant differences in life expectancy between the modalities. This economic advantage may make PD a more viable option in settings where healthcare budgets are constrained, although the higher costs associated with complications in HD should also be considered.

López-Oliva et al. (2014) contributed to the discussion by examining dialysis modality prior to kidney transplantation. Their findings suggested that PD patients had better long-term survival rates post-transplant compared to HD patients, although the choice of dialysis did not impact graft survival. This highlights the potential long-term advantages of PD for certain patient populations.

The discussion between HD and PD remains complex and highly context-dependent. While PD offers notable advantages in terms of quality of life and cost-effectiveness, HD is more effective in managing severe comorbidities and hemodynamic instability. These findings reinforce the importance of individualized treatment plans that consider clinical factors, patient preferences, and healthcare resources. By tailoring dialysis choices to the unique needs of each patient, clinicians can optimize outcomes and improve the overall management of ESRD.

CONCLUSION

This systematic review highlights the complex and multifaceted nature of managing End-Stage Renal Disease (ESRD) through Hemodialysis (HD) and Peritoneal Dialysis (PD), emphasizing the nuanced trade-offs between these modalities. The findings underscore the significant differences in quality of life, survival rates, and cost-effectiveness, which are heavily influenced by patient-specific factors such as comorbidities, age, and lifestyle, as well as healthcare infrastructure and geographic considerations. While PD tends to improve mental health and social functioning, offering greater autonomy and cost savings, HD demonstrates superior efficacy in managing hemodynamic stability and severe comorbidities, such as diabetes and cardiovascular diseases. These results highlight the necessity of an individualized approach to dialysis selection.

The review also reveals important implications for vulnerable populations. For pediatric patients, PD provides better quality of life and fewer complications, making it the preferred modality in many cases. However, for elderly or diabetic patients, HD often

presents a safer option due to better survival outcomes in these groups. Economic analyses further emphasize the cost-effectiveness of PD, particularly in resource-limited settings, although the higher cost of HD-related complications should not be overlooked.

Despite these insights, the evidence base has notable limitations. The studies included in this review varied significantly in methodology, with heterogeneity in patient populations, outcome measures, and study designs. Many relied on small sample sizes, regional data, or retrospective analyses, which limit the generalizability of findings. Additionally, inconsistencies in reporting and potential biases in observational studies pose challenges in synthesizing a unified conclusion about the optimal dialysis modality. The exclusion of non-English, Portuguese, and Spanish publications further restricts the scope of the analysis, potentially overlooking relevant findings from other contexts.

Future research should focus on addressing these gaps by conducting large-scale, multicenter studies with standardized methodologies to better define the comparative outcomes of HD and PD. Particular attention should be given to underexplored populations, such as patients with atypical presentations, and those in low-resource settings where infrastructure constraints significantly influence modality choice. Studies exploring long-term outcomes, including post-transplant survival and the effects of dialysis on comorbidities, are also needed to provide a more comprehensive understanding of these modalities.

Emerging innovations in dialysis technologies and personalized medicine offer promising avenues for improving outcomes. Advances in wearable dialysis devices, home-based dialysis technologies, and tailored treatment protocols based on genetic and biomarker analyses could transform the current landscape of ESRD management. Furthermore, integrating multidisciplinary care teams to address the complex needs of ESRD patients can enhance quality of life and survival while reducing healthcare costs. By addressing these challenges and leveraging emerging innovations, future research can guide evidence-based decisions and improve the prognosis and well-being of patients with ESRD.

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THE USE OF ARTIFICIAL INTELLIGENCE TOOLS IN BUSINESS

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ABSTRACT

Artificial Intelligence (AI) research has emerged as a crucial field of study, with the potential to transform the industry and society. This article explores the evolution of AI in the business context, through a systematic review of the literature, to understand the impact of this technology on business. The objective is to trace the trajectory of AI, highlighting its main applications, benefits, and challenges. The rationale for the study lies in the need to understand how AI has been integrated into companies and what its implications are for the corporate future. The systematic review of the literature was chosen as a methodology to ensure a comprehensive and critical analysis of existing studies. This qualitative approach involved the rigorous definition of inclusion and exclusion criteria, with the selection of peer-reviewed articles and high-quality studies. The research identified the key phases of AI's evolution, from its earliest implementations to the most recent innovations. The results show that AI has been applied in areas such as process automation, data analysis, and customer service, offering significant advantages such as greater efficiency and personalization. However, challenges also arise, including governance issues and resistance to change. In conclusion, AI is shaping the corporate environment in a profound and diverse way. While it offers innovative solutions and drives business success, it is critical for businesses to address the challenges associated with their implementation. Adopting a well-defined strategy and addressing the complexities of AI are essential to maximizing its benefits and sustaining future innovation. The study underlines the importance of effective AI integration to drive business growth and transformation.

Keywords: AI. Organizations. Business.

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INTRODUCTION

Artificial intelligence (AI) research has stood out as a rapidly growing field of study, with the potential to profoundly transform the industry and society in the coming decades (Makridakis, 2017). In this way, leaders in the field of AI research will play a crucial role in guiding and defining this transformation. Therefore, it is essential for academia, the private sector, government agencies, policymakers, and the general public to understand which stakeholders exert the greatest influence in this area (Färber; Tampakis, 2023).

Artificial Intelligence (AI) has been consolidating itself as a transformative force in the business world, catalyzing a revolution in the way companies operate and innovate. This article seeks to present the evolution of AI in the business context, using a systematic review of the literature to trace the development and application of these technologies over time. Systematic analysis will allow for an in-depth understanding of how AI tools have been integrated into business, from their earliest implementations to the latest innovations.

The objective is to examine the trajectory of AI in business, highlighting the main phases of its evolution and how these changes have shaped the current corporate environment. The review will address three main aspects: first, identifying key AI applications over time, highlighting how these technologies have been adapted and evolved to meet business needs.

Secondly, the benefits and challenges that have arisen from the implementation of AI will be evaluated, analyzing the advantages gained and the obstacles faced by organizations.

Throughout this systematic review, this article will provide a comprehensive overview of the impact of AI on business, highlighting its evolution and its implications for the future of organizations.

DATA SCIENCE

Data Science is a multidisciplinary field that combines statistics, machine learning, applied mathematics, software engineering, and computer science to transform data into applicable knowledge.

According to (Marchionini, 2017) and (Virkus & Garoufallou, 2019), Data Science (DC) arises from the application of studies in the areas of measurement, representation, interpretation, and management, involving the resolution of problems in different sectors, such as industry, health, environment, and governments. International Business Machines (IBM) defines a CD as an external practice for solving complex problems and identifying

actionable insights for the business, through advanced data analysis, which integrates math, statistics, programming, AI and machine learning techniques.

This multidisciplinary approach allows Data Science to become an essential tool for innovation and informed decision-making. The increasing availability of data and the improvement of processing and analysis technologies have driven the demand for specialized professionals in the field, who are able to obtain specific knowledge from large volumes of information. In addition, the application of the DC in different contexts promotes the digital transformation of organizations, offering new opportunities for process optimization, development of more effective products and services (IBM, 2024; Marchionini, 2017; Moutinho, et. al., 2024; Virkus & Garoufallou, 2019).

According to Chen et al., 2012), by integrating quantitative and qualitative methods, Data Science not only provides insights into the past but also creates predictive models that can help anticipate future trends and behaviors, directly impacting the development of business strategies. In addition, as pointed out by Davenport and Patil (2012), organizations that adopt Data Science in their management are better positioned to innovate and improve operational efficiency, quickly adapting to changes in the market and consumer needs, identifying market opportunities, and improving the personalization of products and services. This is reflected in an increasing reliance on predictive algorithms, such as those used in product recommendations and consumer behavior analysis, which are central to marketing strategies (Davenport & Patil, 2012).

As stated by Brynjolfsson & McAfee, 2014, the use of real-time data allows companies to adjust their strategies quickly, creating a continuous cycle of optimization that more effectively meets demands. Data Science also facilitates innovation in various sectors, such as healthcare, education, and logistics, improving diagnostic accuracy, improving learning, and optimizing supply chain management (Brynjolfsson & McAfee, 2014).

According to (Wamba et al., 2023), the use of real-time data and integration with artificial intelligence systems have the potential to transform traditional business models, offering managers powerful tools to improve strategic and operational decision-making. With the application of machine learning algorithms, for example, companies can predict consumption behaviors, identify patterns of failures in production processes, and optimize resource allocation.

This results in greater efficiency and agility in responding to changes in the market, as highlighted by (Choi et al., 2023). In addition, Data Science allows organizations to personalize offers and improve the customer experience by creating solutions that are more compatible with the specific needs of each audience segment.

One of the fundamental pillars of Data Science is machine learning, which, as defined by (Mitchell, 1997), is the study of algorithms that automatically learn and improve with experience. Supervised techniques, such as linear regressions and neural networks, help identify patterns in labeled data, while unsupervised methods, such as clustering, are able to uncover hidden structures in unlabeled data (Hastie; Tibshirani & Friedman, 2009). A practical example of the application of machine learning is natural language processing (NLP), where advanced models like Bert have advanced advancements enhanced in tasks such as machine translation and sentiment analysis (Devlin et al., 2019). These developments have impacted aspects such as marketing, customer service, and even education, allowing for large-scale automation of tasks.

In parallel with technical advancement, ethical issues have become increasingly central in the practice of Data Science. The application of data and algorithms must be conducted responsibly to ensure privacy and transmission.

In addition, Data Science has demonstrated transformative impacts in several economic sectors. In healthcare, for example, machine learning-based models are being used to predict diseases and personalize treatments, as in the case of neural networks applied to medical image analysis (Esteva et al., 2017). In the financial sector, algorithms have optimized advanced processes such as credit risk analysis and fraud detection (Domingos, 2018). Companies that adopt data-driven strategies are not only able to predict market trends, but also improve their supply chains, which confers a significant competitive advantage (Fawcett & Provost, 2013).

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) has emerged as one of the most influential technologies today, shaping various industries and impacting society in profound ways. Given this, it becomes essential to understand which stakeholders exert influence on AI research, as pointed out by (Farber & Tampakis, 2023).

Artificial Intelligence (AI) is a field of computer science focused on the development of systems capable of simulating human intelligence, seeking to replicate the ability to learn and solve problems in a logical and rational way (IBM, 2023). AI involves creating machines and software that can interpret data, learn from that information, and perform tasks based on the knowledge gained.

There are different types of AI, each with specific characteristics and applications (Wang & Cheng, 2023). Among them are:

1. Narrow Artificial Intelligence (ANI): This type of AI is designed to perform a specific task with high performance, but without the ability to generalize or comprehend beyond that limited task.
2. Artificial General Intelligence (AGI): This refers to an AI that is able to learn, perceive, comprehend, and operate comprehensively, just like a human. AGI aims to achieve a level of intelligence comparable to that of humans, allowing it to perform a wide variety of tasks.
3. Artificial Superintelligence (ASI): It represents a stage of AI that surpasses human intelligence. ASI is capable of replicating and surpassing the multifaceted intelligence of human beings, possessing an expanded memory capacity, analyzing data at high speed, and making complex decisions efficiently (Wang & Cheng, 2023).

AI is already present in several sectors, such as healthcare, industry, finance, customer service, and transportation, among others. It is used to automate tasks, optimize processes, analyze large volumes of data, offer personalized recommendations, and even simulate human behaviors (IBM, 2023).

Evolution of Artificial Intelligence in Business

The evolution of Artificial Intelligence (AI) had as its starting point the work of Alan Turing in the 1950s, who laid the theoretical foundations of the area with the introduction of the Turing Test. In his paper *Computing Machinery and Intelligence*, Turing proposed that a machine could be considered intelligent if it managed to fool a human interrogator by simulating responses similar to those of another human. The test, which involves a human, a machine, and an interrogator, does not measure consciousness, but rather a machine's ability to mimic intelligent behaviors, challenging the idea that intelligence (Turing, 1950).

The Turing Test had a profound impact on the understanding of AI, in that intelligence could be assessed by observable behavior rather than subjective attributes. This concept continues to be a pillar in discussions about the definition and evaluation of artificial intelligence, reaffirming the relevance of Turing's work in the search for machines capable of replicating human cognition (Turing, 1950).

During the 1970s-1980s**,** John McCarthy developed symbolic AI, focused on rule- and logic-based systems to simulate specialized knowledge such as medical diagnosis and legal advice. In the 1990s**,** Judea Pearl introduced Bayesian networks and probabilistic modeling, expanding AI's ability to deal with uncertainties and make inferences from incomplete data.

In the 2000s, Geoffrey Hinton, Yann LeCun, and Yoshua Bengio pushed the field of deep learning forward, enabling the recognition of complex patterns in large volumes of data and transforming areas such as computer vision and natural language processing (Hinton; Le Cun; Bengio, 2015). While deep learning has revolutionized many areas, some challenges persist in older technologies. An example of this is the Captcha, a test used to verify whether the user of a website is a human or a computer (Von Ahn & Blum, 2003). This tool, although widely used, presents challenges and limitations, as pointed out by several studies in the area.

Captcha works on the premise that the human ability to interpret visual information, even when distorted or presented in unconventional formats, is superior to the ability of a computer. By presenting distorted letters, the Captcha creates an obstacle that, in theory, only a human would be able to overcome (Cloudflare, n.d). The justification is that a human being, through his experience with different fonts and writing styles, can recognize patterns and interpret the letters, even when they are deformed.

In other words, the Captcha, despite its name, works in the opposite way to the Turing test. While the Turing test seeks to determine whether a computer can be indistinguishable from a human, the Captcha aims to differentiate humans from computers. To do so, it presents challenges that exploit the current limitations of artificial intelligence, such as the difficulty of interpreting distorted images or visual noise.

However, with the advancement of artificial intelligence and machine learning, bots are becoming increasingly sophisticated at solving Captchas. Some of these tools use advanced pattern recognition algorithms to identify the distorted letters with high accuracy. Faced with this challenge, companies such as Google, with its reCaptcha, have developed new techniques to differentiate humans from bots, seeking more complex and adaptable tests (Cloudflare, n.d).

reCaptcha has evolved significantly, moving from simple visual testing to a more complex analysis of user behavior. The latest versions are able to evaluate a wide range of factors, such as click patterns, typing speed, and browsing history, to determine whether an interaction is human or automated. This proactive approach allows many users to be authenticated without the need to solve Captchas, making the online experience more fluid.

Starting in the 2010s**,** Andrew Ng highlighted the growing application of machine learning in business, improving personalized recommendations, data analysis, and automation, which brought significant gains in efficiency and decision-making.

In 2018, Buolamwini and Gebru published the study "Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification," which revealed accuracy

disparities in facial recognition systems, showing that these systems had lower accuracy in identifying the race and gender of darker-skinned individuals and women. This study highlighted the need to consider intersectional factors when evaluating the performance of AI algorithms (Buolamwini & Gebru, 2018).

Gebru and Buolamwini (2018-2021) highlight the importance of ethics in AI, emphasizing the need to mitigate biases, ensure data privacy, and use AI responsibly to avoid discrimination and negative impacts on society.

In 2021, Gebru faced controversies and challenges related to his research on AI ethics, which culminated in his departure from *Google*. Despite this, his research and activism continue to influence the field. Together with Buolamwini**,** Gebru continues to collaborate on initiatives to ensure that AI is developed and used responsibly, emphasizing the importance of mitigating biases and negative impacts (Gebru & Buolamwini, 2021).

Gebru and Buolamwini's work is critical to ensuring that AI is used ethically and fairly, shaping discussions on how to avoid bias and promote transparency and inclusion in technology. This Table 1 presents a summary of the main concepts and contributions that have marked the evolution of Artificial Intelligence (AI) over time.

Chart 1: The conceptual milestones of the evolution of Artificial Intelligence (AI)

Year	Author(s)	Concept	Description
1950-1960	Alan Turing	Turing test Fundamentals of AI.	It evaluates whether a machine can simulate human intelligence. Introduction of the theoretical foundations of AI.
1970-1980	John McCarthy	Symbolic AI	Rule- and logic-based systems to simulate expert knowledge.
1990	Judea Pearl	Bayesian Networks and Probabilistic Modeling	Dealing with uncertainties and inferences from incomplete data.
2000	Geoffrey Hinton, Yann LeCun, Yoshua Bengio	Deep Learning	Recognition of complex patterns in large volumes of data.
2010	Andrew Ng	Machine Learning in Business	Improved personalized recommendations and business automation.
2015	Geoffrey Hinton, Yann LeCun, Yoshua Bengio	Deep Learning	Recognition of complex patterns in large volumes of data.
2018	Jai Bolambini, Timnit Gebru	Accuracy Disparities in Facial Recognition	It reveals uneven accuracy in facial recognition, highlighting the importance of intersectional factors.
2018-2021	Timnit Gebru, Jai Bolambini	Ethics and responsible AI	Focus on mitigating bias and responsible use of AI.
2020	Kai-Fu Lee	Digital transformation and automation with AI	Revolutionizing business models and innovation with AI.
2021	Timnit Gebru, Jai Bolambini	Continuing research on AI ethics	Continuation of initiatives for responsible use of AI and mitigation of biases.

Source: The Authors (2024)

Artificial Intelligence in Business Management

Artificial Intelligence (AI) is increasingly integrated into business management, playing a strategic role in enabling businesses to process large volumes of data, identify patterns, and make predictions that aid in informed decision-making. Recent studies show that through AI tools such as predictive analytics, organizations can not only predict consumer demands and behaviors, but also optimize operations and create new competitive advantages (Perifanis & Kitsios, 2023).

Additionally, AI facilitates the automation of manual processes, which increases operational efficiency and allows for greater synergy between humans and machines. However, the implementation of this technology still faces significant challenges in terms of governance and resource organization, which requires a strategic approach to maximize its potential (Teoh & Goh, 2024).

In addition, the work of (Donthu et al., 2023) explores the integration of AI with other emerging technologies, such as blockchain, and discusses how this combination can revolutionize areas such as finance and operations. The authors emphasize that the success of AI in business depends not only on the technology itself, but also on the ability of companies to adapt their organizational cultures and structures to incorporate these innovations effectively.

Studies by (Vickovic & Sitnik, 2023) show how AI can be used in marketing strategies to personalize the customer experience and optimize advertising campaigns, highlighting the impact of AI in improving customer satisfaction and loyalty.

Other studies also highlight the importance of AI in areas such as finance, where the technology is being used for risk analysis, personalization of services, and automation of financial transactions (Bahoo; Cucculelli & Qamar, 2023). The exponential growth of AI in this sector demonstrates how indispensable technology has become for innovation and business competitiveness.

These advances show that AI is not just a technical tool, but an essential component of modern business strategy, capable of transforming the way companies operate and relate to the market (Bahoo et. al., 2024).

Main authors from 1950 to 2024 who influenced the field of Artificial Intelligence (AI) in business management are presented in Chart 2.

Table 2 – Main contributions in the field of AI in business management

Period	Authors	Contributions in AI and Business Management
1950-1970	Herbert A. Simon; Allen Newell	Pioneers in decision theory and problem-solving, fundamental to the use of AI in business decision-making.
	Norbert Wiener	Father of cybernetics, he contributed to the concept of automation and control of systems, later applied to AI.
	John McCarthy	He coined the term "AI" and developed LISP, influencing business programming and automation.
	James G. March; Richard Cyert	Studies on organizational behavior and decision-making in companies, connected to the development of AI.
1980-2000	Marvin Minsky	Founder of the field of AI, with theories that impacted business automation.
	Michael Dertouzos	It predicted the impact of AI on business automation and management.
	Tom Davenport	He discussed how technology and AI could revolutionize business process management.
	James F. Moore	He created the concept of "business ecosystem", linking it to the use of AI to manage complex business flows.
2000-2024	Andrew Ng	It popularized the use of machine learning in business through MOOCs, promoting AI in business processes.
	Kai-Fu Lee	2020 Addresses How AI is Shaping the Future of the Economy and Work
	Perifanis and Kitsios	They explored the strategic impact of AI on creating business value in the context of digital transformation.
	Teoh e Goh	They discussed the importance of governance and challenges in implementing AI in business management processes.
	Donthu *et al*.	They explore the integration of AI with emerging technologies such as blockchain and its impact on finance and operations.
	Vickovic and Sitnik	They show how AI can be used in marketing strategies to personalize the customer experience and optimize campaigns.
	Bahoo; Cucculelli, Qamar *(*2023)	They highlight the importance of AI in finance, for risk analysis, personalization of services, and automation of financial transactions.
	Bahoo *et. al.* (2024)	They emphasize that AI is essential to modern business strategy, transforming operations and market relations.

Source: The Authors (2024)

Table 2 provides an overview of the main contributions in the field of Artificial Intelligence (AI) applied to business management from 1950 to 2024.

In the period from 1950 to 1970, pioneering figures such as Herbert A. Simon and Allen Newell stand out, whose theories on decision making and problem-solving laid the foundation for the use of AI in business decision-making.

Norbert Wiener, known as the father of cybernetics, made significant advances in the concept of automation and control of systems, influencing AI. John McCarthy, who introduced the term "Artificial Intelligence" and developed the LISP programming language, had a crucial impact on automation and programming. In addition, James G. March and Richard Cyert contributed to studies on organizational behavior and decision-making in companies, connecting their findings to the development of AI.

In the period from 1980 to 2000, the consolidation of AI in business management was driven by Marvin Minsky, one of the founders of the field of AI, whose theories

impacted business automation. Michael Dertouzos predicted the transformation brought about by AI in automation and management. Tom Davenport discussed how AI could revolutionize business process management, while James F. Moore introduced the concept of "business ecosystem," which relates to the use of AI to manage complex flows in businesses.

From 2000 onwards, the era of digital transformation brought new perspectives. Andrew Ng played an important role in popularizing machine learning in business through MOOCs, facilitating the application of AI in business processes. Kai-Fu Lee analyzed the impact of AI on global competitiveness, with an emphasis on the economies of the US and China. Perifanis and Kitsios explored the strategic importance of AI in creating business value in the context of digital transformation. Finally, Teoh and Goh discussed the challenges and importance of governance in implementing AI in business management processes, reflecting on the complexities of integrating AI into modern practices.

In 2020, Kai-Fu Lee explored how digital transformation and automation through AI are revolutionizing traditional business models and promoting innovation in various sectors, highlighting the economic and social impact of this technology.

Thus, the table demonstrates the contributions to AI and its application in business management over the decades, highlighting how each author and their innovations have helped shape the field.

Artificial Intelligence Tools in Business Management

Artificial Intelligence (AI) tools are fundamental in modern business management, as highlighted by renowned experts and authors in the field. (Ng, 2016), co-founder of Google Brain and professor of Computer Science at Stanford University, points out that AI can transform efficiency and innovation in business operations. It demonstrates how process automation through AI frees employees from repetitive tasks, allowing them to focus on more strategic activities.

(Lee, 2018), author of "AI Superpowers" and former president of Google China, explores how AI is revolutionizing the global economy and increasing the competitiveness of companies. He argues that the personalization provided by AI not only improves the customer experience, but also fosters innovation in various sectors.

(Gartner, 2023), a global research and advisory consultancy, provides an in-depth look at AI trends and their practical applications in business. Its reports highlight how the integration of AI can optimize processes and assist in strategic decision-making, providing valuable insights for management.

Harvard Business Review articles, especially those by (Wilson & Daughert, 2018) discuss how AI can be applied for automation, advanced data analytics, and personalization. They emphasize that these technologies offer innovative solutions that drive efficiency and innovation in business operations.

Table 1 - AI Tools for Business Decision Making

Category	Tools
Data Analysis	Power BI, Tableau, Google Analytics
Predictive Analytics	IBM Watson, H2O.ai
Virtual Assistants and Chatbots	Salesforce Einstein, Zendesk Answer Bot
Process Automation	UiPath, Automation Anywhere
Sentiment Analysis and Competitive Intelligence	Brandwatch, Crimson Hexagon
Marketing Optimization	HubSpot, Marketo
Personalization via Machine Learning	Amazon SageMaker, Google Cloud AI Platform
Recruitment and Talent Management	HireVue, Pymetrics
Risk Analysis and Compliance	Palantir, Ayasdi
Inventory and Supply Chain Management	Llamasoft, ClearMetal

Source: The Authors (2024)

Table 1 presents several Artificial Intelligence (AI) tools that assist in business decision-making. Power BI, Tableau, and Google Analytics are data analysis tools that help you interpret large volumes of information and generate valuable insights. IBM Watson and H2O.ai are used for predictive analytics, helping to predict future trends and behaviors.

Salesforce Einstein and Zendesk Answer Bot are virtual assistants and chatbots that automate customer service, improving efficiency and interaction. UiPath and Automation Anywhere are process automation tools that optimize repetitive tasks, increasing operational efficiency. Brandwatch and Crimson Hexagon analyze sentiment and competitive intelligence by monitoring brand perception and competition. HubSpot and Marketo are used in marketing optimization, personalizing campaigns, and enhancing lead capture.

Amazon SageMaker and Google Cloud AI Platform are machine learning personalization platforms that allow you to build custom solutions with AI. HireVue and Pymetrics innovate recruitment and talent management by offering new approaches to candidate screening. Palantir and Ayasdi are tools for risk analysis and compliance, helping to identify risks and ensure regulatory compliance. Finally, Llamasoft and ClearMetal improve inventory and supply chain management, increasing efficiency and accuracy in logistics.

AI tools are essential for business management, offering automation, predictive analytics, and personalization that promote efficiency and sustainable growth. The strategic

adoption of these technologies, as evidenced by the *insights* of (Ng, 2016; Lee, 2018; Gartner, 2023; Wilson & Daugherty, 2018*)* is crucial to securing a competitive advantage in today's corporate environment.

METHODOLOGICAL PROCEDURES

This study is a systematic literature review, a qualitative and structured methodological approach that aims to compile, analyze, and synthesize existing research on the use of Artificial Intelligence (AI) tools in business. The methodological procedures followed included the rigorous definition of the inclusion and exclusion criteria.

This research method is extremely valuable for answering specific questions and gaining a comprehensive overview of the literature in a particular field of study. Using a well-defined methodology, systematic review allows minimizing bias and ensuring the robustness of the results (Gohr; Lee; Oliveira, 2013; Bahoo; Cucculelli & Qamar, 2023). By following a structured approach, this methodology provides a critical and organized analysis of the available evidence, contributing to a more accurate and reliable understanding of the topic in question.

The inclusion criteria included studies that address the impact of AI on different areas of business, such as data analytics, process automation, customer service, and marketing. Only peer-reviewed articles, academic books, and high-quality research reports were considered. On the other hand, the exclusion criteria excluded articles that did not directly address the use of AI, as well as studies with unclear methodologies or that did not present relevant results on the impact of AI on business.

The strategy of searching and selecting studies involved the *Web of Science* database for the selection of articles. The search terms included keyword combinations such as "Artificial Intelligence in Business," "AI and Enterprise Automation," "AI Tools," "AI-powered data analytics," and "chatbots and customer service."

The selection of studies was carried out in two stages: the screening of titles and abstracts to ensure initial relevance, followed by the complete reading of the selected articles to verify their adequacy to the established criteria. In the data extraction**,** for each selected study, data were extracted on the research objectives, methods used, main findings and implications for business. These data were systematized in a spreadsheet to facilitate analysis.

The analysis and synthesis of the results involved the thematic analysis of the studies, identifying patterns, trends and gaps in the existing research. The results were then

synthesized to offer an integrated view on how AI tools are being used in companies, their benefits and challenges, and examples of good practices.

The evaluation of the quality of the studies was carried out with the *Bibliometric Analysis* Software**,** Bibliometrix, which allowed the analysis of citation and co-citation networks to identify influential articles and trends in AI research in business.

DATA ANALYSIS

To enrich the analysis of the trajectory of Artificial Intelligence (AI) in business, it is important to integrate studies and contributions from prominent authors in the field. The journey of AI in business can be divided into several phases, each marking significant advancements that have shaped the current corporate environment.

The integration of the contributions of renowned authors and their research offers a comprehensive view of the trajectory, benefits, and challenges of Artificial Intelligence (AI) in business. This provides a deeper and more contextualized understanding of the impact of this technology in today's corporate environment, as illustrated in Table 2. These detailed perspectives help shed light on how AI has evolved over time and how its applications have shaped and continue to transform the business landscape.

Table 2 – Contribution, Advancement and Impact of AI in Business Management

Period	Contributions and Advances	Non-Corporate Environment Impacts
1950-1970	- Development of the foundations of AI by Simon, Newell and McCarthy.- Introduction of cybernetics by Wiener.	- Establishment of fundamental concepts for business automation.- Creation of essential programming tools.
1980-2000	- Advances in AI theories by Minsky.- Discussion of the AI revolution in management by Davenport and Moore.	- Beginning of the automation of complex processes.- Improvement of efficiency and reduction of operating costs.
2000-2024	- Advances in machine learning and big data.- Integration with emerging technologies such as blockchain.- Studies by Ng, Lee, and Donthu.	- Optimization of predictive analytics and personalization.- Creation of new competitive advantages.- Challenges in governance and organizational adaptation.
News and Future	- Continued evolution of AI and technological innovation.	- Continuous transformation in business management.- Need to adapt to emerging innovations and challenges.

Source: The Authors (2024)

Early (1950-1970): The trajectory of AI in business began with theorists such as Herbert A. Simon and Allen Newell, who developed crucial concepts about decision-making and problem-solving. Norbert Wiener introduced cybernetics, the basis for automation, while John McCarthy created the term "AI" and the LISP language, early tools for business automation.

Evolution and Consolidation (1980-2000): In this period, AI began to integrate more into business processes. Marvin Minsky and others advanced AI theories, and Tom Davenport and James F. Moore introduced the concept of the "business ecosystem." Automating complex processes has increased efficiency and reduced costs.

Digital Transformation and Advanced AI (2000-2024): With the rise of machine learning and big data, predictive analytics and service personalization have come into prominence. Andrew Ng and Kai-Fu Lee showed how AI has transformed global competitiveness, while integration with emerging technologies such as blockchain has brought new opportunities and challenges. Challenges such as governance and organizational adaptation remain critical.

Ben C. Stahl and David Eke's work, Ethical Implications of Artificial Intelligence in Business: A Comprehensive Review *in* 2024, contributes significantly to understanding the ethical challenges that arise with the adoption of Artificial Intelligence (AI) in business.

Current and Future Impact: AI has optimized processes, improved decisions, and created competitive advantages. To fully take advantage of their opportunities, companies must adapt and implement effective governance. The future of AI promises more innovations and challenges, requiring agility and adaptability in the ever-evolving corporate environment (Lee, 2018, 2021; Deep; Adkins, 2024).

The implementation of Artificial Intelligence (AI) in business has promoted significant and impactful changes. Among its main applications are process automation, which improves efficiency by reducing repetitive tasks; predictive analytics, which facilitates trend forecasting and inventory optimization; and the personalization of products and services, which enhances the customer experience. Additionally, AI plays a crucial role in financial risk management and optimizing operations, such as logistics and supply chain (Lee, 2018, 2021; Deep & Adkins, 2024).

AI-influenced automated decisions have the potential to profoundly impact business management and operations. It is critical to maintain human control over critical decisions to avoid negative impacts and ensure that AI is used responsibly (Stahl & Eke, 2024).

The benefits of AI are evident, it increases operational efficiency, enables accurate data-driven decisions, improves the customer experience, and reduces costs through automation and optimization. However, the adoption of AI also presents significant challenges. Effective governance is needed to ensure compliance and security, and there may be resistance to change from automation-conscious employees. In addition, technical difficulties and high initial cost represent obstacles that must be overcome (Lee, 2018, 2021; Sanghvi & Bashir, 2023; Deep & Adkins, 2024 & Stahl & Eke, 2024).

FINAL CONSIDERATIONS

The analysis of the trajectory of Artificial Intelligence (AI) in business reveals a dynamic and transformative panorama, which underlines the importance of this technology in corporate evolution. The review highlighted how AI applications have been progressively adapted to meet growing business demands, evidencing a profound impact on the corporate environment.

First, the adaptation and evolution of AI technologies over time were examined, highlighting their various applications, from process automation and data analysis to personalization and optimization of operations. These advancements demonstrate how critical AI has been in meeting the changing needs and challenges of organizations.

In the background, the analysis of the benefits and challenges of AI implementation revealed a balanced picture. While AI offers significant advantages, such as increased efficiency, better decision-making, and improved personalization, it also presents obstacles, including governance issues, resistance to change, and technical complexities. These challenges need to be carefully managed so that companies can maximize the benefits of technology.

In conclusion, the use of AI is transforming businesses in profound and varied ways. From automation and data analytics to customer service and marketing, AI offers innovative solutions that have the potential to drive business success. However, to make the most of these opportunities, it is essential for businesses to take a strategic approach, address the associated challenges, and integrate AI effectively into their operations.

Thus, AI not only promotes transformation in the corporate environment, but also offers a solid foundation for future growth and innovation.

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ADVANCES IN THE SURGICAL MANAGEMENT OF GASTRIC CANCER: MINIMALLY INVASIVE TECHNIQUES VERSUS CONVENTIONAL APPROACHES

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ABSTRACT

Gastric cancer represents one of the main causes of mortality from neoplasms in the world, especially in developing countries. This study aims to compare clinical, oncological, and quality of life outcomes between minimally invasive surgical techniques, such as laparoscopic and robotic gastrectomy, and the conventional open approach in gastric cancer management. A narrative review of the literature was carried out, using databases such as PubMed, Embase, Cochrane Library and SciELO. Studies published in the last ten years that comparatively addressed the different surgical techniques in patients with early and advanced gastric cancer were selected. Inclusion criteria were randomized clinical trials, systematic reviews, and meta-analyses focusing on perioperative, oncological, and quality of life outcomes. Descriptive studies or studies with a small number of cases were excluded. The data were analyzed descriptively, synthesizing information on intraoperative blood loss, length of hospital stay, postoperative complications, recurrence rates, and overall survival. The results showed that minimally invasive techniques have significant benefits in short-term outcomes, such as less surgical trauma, reduced blood loss, and faster recovery. Robotic gastrectomy demonstrated advantages in surgical precision and greater lymph node dissection, while laparoscopic gastrectomy stood out for its economic viability. Long-term oncological outcomes were equivalent between techniques, reinforcing the safety of minimally invasive approaches. However, barriers such as high costs and the long learning curve limit its large-scale implementation. It is concluded that minimally invasive techniques are safe and effective in the management of gastric cancer, and greater training and technological accessibility are needed to expand their application, especially in developing countries.

Keywords: Gastric Cancer. Minimally Invasive Techniques. Surgical Management.

INTRODUCTION

Gastric cancer is one of the main causes of mortality from malignant neoplasms in Brazil and worldwide, and is considered a global public health problem. Although its incidence shows a downward trend in developed countries, such as the United States and Japan, in Brazil, the scenario is still heterogeneous, with mortality rates stationary in some regions, such as the North, and increasing in the Northeast (HORA *et al.*, 2022). Factors such as inadequate diet, with high consumption of processed foods rich in nitrates, infection by Helicobacter pylori and smoking are among the main causes associated with its etiology (GONÇALVES *et al.*, 2018; HORA *et al.*, 2022). In addition, limited access to health services and early diagnosis strategies aggravates the impact of this neoplasm, particularly in regions of greater socioeconomic vulnerability (HORA *et al.*, 2022).

Surgery plays a central role in the curative treatment of gastric cancer, with total or subtotal gastrectomy being the standard in operable cases (ROLDÃO *et al.*, 2024). Lymphadenectomy is an essential component of this procedure, and the D2 technique is widely recommended due to its efficacy in locoregional control of the disease and positive impact on long-term survival. Studies indicate that adequate removal of regional lymph nodes not only improves oncological staging, but also significantly reduces the risk of local recurrence (ROLDÃO *et al.*, 2024; SVERSUTI FILHO *et al.*, 2024). However, more extensive lymphadenectomy, such as D3, although potentially beneficial in specialized centers, is associated with higher rates of perioperative complications, limiting its indication (ROLDÃO *et al.*, 2024).

In recent years, minimally invasive techniques, such as laparoscopy, have been explored as alternatives to improve postoperative recovery and reduce complications, without compromising oncological outcomes (MELO *et al.*, 2024; ROLDÃO *et al.*, 2024). Despite the advances, the choice of surgical method should be individualized, considering the tumor staging, the clinical conditions of the patient and the experience of the medical team (ROLDÃO *et al.*, 2024).

In recent years, advances in minimally invasive techniques, such as laparoscopy and robotic surgery, have transformed the management of gastric cancer, offering significant benefits compared to conventional approaches. These techniques are associated with smaller incisions, less surgical trauma, faster recovery, and reduction in postoperative complications, such as infections and hemorrhages (COUTINHO *et al.*, 2023; BARCHI *et al.*, 2021). Robotic surgery, in particular, stands out for its precision, allowing a three-dimensional view of the operative field and greater ergonomics for the surgeon, which facilitates the dissection of complex anatomical structures (COUTINHO *et al.*, 2023).

However, these techniques face limitations, such as the need for an extensive learning curve and the dependence on advanced technological infrastructure, restricting their implementation in centers with a lower surgical volume (BARCHI *et al.*, 2021; MELO *et al.*, 2024). Recent studies have shown that minimally invasive techniques have achieved oncological results comparable to those of open surgeries, consolidating themselves as an effective and safe alternative, especially for cases of early gastric cancer (COUTINHO *et al.*, 2023).

Despite the advantages of minimally invasive techniques, their widespread adoption faces significant challenges. The implementation of these approaches requires specialized training and high surgical volume to overcome the learning curve and ensure the performance of procedures with adequate technical quality (BARCHI *et al.,* 2021). In addition, the high cost of equipment and the need for advanced technological infrastructure are relevant barriers, particularly in health systems in developing countries, such as Brazil (COUTINHO *et al.*, 2023). Another critical point is the limitation in the indication of these techniques for more advanced cases of gastric cancer, in which the need for extensive lymphadenectomy and complex resections can compromise oncological results when performed by a minimally invasive route (MELO *et al.*, 2024). Prospective and controlled studies remain essential to evaluate the safety, efficacy, and cost-effectiveness of these techniques in different stages of the disease and clinical settings (BARCHI *et al.*, 2021; COUTINHO *et al.*, 2023).

This study aims to analyze and compare minimally invasive and conventional approaches in the surgical management of gastric cancer, discussing the advances, limitations, and impact of these techniques on oncological outcomes and patients' quality of life.

METHODOLOGY

This study constitutes a narrative review of the literature, conducted in December 2024, with the objective of analyzing and comparing minimally invasive and conventional approaches in the surgical management of gastric cancer. The research was guided by the following research question: "What are the oncological, perioperative, and quality-of-life outcomes of minimally invasive techniques compared to conventional surgical approaches in the treatment of gastric cancer?".

The selection of references was carried out in the PubMed and Virtual Health Library (VHL) databases, using controlled descriptors extracted from the DeCS and MeSH vocabularies, such as "gastric cancer", "gastrectomy", "minimally invasive surgery" and

"laparoscopic surgery", combined with Boolean operators (AND and OR). Filters were applied to include only studies published in the last five years, available in full text and in Portuguese, English or Spanish. The inclusion criteria involved comparative studies between surgical techniques, addressing oncological outcomes, perioperative complications, and quality of life. Simple abstracts, expanded abstracts, opinion articles, descriptive studies, and studies that did not directly address the scope of the present study were excluded.

The study selection process was carried out in stages. Initially, titles and abstracts were evaluated to identify eligible works. Subsequently, the full texts of the potentially relevant articles were reviewed to confirm their adequacy to the inclusion criteria. Data analysis was conducted descriptively, synthesizing the most relevant contributions of each study, focusing on the advances and limitations of minimally invasive techniques compared to conventional open surgery.

RESULTS AND DISCUSSION

A total of 115 articles were found and 11 studies were selected for full reading and inclusion in the results of this study.

Minimally invasive techniques, including laparoscopic gastrectomy (GL) and robotic gastrectomy (RG), have been consolidated as promising alternatives to conventional open surgery (GA) in the treatment of gastric cancer. These approaches are based on principles of reducing surgical trauma, preserving functional anatomy, and optimizing the postoperative period, with the expectation of offering outcomes similar to or superior to those of conventional techniques. Laparoscopy, widely adopted in cases of early gastric cancer, is characterized by minimally invasive access with advanced instrumentation and less tissue trauma, while robotics uses platforms such as the Da Vinci System, which increase surgical precision and minimize ergonomic limitations inherent to traditional laparoscopy (RIBEIRO JR. *et al.*, 2022; GUERRINI *et al.*, 2020).

On the other hand, open surgery continues to be widely used in more advanced cases or in situations of greater technical complexity, due to its versatility and the familiarity of surgeons with the approach. However, the literature has pointed to increasing advantages of minimally invasive techniques, including less intraoperative blood loss, reduced hospital stays, and better postoperative functional recovery, factors that have expanded their adoption even in scenarios of greater oncological complexity (BITTAR *et al.*, 2024; ELE *et al.*, 2024). Still, issues such as the long learning curve and the high cost of

robotic technology remain barriers to the universal implementation of these techniques (OJIMA *et al.*, 2021).

Although initially limited to early gastric cancer scenarios, minimally invasive techniques have been shown to be effective in more advanced cases, especially when performed by experienced teams in high-complexity centers. WPA, for example, has demonstrated oncological outcomes equivalent to GA in the long term, with similar rates of R0 resection and overall survival, as evidenced in studies such as the one by Etoh *et al.* (2023). In a complementary way, GR has overcome the technical limitations of conventional laparoscopy, presenting greater efficiency in lymph node dissection and a lower rate of serious postoperative complications (GUERRINI *et al.*, 2020; RIBEIRO JR. *et al.*, 2022).

Ribeiro Jr. *et al.* (2022) observed that RG reduced intraoperative blood loss by more than 50% compared to GA, with no significant difference in the mean number of lymph nodes collected or in the frequency of postoperative complications. However, GR was associated with a longer operative time ($p < 0.001$), highlighting its safety and feasibility in Western institutions with adequate infrastructure. Guerrini *et al.* (2020) reinforced these advantages by demonstrating that GR has lower rates of serious complications (OR 0.66; $p = 0.005$) and a higher number of dissected lymph nodes (MD 1.84; $p = 0.0003$), compared to WPA. However, the learning curve of GR and high costs limit its large-scale adoption, especially in developing countries.

The meta-analysis conducted by Bittar *et al.* (2024) highlighted the benefits of WPA over GA, such as less intraoperative blood loss (MD −51.24 mL; 95% CI −81.41 to −21.06) and shorter length of hospital stay (MD −0.83 days; 95% CI −1.60 to −0.06). Despite this, WPA was associated with an increased risk of pancreatic fistula (RR 2.44; 95% CI 1.08 to 5.50), requiring greater caution in advanced tumors. In super-elderly patients (>80 years old), Ele *et al.* (2024) demonstrated that WPD offers better short-term outcomes, including less blood loss (SMD = −166.96 mL; $p < 0.001$), shorter hospital stay (SMD = −0.78 days; $p < 0.001$), and a higher 5-year overall survival rate (OR = 1.66; $p = 0.03$), highlighting that age should not be a contraindication for minimally invasive techniques.

With regard to quality of life, Farias (2023) evaluated patients undergoing WPA and AG using the QLQ-C30 and QLQ-STO22 questionnaires, observing significantly better scores in the pain and physical function domains for patients treated with WPA. In addition, Park *et al.* (2023) investigated patients undergoing laparoscopic proximal gastrectomy with dual-tract reconstruction (LPG-DTR) and laparoscopic total gastrectomy (LTG), concluding that LPG-DTR reduced the need for vitamin B12 supplementation (2.1 mg vs 0.4 mg; $p <$

0.001) and had better physical and social function, suggesting its superiority in patients with early gastric cancer in the upper third.

Long-term oncological results show equivalence between minimally invasive techniques and GA. Etoh *et al.* (2023) reported similar rates of 5-year relapse-free survival for SGA with D2 dissection and GA (75.7% vs 73.9%; HR 0.96; p = 0.03), consolidating WPA as a viable alternative for advanced cases. In a broader context, Araújo *et al.* (2022) reinforced the oncological safety of WPA, observing R0 margins comparable to those of GA in tumors larger than 5 cm (p = 0.76) and similar recurrence rates (p = 0.09).

While promising, minimally invasive techniques face significant barriers to their widespread adoption. Ojima *et al.* (2021) highlighted that, despite the advantages of GR in reducing serious infectious complications (5.3% vs 16.2%; p = 0.01), the high cost and dependence on advanced infrastructure restrict its implementation. Similarly, Liu *et al.* (2020) pointed out that despite the safety of laparoscopic total gastrectomy for early gastric cancer, its extensive learning curve requires highly skilled surgeons and ongoing training.

Outcomes related to postoperative recovery show clear advantages of minimally invasive techniques over open surgery. Studies such as the one by Liu *et al.* (2020) indicate that laparoscopic total gastrectomy for early gastric cancer reduces the time required for resumption of daily activities, including the time for ambulation (MD −0.27 days; 95% CI −0.47 to −0.07) and the start of fluid intake (p < 0.05). These findings are particularly relevant for elderly patients or those with comorbidities, in whom a faster recovery can positively impact quality of life and minimize late complications.

In addition, laparoscopic gastrectomy with double tract reconstruction (LPG-DTR) has been shown to be a functionally preserving alternative in patients with early gastric cancer in the upper third, with a positive impact on hematological parameters. Park *et al.* (2023) reported a smaller drop in hemoglobin levels and significant reduction in the need for vitamin B12 supplementation compared to laparoscopic total gastrectomy. This suggests that surgical strategies that prioritize functional preservation may be preferable in patients with favorable prognosis, improving not only survival but also long-term nutritional and metabolic aspects.

Technological advances, such as the use of 3D laparoscopy, have contributed to the optimization of results in minimally invasive surgeries. Rodrigues *et al.* (2023) demonstrated that 3D laparoscopy reduces operative time (WMD −28.57 minutes; p = 0.011) and intraoperative blood loss (WMD −6.69 mL; p < 0.001) compared to conventional 2D laparoscopy. Although these benefits seem modest in absolute terms, in highly complex

settings, these differences can translate into fewer intraoperative complications and greater procedural efficiency.

On the other hand, differences in oncological outcomes between techniques remain an area of debate. The study by Etoh *et al.* (2023) pointed out that 5-year recurrence-free survival was equivalent between laparoscopic and open gastrectomy, regardless of tumor stage (HR 0.96; p = 0.03). However, the greater lymph node dissection observed in RG (MD 1.84; p = 0.0003) in studies such as the one by Guerrini *et al.* (2020) raises questions about the potential impact on locoregional recurrence and long-term cancer control, especially in high-risk populations.

The surgeon's experience and the volume of the center are critical factors that directly influence the outcomes of minimally invasive techniques. The CLASS02 study (2020) highlighted that morbidity and mortality rates are similar between laparoscopic and open gastrectomy only when performed by highly qualified teams. In lower-volume centers, lack of training and an extensive learning curve can increase perioperative complication rates and compromise the expected benefits of minimally invasive approaches.

Finally, the socioeconomic impact of robotic and laparoscopic techniques deserves to be highlighted. Although RM has clinical benefits, such as a lower rate of serious complications and greater surgical precision, its high cost and dependence on state-of-the-art technology limit its widespread implementation. Ribeiro Jr. *et al.* (2022) pointed out that, in developing countries, the availability of robotic platforms is restricted, and GA remains the predominant approach, even in cases where minimally invasive techniques could offer advantages. Investments in technical training and the dissemination of accessible technologies are essential to expand access to these innovations.

FINAL CONSIDERATIONS

Advances in minimally invasive techniques, such as laparoscopic and robotic gastrectomy, have provided significant improvements in gastric cancer management, excelling in short-term outcomes such as reduced surgical trauma, less blood loss, and accelerated recovery. In addition, these techniques have demonstrated oncological results equivalent to open surgery, especially in cases of early cancer, and remarkable benefits in terms of quality of life, particularly in elderly patients or those with favorable prognosis.

However, important barriers still limit the widespread adoption of these approaches, including the long learning curve, the need for advanced infrastructure, and high operating costs, especially in developing countries. The individualization of the choice of surgical

technique is fundamental, considering factors such as tumor stage, clinical conditions of the patient, availability of technological resources and the experience of the surgical team.

In the global context, efforts to disseminate accessible technologies, offer specialized training, and conduct additional studies with higher-risk populations are crucial to consolidate minimally invasive techniques as the standard of care in various clinical settings. With the continuous advances in technology and the expansion of its accessibility, it is expected that these minimally invasive approaches will play a central role in the surgical management of gastric cancer, promoting better outcomes and quality of life for patients.

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RIGHT TO HEALTH: A STUDY OF THE CHALLENGES FACED IN HEMATOPOIETIC STEM CELL TRANSPLANTATION

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ABSTRACT

This article has as its object the challenges faced by SUS users in accessing Hematopoietic Stem Cell Transplantation HSCT in the interface with the social issue. The theoretical concepts researched were: Social Issue, Health Policy and Access. Dialectical historical materialism was adopted as a method, and as for the methodological path, it is a qualitative research, using some quantitative data; covering bibliographic research – about the conceptual categories; Documentary research (in Laws, decrees, among others); and the Field Research, with SUS users who underwent HSCT as participants. The inferences of this study indicate the challenges experienced by the participants in the search for the right to access health in an integral way in its interface with the social issue. In this sense, the construction of public health policies must be based on the reality and needs of the subjects who use it, built from processes of struggles and mobilizations that reiterate the forms of collective confrontation expressed in the social issue, having as a guiding thread the realization of the rights to health.

Keywords: Access. Health. TCTH. Social Question.

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INTRODUCTION

This article is the result of concerns that were established in the daily experience as a resident, Social Worker, in the Multiprofessional Residency Program in health, Hematology and Hemotherapy axis of concentration, at Hospital das Clínicas HC-UFG/EBSERH[3] in the years 2017 to 2019.

In this scenario, users of the HC-UFG/EBSERH are referred to the Institute of Cardiology of the Federal District (ICDF), located in Brasília-DF, to perform the Transplant procedure[4] - Hematopoietic trunk cells (TCTH)[5]. Considering the daily experience of care at the hematology outpatient clinic, several social consultations were carried out with users and their families before referral for HSCT, thus, it was possible to mature some reflections about the object.

It is noteworthy that through social struggles in the 1990s that the population conquered the right to public health for all. In the past, health services in Brazil were based on the campaign and social security models. This time, the current health model was enacted in the Federal Constitution of 1988 and is configured as an important achievement of the population through the Unified Health System (SUS).

Transplantation is a highly complex procedure made available by the Unified Health System (SUS). Aiming to give materiality to its various principles such as integrality, equity, popular participation and universality. The SUS offers the population numerous health services and procedures at all levels of care.

Regarding its composition, the Unified Health System was organized according to levels of complexity, namely: low, medium and high complexity. With regard to low complexity, also called Primary Health Care (PHC), the following stand out: basic health units (UBS) or health centers and posts – characterized by simple services made available to the population (SORRENTINO, 1997). These constitute gateways to the SUS, being responsible for referrals when necessary to the other levels of health care.

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[3]The Hospital das Clínicas of the Federal University of Goiás (UFG), founded on February 23, 1962, is a University Hospital, a federal public institution that provides free care through the Unified Health System (SUS). Linked to UFG, in 2014 it started to be managed by the Brazilian Company of Hospital Services (EBSERH), which manages federal university hospitals throughout Brazil (information from the HC-UFG/EBSERH website, online, 2018).

[4]ICDF located in Brasília, until the first half of 2018, received these patients referred for transplantation as an "open door" without the need for regulation, being required as a conditionality, only that they went with the TFD open. The medical team referred the patient to the ICDF with the indication of HSCT and, after initial evaluation, the ICDF admitted and transplanted the patient. However, as of the second half of 2018, the ICDF team issued a statement that it would no longer receive patients with open doors, requiring the request for regulation, placed as a new requirement of the Health Department of the Federal District. The referral flow has not yet been reestablished, nor defined until the beginning of 2019.

[5] There are other transplant centers located in other states in Brazil that perform this type of transplantation, however, in this study, we chose to analyze only patients referred to the ICDF Brasília.

It is noteworthy that the medium complexity, or secondary level, is made up of specialized services that require more specific treatment resources. The high complexity or tertiary level, on the other hand, is characterized by a network that is more specialized in its complexity in serving the population. A hospital can aggregate the secondary and tertiary levels, as well as research and specific treatments, so-called quartenary level – inserted in high complexity (GONÇALVES, 2006).

These last two levels of complexity are inserted in the HC-UFG/EBSERH of Goiânia-GO, a public university hospital, serving 100% SUS. Regarding the particularity of this study, this hospital is a state reference in treatment in the specialty of Hematology (a specialty that deals with diseases related to blood cells), but the unit does not have a transplant service, which requires referral, when necessary, to other units.

The transplantation of organs and tissues is a right to health regulated in the SUS through Law No. 9,434, of February 4, 1997, which "Provides for the removal of organs, tissues and parts of the human body for the purposes of transplantation and treatment and provides for other provisions" (BRASIL, 1997).

With regard to human tissue transplantation, as is the case with HSCT, they are classified as autologous (when the progenitor cells come from the patient himself); allogeneic (when the progenitor cells come from a compatible donor. The latter, for the most part, are family members or donors registered in the bone marrow banks REDOME – National Registry of Bone Marrow Donors), and finally there is syngeneic transplantation (a characteristic of transplantation in which the donated cells come from an identical twin brother) (PASQUINI AND COUTINHO, 2013, p.711).

According to the official website of the Institute of Cardiology of the Federal District (ICDF), the implementation of this procedure in the institution is very recent, it began in 2013 as accreditation for autologous HSCT and later in 2014 the allogeneic HSCT was implemented. Since the implementation of this procedure at the ICDF, the Hospital das Clínicas de Goiânia HC-UFG/EBSERH has referred SUS users for transplantation at this institution.

It is worth mentioning that HSCT is considered a complex procedure,

> [...] aims to graft the Hematopoietic Stem Cell (HSC) with the aim of correcting a quantitative or qualitative bone marrow defect. In the last 30 years, HSCT has been used in the treatment of malignant and non-malignant hematological diseases, immunodeficiencies, inborn errors of metabolism, solid tumors, as well as autoimmune diseases [...] HSC may originate from bone marrow, peripheral blood or umbilical cord blood (PASQUINI AND COUTINHO, 2013, p.711).

However, not all patients undergo HSCT. The indication is only made when other therapies do not present satisfactory responses, so bone marrow transplantation is usually the last alternative for successful treatment. The need for its performance according to (PASQUINI AND COUTINHO, 2013) "is based on the superiority of this therapy over the others available, taking into account the age of the patient and the donor, basic disease, clinical stage, previous complications and those present in the pre-transplant phase".

Goiânia has a transplant unit that serves the SUS, located at the Araújo Jorge Hospital (HAJ). There is a service in the unit for HSCT and a team serving in this specialty, the physical space has four individual wards, in this sense the HAJ prioritizes HSCT beds for patients who have already been monitored and treated at the HAJ. The unit receives patients referred by the network via regulation, but considering the low turnover of beds – due to the characteristics of the transplant that require longer hospitalization time – the wait in line for patients from other hospitals can take a considerable time; characteristics that lead the HC medical team to resort to other services that also perform HSCT, in the specific case to be analyzed, the ICDF.

When HC users are referred to Brasília, they undergo several consultations with the ICDF multiprofessional team, with a view to evaluating the conditions for transplantation. It is noted that there are patients who do not have stable levels in the exams and in the general evaluation, being considered unfit for transplantation, temporarily or permanently.

Contemporaneous with this process, there is a significant number of users who, even presenting clinical conditions for transplantation, fail to undergo the transplant for reasons external to the disease, which are related to the expressions of the social issue, such as: lack of a companion (family member, wife, friend, neighbor), etc.) who can go with the user; impediment to leave work; unfavorable socioeconomic conditions; among others.

In the guarantee of health rights, the Ministry of Health issued Ordinance 55/1999, constituting the so-called Out-of-Home Treatment.

The antinomies of this process denote that, if, on the one hand, the GT is expressed as a way of guaranteeing access to health in the SUS, providing financial assistance to the patient and his companion (when applicable), to cover expenses with food, accommodation and tickets when undergoing treatment outside their municipality of origin; on the other hand, the reality as a Social Worker/Resident, it is denoted that this is not enough to keep the patient in HSCT.

In this sense, the daily afflictions raised some concerns, here called problematization, namely: Are the actions offered by the public health policy, GT, enough to meet the needs of a patient who is going to undergo hematopoietic stem cell transplantation

(HSCT) in Brasília together with his companion? What are the expressions of the social issue present in the daily lives of these users and how are they presented in terms of access to treatment in a comprehensive way? What are the barriers to access and permanence faced by these patients and their companions to undergo HSCT?

These initial questions allowed us to outline the problem of this research, which is: What are the challenges faced by SUS users in accessing HSCT at the interface of the Social Question?

To this end, we will present below the methodological path taken and the discussion of the fundamental categories to support the analysis of the testimonies of the research participants who narrate their singular trajectories to perform HSCT at the ICDF.

METHODOLOGICAL PROCEDURES

In this study it is understood that the methodology expresses the systematization of the processes developed in the study that is proposed, describing both the method and the instruments used to carry it out. Thus, the research method that supported this work is dialectical historical materialism, emphasizing that "it does not result from sudden operations, genius intuitions or enlightened and momentary inspirations. Rather, it is the product of a long theoretical-scientific elaboration, matured in the course of successive approximations to its object" (NETTO, 2009, p.11).

In this way, this same author points out that the method is not a set of formal rules that "apply" to an object that has been cut out for a given investigation, nor, even less, a set of rules that the subject who researches chooses, according to his will, to "frame" his object of investigation (NETTO, 2009, p.25). The choices and rules for conducting a research are built according to the reality that one wishes to investigate, without a ready-made and finished method, in a rigid way, it is possible to build methodological paths according to each occasion. Also according to this author,

> The research method that provides theoretical knowledge, starting from appearance, aims to reach the essence of the object. Reaching the essence of the object, that is: capturing its structure and dynamics, by means of analytical procedures and operating its synthesis, the researcher reproduces it on the plane of thought; Through research, made possible by the method, the researcher reproduces, in the ideal plan, the essence of the object he investigated (p.8).

By taking into account the guiding question presented at the end of the Introduction of this work, it delimited as the object of the research, the challenges faced by SUS users in accessing HSCT in the interface with the social issue.

This initial process allowed the elaboration of the common thread, that is: the challenges faced by SUS users indicated to HSCT go beyond transplantation, which hinders and weakens the right to access expressed in laws, decrees, ordinances and regulations.

The general objective, then proposed, was to identify and analyze the challenges faced by SUS users in accessing Hematopoietic Stem Cell Transplantation (HSCT) when referred to the Institute of Cardiology of the Federal District (ICDF), in view of the interfaces of the social issue.

The specific objectives were: To know the main barriers related to the expressions of the social issue in access to HSCT; To identify how patients who go to the ICDF for HSCT access and permanence take place; To analyze the processuality in the access to health of patients of Hematopoietic Stem Cell Transplantation (HSCT) as a health right**.**

In order to approach the object as a qualitative research; the latter understands movement as a constituent part of the reality that surrounds it, full of contradictions; encompassing the construction of three inseparable researches, namely: bibliographic research, documentary research and field research.

Regarding the bibliographic research, it was constituted from the conceptual categories, which are: Social Issue, Health Policy and Access. This theoretical framework guided the survey of the academic-scientific production of Theses, Dissertations, articles, as well as other bibliographic sources and existing websites on the subject.

To carry out the documentary research, primary and secondary sources were used, through Laws, Decrees, official documents, statistical sources, among others.

Regarding the field research, it considered the path to reach the essence of the object, delimiting as the *locus* of the field research the Hematology Outpatient Clinic of the Hospital das Clínicas de Goiânia HC-UFG/EBSERH, identifying as participants the patients of this Outpatient Clinic who underwent Hematopoietic Stem Cell Transplantation.

Data were collected between November and December 2018, using semi-structured interviews with a guiding script and the participant's consent signed in the informed consent. The interview was recorded by audio device and later transcribed for analysis.

In the universe of about 25 patients[6] referred for transplantation in the years 2017-2018, a sample of four (04) patients, randomly chosen, in post HSCT, in which

[6]An estimated value of 25 patients with indication for HSCT during the period delimited as a criterion of the research is mentioned. The value is not exact because there is no systematization of records, tables or annual/semiannual surveys of the HC Hematology Service that account for the total universe of users referred for transplantation in this period, except for the records made in individual physical records. This estimate was made based on the considerations of a professional who works at this outpatient clinic.

transplantation was used as therapy to treat oncohematological diseases (Leukemias, lymphomas, Multiple Myeloma, bone marrow aplasia), of this universe, 02 female subjects and 02 male subjects were interviewed.

The inclusion criteria were for patients over 18 years of age, attended by the Hematology outpatient clinic of the HC with hematological oncological diseases and have already successfully passed the HSCT stage, at the ICDF, in a period of time between three (03) months and one year (01) after transplantation, between (2017-2018).

The exclusion criteria were: not being hematological cancer patients, being minors, having had a transplant more than one year and less than 02 months, having undergone the transplant in a unit other than the ICDF.

In this article presented here, it strictly followed all the ethical steps of the research based on Resolutions 466/12 and 510/16, being submitted and approved by the Ethics Committee of this Hospital in September 2018 under opinion No. 2,873,076, using its own resources to carry it out.

DISCUSSION

SOCIAL ISSUE AND HEALTH POLICY

In this item, we sought to bring the results of the research, together with its analysis, from the a priori conceptual categories, such as: social issue and poverty, health policy and access to health.

This organicity was defined considering the relationship that the social issue establishes with public policies, in which social policy is established as a set of actions that arises through the intervention of the State in capitalist society, as a way of confronting the class struggle, as a confrontation of the social issue, among these policies, the health policy stands out, focus of our discussion.

The starting point that we originated to understand social reality is established in the capitalist society that produces inequalities, which are related to the exploitation of workers, and the responses engendered by social classes and their segments; in its concrete relationship expressed by the process of accumulation of capital, produced and reproduced with the operation of the law of value, whose counterpart is the subsumption of labor by capital (BEHRING; BOSCHETTI, 2006).

In this sense, the class that does not own the means of production, in order to maintain its basic needs, sells its labor power to the capitalists, so that "the worker is deprived of the product of his surplus labor (surplus value); this characterizes a relationship

of exploitation: the private appropriation by capital of the surplus value produced by the worker" (MONTAÑO, 2011, p.79).

The exploitation of the worker by the capitalist system does not guarantee an equivalent distribution of income over those products or commodities produced by it. In this sense, it is possible to apprehend that the relationship between capital and labor established in capitalist society is the founding arena of the disparities between the social classes that live from work and those that own the means of production. This relationship establishes a perverse configuration between profit, wealth and power, as opposed to poverty, misery and subordination.

It is in the establishment of these causal links that the social question is established, expressing,

> the set of expressions of the inequalities of mature capitalist society, which has a common root: social production is increasingly collective, work becomes more broadly social, while the appropriation of its fruits remains private, monopolized by a part of society" (IAMAMOTO, 2015, p. 27).

Thus, for this same author, the analysis of the Social Question is inseparable from the configurations assumed by work and is necessarily situated in an arena of disputes between societal projects, informed by different class interests, about conceptions and proposals for the conduct of economic and social policies (IAMAMOTO, 2004, p.10).

To this end, it is important to reiterate that the contradictions arising from the relationship between Labor and Capital that the social issue is established in the daily life of these subjects who live from work where inequalities will be more latent; established in the face of the components of resistance and rupture, therefore, impregnated by the class struggle.

Even disjointed or punctual, these ways of confronting the social issue are fought by the working class "being inequality, it is also rebellion, as it involves subjects who experience inequalities and resist and oppose them" (IAMAMOTO, 2015, p.28). This condition of conflict does not exclude subjects from conditions of poverty and vulnerability[7] – one of the main expressions manifested in the daily lives of subjects who live from work.

Poverty here is defined as "the face of the discarding of cheap labor, which is part of capitalist expansion." An expansion in which work, the source of social wealth, undergoes devastating effects of the changes that have been occurring in the accumulation process,

[7] Vulnerability here understood as "the production of inequality is inherent to the capitalist system, by (re)producing it, it produces and reproduces vulnerabilities and social risks" (Silva; Yazbek and Giovanni, 2011, p. 50).

with the productive restructuring and the "financialization" of capital (YAZBEK, 2012, p. 293).

The consequences arising from capitalist reproduction do not leave many possibilities for those who make up a reserve army, other than "a universe marked by subordination, silent revolt, humiliation and fatigue, [...] by alienation and resistance and, above all, by strategies to better survive, despite everything" (YAZBEK, 2012, p.292).

Considering poverty and vulnerability as some expressions of the Social Question in the daily lives of the subjects, it is possible to verify that only in these conditions do the "sequelae of the social question [...] can become the object of continuous and systematic intervention by the State" (NETTO, 2011, p.29).

By bringing this fragment, the author refers to the intervention of the State in social ills through public policies, in which it executes such concessions "by seeking political legitimacy through the democratic game, it is permeable to the demands of the subaltern classes, which can make their interests and their immediate demands influence it" (NETTO, 2011).

Also according to this author, it is important to understand in this process the consensual role imprinted through social policy, in which "the bourgeois state in monopoly capitalism seeks to manage the expressions of the social question in order to meet the demands of the monopolistic order, conforming, through the adhesion it receives from categories and sectors whose demands it incorporates, variable consensus systems, but operative" (NETTO, 2011, p.30).

In this sense, social policies are constituted as developments to responses and forms of confrontation, even if in a sectorized and fragmented way, to the multifaceted expressions of the social question in capitalism.

Among these policies signaled in the relationship that is established in society between the forms of confrontation of the working class and the responses given within the State, the following stand out: making it necessary to briefly contextualize how it was instituted as a social right guaranteed in a constitutional text in Brazil.

HEALTH POLICY IN BRAZIL

Health policy in Brazil emerges as strategies of social protection pattern in the face of the unfolding of expressions of the social question at the beginning of the twentieth century, in the midst of the transition between the agro-export economy and the industrial urban economy, reflecting the advance of the division of labor, that is, the emergence of salaried labor (BRAGA; PAULA, 1986, p.41-42).

Assumed in the logic based on the absence of diseases, it has its features in public health with

> The Carlos Chagas reform, of 1923, *[which]* attempts to expand health care by the central power, constituting one of the Union's strategies to expand national power within the ongoing political crisis [...] During this period, the issues of hygiene and health of the worker were also raised, and some measures were taken that constituted the embryo of the Brazilian social security scheme, the most important being the creation of the Retirement and Pension Funds (CAPs) in 1923, known as the Elói Chaves law. The CAPs were financed by the Federal Government, the employing companies and the employees (BRAVO, 2009, p.90).

According to Bravo (2009) this was the first form of social security organization in Brazil and provided some "benefits" such as medical-curative assistance, medications, retirement for length of service, old age and disability, death pension for dependents and funeral assistance. It can be inferred in this process that the State was only responsible for limited campaigns in the face of epidemics. Social security, as in the case of CAPs, was responsible for medical care – intended only for people who contributed.

According to Braga and Paula (1986), the central alternatives sought for Health between the periods of 1930 and 1940 stand out: limited sanitary campaigns, with emphasis on actions for rural endemic areas; and from 1937 onwards, services to combat endemic diseases, such as yellow fever and malaria. Subsequently

> the health situation of the population in the period from 1945 to 1964 (with some variations identified mainly in the years 50, 56 and 63, when public health expenditures were more favorable, with an improvement in sanitary conditions), was not able to eliminate the situation of infectious and parasitic diseases and the high rates of morbidity and infant mortality, as well as general mortality (BRAVO, 2009, p.92).

These characteristics permeate the 1950s, with the creation of the Ministry of Health, and take on a more accentuated configuration with the precariousness and focus of services, in the period from 1974 to 1979. The national health policy faced a constant tension between the population and the services provided under the management of the dictatorial State – unfolding great clashes and struggles for the quality of health.

The consequences of the process corroborated the emergence of the so-called Health Reform Movement (MRS), whose banner of struggle had universal access to health care for the population as its centrality, with quality in the services provided, "managing to advance in the elaboration of proposals to strengthen the public sector in opposition to the model of privileging private producers" (BRAVO, 2009, p.203).

Thus, in the 1980s, health professionals and representatives of civil society, in the search for more effective solutions that would mitigate the problems arising from

conjunctural and structural issues, constituted considerable advances for the health area and, therefore, in the lives of individuals, based on

> Conferences, seminars and mobilizations in São Paulo, dealing with the worsening of the health situation, especially preceding the 7th and 8th Health Conferences, advanced towards the proposal of a Unified Health System with popular participation and social control (FARIA; JATENE, 1995).

These mobilizations strengthened the agendas of the MRS, condensing them into the Health Reform Project, which had significant parts of its struggles expressed in the promulgation of the Federal Constitution, Social Security – guaranteed as a public policy of rights – composed of the policies of Social Assistance, Health and Social Security[8].

Thus, health in Brazil became a right of all and a duty of the State from the Federal Constitution of 1988, specifically in articles 196 to 200. The consequences of this process made it possible to build a hierarchically organized system, called the Unified Health System (SUS), regulated in the decade by the Organic Health Laws (LOS) No. 8,080/90 and No. 8,142 – both from 1990.

It is noted that these laws were fundamental in directing the operationalization of the health system, since they defined the principles and guidelines of the SUS, among them; universality, equity and integrality, participation and social control. It is worth highlighting the SUS guidelines based on Decentralization, with a single direction in each sphere of government; Comprehensive care, with priority for preventive activities, without prejudice to care services; Community participation (BRASIL, 1988).

In this period, the contradiction posed to social policies is also highlighted, resulting in disagreements with the SUS, since, contemporaneous with the achievements, there is a redirection of the role of the State, influenced by the neoliberal adjustment policy (BRAVO, 2009); bringing strong repercussions to the health policy proposal built on the principles of the Health Reform Project. These neoliberal adjustment policies have significantly reduced investments in health, falling back on different actions with a bias towards expanding privatization, stimulating private insurance, and focusing on serving vulnerable populations through the basic health package, focused on health merchandise (COSTA, 1997). This scenario refers to advances and setbacks that fall directly on the most vulnerable working class and that uses public health policy, weakening the rights achieved.

[8] Through Social Security, Health and Social Assistance are instituted as a universal policy, but the latter will primarily serve those who need it (due to the absence of minimum social conditions for survival. Social Security, on the other hand, continues with its social security character, screening its insured by contribution criteria, linked to labor relations.

As already highlighted, the ways of facing inequality have been making advances and challenges faced within the scope of the SUS. The processuality of these rights gains materiality in the guarantee of access to quality treatment, subsidized by strategies – consolidated through policies, norms and other regulations – among them: the institution of the TFD (1999); the National Policy for Humanization in the SUS (2003); the Popular Pharmacy Program (2004); the Pact for Health (2006).

The antinomies denote that in the opposite direction of the conquered rights, neoliberal attacks on social policies unfold, with its most perverse onslaught the proposed Amendment to the Constitution No. 55, of 2016 – PEC of the ceiling on public spending, authored by the Federal Chamber of Deputies, voted and approved, becoming the fearful Constitutional Amendment No. 95, of December 15, 2016 – which we infer as one of the measures that most express the counter-reform of social policies in the perspective of the consolidation of the privatist project.

These measures consolidate the freeze on public spending by the Federal Government for 20 years, starting in 2018[9]. During this period, the resources allocated to public policies, such as health and education, tend to be the most harmed, causing incisive scrapping and dismantling of social achievements. According to Bravo *et. al.*

> With the advent of the Temer government, the acceleration and intensification of policies that contribute to the dismantling of the Brazilian State is flagrant, configuring a new phase of structural counter-reforms that attack workers' rights (BRAVO; PELAEZ; PINHEIRO, 2018, p.10).

These same authors reiterate that this picture of setbacks to Brazilian health policy is not recent in Brazil, is part of world politics and takes on different features in view of the Brazilian socio-historical particularities. Such configurations, in the current conjuncture, are thickened in the face of the conservative project assumed by the illegitimate government[10] , gaining materiality with a series of measures that go against the social rights to health, whose assumed exposure is demarcated by the privatist project, in which it has a focused character to serve vulnerable populations through the basic package for health, expansion of privatization, encouragement of private insurance, decentralization of services at the local level, elimination of the linkage of sources in relation to financing (2009, p.101).

[9] For more information on these consequences see Bravo (2018).
[10] Temer assumed the presidency of the country after an impeachment suffered by the Dilma government, contrary to the principles of democracy that elected her. Undeniably, he represents the most reactionary, backward and conservative sectors of Brazilian society, allied with the bourgeoisie "[...] ultra-neoliberal, clearly pro-capital, which aims to solve the impasses of accumulation and favor the interests of the ruling class in the country and deepen its dependence on international capital" (BRAVO; PELAEZ; PINHEIRO, 2018, p. 12).

It is reiterated that such mismatches weaken and fragment the rights to health, including the population's access to the SUS.

RIGHT TO ACCESS TO HEALTH

Bringing the debate to the category of access within the scope of the SUS presupposes outlining the ways in which health is configured in people's daily lives. According to (FRANÇOIS, 2008) access to health is a right recognized by international organizations and by most countries. In Brazil, as already pointed out, the Federal Constitution of 1988 recognizes health as a fundamental right of the human being.

This same author also emphasizes that access to health, in addition to the proportionality between services and users, implies a dynamic relationship between the needs, aspirations and culture of the population, the demand for service and the resources available to satisfy it. Thus, "the institutional health system – Public and Private – has deficiencies that prevent care for all" (FRANÇOIS, 2008, p.140). Thus, this author explains the recommendation of the World Health Organization (WHO) that the meaning of "accessible" be adapted to each reality and each region,

> [...] this means thinking about the needs of the population not only in relation to existing institutional resources, but also in a localized way, in the communities (FRANÇOIS, 2008, p.140).

In this sense, access to health has several elements, not depending only on existing institutional resources, or on the mere provision of the service. "In Brazil, with its great distances and economic, population and distribution inequalities, the path between disease, care and cure means walking a long and difficult path" (FRANÇOIS, 2008); It is necessary to understand how these economic and social inequalities, in the interface with the social issue, affect access to health.

It is noteworthy that the supply of this service in the SUS is not enough to meet the user's demand for access to health; corroborating the notes of Travasso and Castro (2012, p.186) the "mere availability of resources does not guarantee access", there are beyond these impasses,

> [...] geographical, financial, organizational, informational, cultural barriers, among others, a characteristic expression of the offer that, in an interrelated way, act to facilitate or obstruct people's ability to use the health service (TRAVASSOS; CASTRO, 2012, p.186).

Thus, in order to guarantee access, based on comprehensiveness at all levels of care, the legal support for the TFD was established in the SUS as a possibility of access

within the SUS, which even in the face of all the contradictions, the responsibility of the State in the user's health care is guaranteed.

The TFD was standardized in the 1990s by Ordinance No. 55/1999, regulating norms to endorse that the State must be responsible for referring the user to treatment outside their municipality of origin, and concomitantly, pass on

> [...] an allowance[11] to the patient, and in some cases, also to the companion, referred by medical order to health units referenced in another municipality or state of the Federation, when all means of treatment have been exhausted in the place of residence of the same, provided that there is a possibility of total or partial cure, limited to the period strictly necessary for this treatment and to the existing budgetary resources (MANUAL OF STANDARDIZATION OF THE TFD, 2015, p.03).[12]

In this sense, the TFD, through the SUS, guarantees medical treatment to patients affected by diseases that cannot be treated in the municipality of origin, when all means of care in their locality have been exhausted (BRASIL, 1999). The TFD transfers to the patient, and in some cases, to the companion, assistance for travel costs referred to other municipalities or states that are not their place of origin; having as one of the criteria for this reference the possibility of total or partial cure.

According to the TFD Manual, and Ordinance No. 55/99, the following are offered within the scope of the SUS:

> Consultations, outpatient, hospital/surgical treatment previously scheduled; Round-trip tickets for patients and, if necessary, companions in the same amount, so that they can travel to the place where the treatment will be carried out and return to their city of origin; (air, land or river transport); Allowance for food and lodging of the patient and/or companion for the duration of the treatment; Responsibility for expenses resulting from the death of the TFD user; Analysis of special situations, when the patient's physical conditions do not allow road transport (BRASIL, 1999).

It is noteworthy that the amounts referring to the aid transferred by the TFD to the user and his companion are outdated, considering that the reference of values transferred to the user/companion, established in Ordinance No. 55/99, has not undergone monetary adjustment over the years. For understanding, it is described below:

- Remuneration for air transport every 200 miles per patient/companion: R$100.00 (Individual value).

[11] Ordinance No. 55 of 1999, which instituted the TFD, defines this financial transfer as "allowance", which is disagreed, since it goes against the perspective of rights to health in the SUS based on the universality and integrality of services in an equitable way and not as "aid".
[12] This Manual was designed by the Health Department of the State of Espírito Santo based on Ordinance No. 55/99. It was decided to use the text of this manual for the clarity of the content. Available at: https://saude.es.gov.br/Media/sesa/TFD/Manual%20TFD%202015_.pdf. Accessed on February 01, 2019.

- Remuneration for ground transportation per 50km of distance per patient/companion: R$ 3.00 (Individual value).
- Remuneration for river transport every 50km of distance per patient/companion: R$ 2.00 (Individual value).
- Allowance for food for patient and companion when there is no overnight stay away from home: R$10.00.
- Allowance for full daily allowance (food and overnight stay) for patient and companion: R$ 30.00.
- Allowance for feeding the patient without a companion when there is no overnight stay away from home: R$ 5.00.
- Allowance for full daily allowance (food and overnight stay) for unaccompanied patient: R$15.00. (BRAZIL, 1999).

For the above, the TFD alone is not able to fully guarantee the access and permanence of HSCT patients who are referred by the HC to the ICDF, [13]in which they imply the right to health and express themselves as one of the expressions of the social issue.

However, reality shows that thinking about access to health, based on the TFD policy, still requires revisiting many elements that directly interfere in the defense of rights, especially when we consider that the demands of users are plural and the difficulties are presented beyond geographical, economic and functional issues.

According to the National Cancer Institute (INCA, *online*),[14] the first 100 days after transplantation is the phase in which care is the most important, so the patient needs to be very close to the transplant unit to facilitate care in case of any symptoms (cough, fever, graft-versus-host disease, among other complications).

Considering these elements, we observed impasses and adverse challenges faced by patients and companions who need to go to Brasília to undergo HSCT. The conditions established for a successful transplant and recovery require these patients to have some obligations that are sometimes far from the social and economic reality of their families.

[13] The cost of living in Brasilia is considered one of the highest in relation to other capitals in the country. The information is supported by the IBGE, which released the Extended National Consumer Price Index (IPCA) and the National Consumer Price Index (INPC) for the month of November 2017. Available at: http://www.curtamais.com.br/brasilia/brasilia-e-a-cidade-mais-cara-para-viver-no-brasil-segundo-ibge. Accessed on January 05, 2019.
[14] Available at: http://redome.inca.gov.br/paciente/vida-depois-do-transplante/ Accessed on December 06, 2018.

In this sense, it is identified in the daily routine – Resident Social Worker – that during the process of preparation for HSCT in the initial outpatient consultations at the ICDF, patients have the possibility of going and returning on the same day; or in some cases to stay for a few days in Brasilia, relying mainly on the support house (because the transplant has not yet been performed).

The situation worsens after the transplant, since the care is different, as previously pointed out. It is in this article that the presentation of the field research and the analysis of sensitive data are introduced, based on the testimonies of the researched subjects – explained in the final item of this work.

RESULTS

HSCT: TESTIMONIES OF A TRAJECTORY OF CHALLENGES

As previously indicated, the manifestation of the social question is expressed in its refractions in the face of capitalist social relations, with the exploitation of capital over labor being central. Thus, the subjects engender their ways of coping with social inequality. Such characteristics take on different contours in the particularities of social policies, but above all how they are assumed within each reality, as an example of the trajectory of Brazilian health policy.

Bringing these elements corroborate to think about universality and, from the singularity of the relations expressed by the subjects who experience it, the necessary mediation to think about the particularity of relations in the face of this categorical complex unfolds – in a dialectical movement.

It is worth mentioning that this text understands that particularity is the key to unveiling knowledge of the way of being social – fields of mediations – through the unveiling of social complexes, breaking with immediacy (PONTES, 2016).

Thus, considering these assumptions, an analysis of the sensitive data will be made based on the subjects' speeches, making it possible to know the social reality experienced by them in such a challenging daily life; in its determinants and conditioning factors from *the a priori categories*, with emphasis on access to health in the interface with the social issue.

As a way to enable the organicity of the interviews, we initially opted for the identification and presentation of the participants, entering into considerations about the socio-economic and family reality, ending in the notes their apprehension about Health, SUS and the process of illness – both marked by the debate on access.

Regarding the identification of the research subjects, it is presented as follows:

Table 1 - Presentation of the subjects.

Identification	Age	Sex	Municipality of residence	Schooling	Profession
Participant 1	27	M	Goiânia	Complete higher education	Environmental Engineer
Participant 2	63	F	Orizona	Complete high school	Tec. Master of Science in Nursing
Participant 3	49	F	Goiânia	Illiterate	Farmer
Participant 4	53	M	Goiânia	Complete elementary school	Production Assistant

Source: Elaborated by the researcher herself, 2019.

The age range of the participants is between 27 and 63 years old, two female and two male. Of these, only one resides in the municipality of Orizona-GO[15], the other three report currently living in Goiânia. Two of them signal the discovery of the diagnosis as a beacon for moving to the capital. As for schooling, the formations range from complete higher education, complete high school, incomplete elementary school and not literate.

In this same table 1, the profession and education of the research subjects were presented, being expressed concomitantly: Environmental Engineer, Nursing Technician, Farmer and Production Assistant; transiting through a very diversified sample when we resort to schooling, whether for illiteracy, elementary school, high school and higher education. Although, in view of the Brazilian reality, these data converge by the low level of education if compared to the process of professionalization arising from higher education, the most vulnerable conditions that these subjects are subjected to are denoted. Such information is corroborated when we present income as a social determinant that influences health, and also as a means by which people are able to provide for their basic needs, expressed in table 2:

Table 2: Social Reality.

Participants	Number of people per household	Assistance Benefit	Social security benefit	Income per household	Renda individual	Housing situation
Participant 1	User; sister	No	No	No income	No income	Rented
Participant 2	User	No	Retirement	R$ 954,00	R$ 954,00	Own
Participant 3	User; Grandson; Daughter	Bolsa Família Program	No	R$1,036.00	R$ 82,00	Rented
Participant 4	User; father; nephew; sister	No	No	R$954,00	No income	Courtesy

Source: prepared by the researcher herself, 2019.

[15] In a survey carried out, it is noted that the distance between Orizona/GO and the capital Goiânia is 138km (IBGE/ Cidades, 2018).

Only participant 2 reported living alone, the others lived with family members, with an average of 4 people per household. With regard to individual income, subjects 1 and 4 do not have any assistance/social security benefits, as well as any other source of income; participants 2 and 3 have some form of income, either through retirement and the Bolsa Família welfare benefit. However, convergence appears in the value of the income of both participants, which move between the minimum and below them, which leads us to infer the low socioeconomic situation.

This situation corroborates the family income presented, which does not change the condition of the minimum necessary for the maintenance of the subjects, and is more acute when compared to participants 1 and 4 who depend on their families for their own maintenance.

None of the participants had any activity related to work or profession, except for participant 2, who said she crocheted, dishcloths and handicrafts to supplement her income.

These elements contribute to identifying the characteristics of the patients who underwent HSCT who participated in the research. It is noted that the absence of formal employment contract registration is part of the reality of the research subjects, contemporaneous with a reality marked by structural unemployment and such adverse health conditions that, guaranteeing their rights through social assistance and/or social security benefits, constituted in the face of so many antinomies, expressed as follows:

> It blocked the benefit then I did the expertise in the Federal Court. It was for retirement, but it doesn't come easy, the doctor there, the expert there is tiring! (Participant 4).

> I don't have... was denied... I appealed to the courts but I lost everything! I lost everything! And the contradiction, first by the INSS, I was denied by the medical criterion and then in the Judicial by the socioeconomic criterion... And the worst, the Social Worker expert was favorable, no one understands why the doctor and socioeconomic were favorable... Did you answer? The two requirements to be granted the benefit, but denied, go figure... It's because he earns little, right?! He earns only 30 thousand reais, and he doesn't have cancer (Participant 1).

Participant 4 and participant 1 report the attempt to access the social security/assistance benefit through the courts. Both refer to this strategy as a way to access the right to the benefit while taking care of their health conditions, since they are out of the labor market.

The multifaceted expressions of the social issue gain materiality in the daily life full of challenges to the working class, falling on the different dimensions of life that become more acute, as indicated in the following statements:

> I lost the family allowance, then I managed to do it again, it's been two months that I've been receiving R$ 82.00 reais [...] Already! I tried too hard, I've already done an expert opinion, I didn't pass, but now my daughter put it in the lawyer's hand and I'm waiting for the result (Participant 3).

Participant 3 talks about her economic condition, referring to access to the Federal Government's Bolsa Família Program (PBF) and also signals the need for judicialization of the process as a way to face social issues, with a view to accessing another welfare benefit. It is noted that the BFP constitutes his only income, having to resort to the help of the family in its maintenance.

The understanding of poverty according to (YAZBEK, 2012, p.290-291) has commonly been evaluated through income and employment indicators, "along with the enjoyment of social resources that interfere in determining the standard of living, such as health, education, transportation, housing, retirement and pensions, among others". The same author adds that the criteria, although not homogeneous and marked by the income dimension, end up converging in the definition that poor are those who, temporarily or permanently, do not have access to a minimum of goods and resources, and are therefore excluded, to different degrees, from social wealth.

It is emphasized that the ways in which poverty, as an expression of the social question, gains materiality in people's daily lives emerge, especially in the face of relationships that have work as their centrality; Factors such as unemployment and income are the most expressive, accompanied by other determinants, since poverty "is a multidimensional category, and, therefore, is not characterized only by the lack of access to goods, but is a political category that translates into the lack of rights [...]" (MARTINS, 1991, p.15).

In this sense, the population in poverty is unable to provide for their minimum needs, nor access basic citizenship rights that guarantee their dignity. In the face of this, social ills are reinforced by the neoliberal minimal State that determines the selectivity of policies and their fragmented coverage. And, even in the face of the right to health, the relationships that are imposed and constituted do not only require the absence of disease, the statements are expressed as follows:

> Oh! Health is everything in our lives, right, because sick people can't do anything, it's hard, right... Health is everything, right? We are healthy ready! (Participant 3).

> Oh! Health for me is everything, right? If you can't stand working in a... You won't... If it stands still, if it is a... Like me, I can't lift, keep lifting weight more than 5% of my weight because I operated on my spine as well. I've worked all my life, then two years and a little bit since I stopped (Participant 4).

Participant 3 and participant 4 converge in the statements when they refer to health as being "everything"; relating health to the capacity for autonomous life and work.

Participant1 answers this question with the following statement:

> Oh! I think it's complete well-being, right? Social, psychological, emotional well-being, so it is a set of factors that makes you... (pause), that people think that health is just a medical issue, physiological and such, but I think it's a set of factors, because like that, everything influences, right, if you think like that, if I don't have a very well-structured social life, this will influence my health, if I don't have the emotional, this social environment influences my psychology and my professional, which will influence my physique (Participant 1).

In its different forms, the subjects understand the importance of health in their lives, with some perspectives beyond the health-disease process. The definition most used to describe health is the one highlighted by the WHO (1948), which understands health as a complete state of physical, mental and social well-being, not limited only to the absence of diseases, corroborating the statement brought by participant 1.

When asked about the SUS, it is noted that there are convergences and divergences; Participant 3 expresses herself:

> SUS? SUS is a good thing, right!? because we can't afford to do an exam, the SUS gives the check, we do it, you know, so the consultations, if it was private, I wouldn't have any conditions, the treatment, you know, so the SUS is everything too, right! It's a lot (Participant 3).

The participant's statement expresses guarantees that she can access the SUS, correlating with the living conditions in the face of the services she has accessed. This understanding of the SUS based on their experiences is what gives concreteness to know the real in its multiple approximations, as follows for participant 1 and participant 2:

> The SUS is our health plan, right! Of the poor and the rich too, right?! I think it's a system, I think it's access to everyone that most people have no idea about [...] so the SUS for me, it's like I did the SUS in my personal context, it was extremely essential, relevant, very important, without the SUS I would have died a long time ago! A long time ago, because I didn't have health insurance, so if it weren't for the unified health system to try to maintain this quality of life of mine, I don't even know what it would be because the cancer treatment is very expensive, right?! (Participant 1).

> The unique system, ah! There are a lot of people who complain, right?! That's what I say, I can't complain, because my treatment is all through the SUS [...] I value it a lot because if it weren't for that [...]Expensive, prolonged, follow-up treatment (Participant 2).

These subjects understand the SUS in its universal aspect of the citizen's right, highlighting the access they had to cancer treatment through this system – it is denoted that the principles and guidelines of the SUS are part of the subjects' lives, whether in the

appropriation and/or enforcement of these rights; At the same time, the health antinomies expressed in the previous item gain different contours in the statements.

It is worth mentioning that the Oncology policy in the SUS offers several types of services and treatments ranging from low-cost drugs to chemotherapy with more expressive values, as well as surgeries, radiotherapy, low, medium and high complexity exams such as CT scans, MRIs, biopsies, among others, representing the processuality of the principles of universality and integrality emphasized by the participants.

This appropriation of the right to health is pointed out:

> So I think that the right to health is to have access to all these benefits and these guarantees and that they are rights guaranteed by the state, right, the State in its Constitution, in its Magna Carta, says that we have to have access to health, environment, well-being and so on, so having access to this kind of thing is, I think, it's a wonderful thing (Participant 1).

> Having the right to health is... Good thing, right!? You have the right to health for the people who are good (Participant 3).

Both infer the right to health as a "good thing" or a "wonderful thing", which demonstrates recognition of the importance of this right, both individually and collectively. The highlight is also presented in the participant's speech1, referring to the Federal Constitution of 1988 as a guarantor of the State's responsibility in the realization of the right to health.

In this sense, participant 2 and participant 4 bring such guarantees of rights plus criticism, namely:

> This is the obligation of the SUS [...] You pay taxes and don't have... It doesn't reciprocate at all. If you need them they help very little, right?! (Participant 4).

> Oh, I think that's how it is, having the right to health, having better care, oh I don't know... Be entitled to more things (Participant 2).

These statements demonstrate that the participants relate the right to health to the gaps presented in the SUS. Participant 2 talks about "having better care" and participant 4 does not feel fully contemplated by the SUS health policy, stating that "it does not reciprocate at all" and "helps very little". Also in this sense, participant 2 adds:

> [..] But what is the unique system that we see on television, the poor service and everything... It needs to improve! (Participant 2).

Participant 2 talks about the SUS based on content seen on TV linked to information on the conditions of public health care. These positions are reinforced by the media in general, in which they focus more on the gaps than on the potential of the SUS. And thus,

they corroborate the fact that the SUS is bad is designed in users and in the general population.

This work does not ignore the deficiencies in the face of the contradictions expressed in capitalist society that fall on the way social policies are presented, especially in the current conjuncture. However, the criticism made is that, sometimes, the ideological constructions made by the press can trigger more of a strategy to encourage the search for supplementary health plans, than the proposition that the rights to health is something constructed, requiring collective struggles and mobilizations to guarantee rights.

Regarding the guarantee of SUS services based on exams, consultations and medicines as a right to health, the participants converge:

> I was earning a little money so I started to do everything privately [...] Then I picked up and paid for some exams at Araújo Jorge (Participant 1).
>
> Sometimes it's hard for us to pay, medicines sometimes you have to buy. Now I'm getting the acyclovir, I used to buy it, then I went to the secretariat and they are giving me [...] There are some exams that I pay for, right?! (Participant 2).
>
> These exams that I brought today I couldn't do through SUS because the check was only going to come out to do it now on the day of my appointment, it was going to come out yesterday to do it and then it's 15 days to leave, it was R$ 305.00 reais that was paid to do it, but because I didn't get the check early, right?! when I went I was on top (Participant 3).
>
> I don't stay there once in the ... (pause) the train stayed there for a couple of months and in a vorto, I'd rather pay than in one... (pause). This is the budget, then the girl left it for R$ 600.00 conto, then with the funeral plan she released it, took R$ 400.00 (Participant 4).

The difficulties in accessing the exams make users bear financial resources out of their pockets to pay for them, expressing one of the barriers to the effectiveness of their treatment. Although exams and medications are health rights, all participants report paying or having already paid for them. The participants recognize the SUS as a right, valuing it, but identify antinomies when they seek private exams. Such situations, due to the risks that the health situation implies in the lives of the participants, weaken the rights, because access becomes an individual pursuit.

Regarding the referral to a specialized treatment network, the testimonies of participants 1 and 4 converge:

> The part that I had the most difficulty with was the regulation of the SUS, because usually the SUS regulates and it is the one that sends where it is going to be treated (Participant 1).
>
> He stayed there for about three months, he went hunting for the train, the train is shelved here in Goiânia, then a boy worked at SAMU then he went there and talked

> to the girl, he was pulling the train was there... He didn't even touch the train (Participant 4).

The difficulties presented by both are translated by the delay in getting a place in specialized care to carry out a cautious investigation when there was still no diagnosis to start treatment. An institutional and management barrier has been established in the SUS to ensure that people have access in a timely manner to treat malignant neoplasms. The testimony of participant 3 adds:

> Then I did all kinds of tests, I went twice to that hospital near the bus station to give me the referral and he listened to my exams and said that I had nothing! Then I said my daughter take me home, let me die at home (Participant 3).

Illness linked to the delay in discovering the diagnosis impacts the chances of improvement or cure of these users, during this time of uncertainty, they go through several paths until they get regulation[16] in a specialized unit for treatment.

These dimensions that make access unfeasible are reiterated, either in the process of discovering and identifying the disease, or after the discovery, in the face of the need to carry out necessary tests:

> The doctor said to me: oh no! You have to pay for the CT scans, I took it and said: look, paying is not something seen much in my life! I can't afford to pay! She said: look, ask! (Participant 1).

> Then he asked for a series of exams, right, and after he looked at the result and asked if I was able to pay for an exam, which is the bone marrow exam. (Participant 2).

Thus, the dismantling of health policies gain materiality in the daily lives of the subjects, on the one hand the professionals incorporate as something natural the payment for the performance of exams in private places; and, on the other hand, it rebounds on the life of the user himself, who is faced with decisions that cross between the disease and the financial condition – expressions of the social issue that are intensified with the neoliberal offensive, a conservative perspective that tends to blame the subject himself for his conditions.

[16] In the State of Goiás, the main hospitals in the SUS that serve the hematology specialty are the Araújo Jorge Hospital and the Hospital das Clínicas, these have support for hospitalizations, chemotherapy and Radiotherapy at the HAJ. The vacancies made available by the units to receive newly diagnosed patients are insufficient in the face of the growing demand, leading the user to many days of waiting until they can be regulated to start treatment, going against Law No. 12,732 of 2012, which determines that patients with malignant neoplasms have the right to undergo the first treatment in the Unified Health System (SUS), within up to 60 (sixty) days from the day on which the diagnosis is made in a pathological report.

In this sense, the challenges to access begin with the indication and referral to HSCT, since when asked about the access barriers encountered for transplantation, the statements of participant 1 and participant 4 converge:

> The first aspect was the financial aspect! (pause) Right away! Right away, it was the demand that worried me the most, because I said: how am I going to stay there? (Participant 1).

> [...] Financial then I filed the thing, it took almost a year for them to release it... the INSS then I took the money and went to Brasília, because it took a while to get the papers (Participant 4).

The statements denote that one of the barriers and difficulties that the participants present is related to the financial condition of bearing the expenses when traveling to Brasília to prepare and perform the transplant. The weaknesses increase in the face of the slowness of the process for the benefit of the TFD:

> [...] Then there is also an issue that is very heavy, right, there are people who are not able to do the transplant and will not do it! So this is very much like this (pause), it's not that it's inhumane, but it's painful, you say: 'you don't have money' (pause) Oh, there's TFD. Oh it's all right, but the TFD pays later! The TFD should pay before, or during, it doesn't even have to be in cash, I don't know if there is a department that manages and rents, 'no, we're going to rent a net kit for you in the amount of so much and we're going to give you a value of so much food voucher in the supermarket', you understand? (Participant 1).

> [...] Because we could go like this with confidence, because we were trusted only in courage! Just in the courage that we were, my daughter said like this: mom, we have to trust, everything will be fine. On the day they called me at four o'clock in the afternoon, she was there at seven o'clock in the morning to do the transplant, she didn't have a penny! (Participant 3).

Both participants evidence the financial barrier as decisive in access to health, demonstrating that access to the service in a strict way is not a condition to guarantee the right, since even with the vacancy destined for HSCT, there are determinants and conditions expressed in the interface with the social issue that could prevent or hinder their access to transplantation.

This text understands that the TDF is an advance in the perspective of health rights, this strategy is timid when it comes to the difficulties experienced and reported by users, with emphasis on bureaucracy. Users only receive part of what they spend[17] after returning from treatment outside the home, so if the user does not initially have a financial reserve to cover their expenses and that of their companion, these rights become a barrier.

[17] The reimbursement amounts are in accordance with the amounts of Ordinance No. 55/99 already mentioned in this work.

Also endorsing the conditions presented by the participants to perform the transplant, participant 1 and participant 3 converge on the point that deals with companion:

> [...] Then my sister was also working and I said: look, you have to accompany me... And so she was the one who was willing, so at the time my mother was going to accompany me but my mother was very shaken by this whole process, from the discovery to the relapse it was a very heavy train for her [...] And then my sister resigned from her job, and went to accompany me (Participant 1).

> It was the companion! He was the companion. It was because my daughter couldn't because she worked, and it's rented, then I have 10 siblings, my siblings none, everyone poor couldn't come, then twice I told the dotor [...] to remove my name from the list because I didn't have a companion, then I was already half, then when I talked to a brother I couldn't, The other one couldn't, then I say, until he said he could come to court, right, but we don't want that, right!? Then I said: no! If it doesn't come for love, it's because of the family (Participant 3).

For these participants, the availability of a person who could accompany them throughout the process in Brasília presented itself as a barrier to access. Participant 1 lives with his sister[18], reporting that she left her job to accompany him. It is noteworthy that in the interview it was signaled that after this process and back in Goiânia, both are unemployed – demonstrating the repercussions of this process in family life.

Participant 2 lives on rent and has a family income of just over one minimum wage[19], composed of his value from the BFP and his daughter's income, so, according to her, it was unfeasible for the family provider to leave her job to accompany her mother to the transplant.

According to Yazbek (2008), these are times when the disposable masses are growing, surplus and on the margins of rights and social protection systems in a world in which precarious wages and social insecurity are widespread, triggering poverty.

In this sense, poverty is exacerbated in the face of a significant portion of workers who have become unemployable, growing portions of workers who do not find a recognized place in society, who move on the margins of work and socially recognized forms of exchange (TELLES, 1998).

Among the participants who had companions, it is noted as follows:

> [...] my sister went with me (Participant 2).

> [...] My sister, only my sister, is single too, right, she has more children... (Participant 4).

[18]See Table 2.
[19] Available in table 2.

It can be inferred that, unlike the other participants, participant 2 and participant 4 resorted to family members who do not have a job and/or other direct relationships of dependence, generated by an internal network of collaboration in the absence of support from the State.

Regarding the users' strategies to fill the gaps in the State in the provision of conditions to access health, participant 1 and participant 2 converge:

> During this period the agent organized himself, the people organized a raffle to try to raise money for me to try to pay for what? The rent in the first place, because there in social assistance they had already told me there is no support house, but the nearest support house is in Taguatinga (Participant 1).
> The girls there, a lot of people helped me, right, then I took this money and went[...] In my city, she asked and a lot of people deposited it for me and it was that she helped me too, she had my salary, right!? I put the two together (Participant 2).

These participants report in their experiences one of the strategies that contributed to them being able to go and stay for transplantation. In the face of these latent expressions of the social issue, the solidarity of the community comes into play, relatives and people close to the users try to organize themselves to make up for the lack of effective intervention of the State in this process, seeking options such as raffles and cash donations.

For Montaño (2010, p.197) these solidarity actions are expressed in the "transfer to the orbit of 'civil society' the initiative to assist it through voluntary, philanthropic and charitable practices, mutual aid or self-help". It can be inferred that there is an emphasis on the responsibility of individuals to assume the needs not met by the State, which is a reflection of the increasingly strong neoliberal attacks, "the crisis and the supposed scarcity of resources serve as a pretext for the State to withdraw its social responsibility" (MONTAÑO, 2010, p.188).

From this point on, the analysis that concerns the conditions presented by the participants about the moment when they had already gone to Brasília is established. Regarding the place of accommodation, the statements of participant 1 and participant 4 indicate:

> [...] So, I put it on the scale, I made a cost-benefit ratio so I said: no! It's much better for me to rent, rent the place near the hospital that even gives me sometimes to walk, or that the uber is the minimum price (Participant 1).

> [...] There is if you don't have money you have to have something, where we stay there right there are a lot of people, I paid, I got a rent [...] R$ 350.00 reais in rent[...] I paid about four months and that's it[...] It was 35 km from the hospital[...] It was because it was far away, right, there was a lot nearby, right, but it was R$ 1,200.00 per month (Participant 4).

The interviews show that, in general, the transplant recipients resorted to renting real estate, changing the barriers to access according to the economic conditions of each one.

Participants 2 and 3 used other strategies:

> There was my nephew, you know, I already stayed, I talked to him, he said he could go, he lived so far from the hospital (Participant 2).
>
> [..] I already left here knowing about the support house because I couldn't afford it, yes I couldn't afford it, then everything was arranged here for me to go to the support house, I couldn't afford to rent even there (Participant 3).

From the speeches, they demonstrate that a network of solidarity comes into play again in the face of absence, demarcating the current processes of redefinition between the roles of the State and civil society, configured from philanthropization – whether between family members or between the Third Sector. It is noteworthy that both these two participants, as well as the previous ones, converge in the fragility of the right to access due to geographical barriers.

It is worth mentioning that the institutions known as "support houses"[20] in Brasília do not have enough support to receive this patient profile, because they receive patients with the most diverse pathologies; and with collective rooms that do not meet the reality of the care that patients need after transplantation.

And, even with the geographical barriers partially resolved, his stay in Brasilia imposed other barriers, namely:

> And the support house from Taguatinga to the ICDF I couldn't take the bus, and I don't have my own drive, what would I have? Uber! Uber in Brasilia is a train like that... crazy, you jump in, it was R$15.00 reais, so from the support house in Taguatinga to the ICDF it's R$35.00 reais more or less, R$35.00 to go and R$35.00 to come back, R$70.00 reais per day, there were weeks that I went there every day, you know? (Participant 1).
>
> Then we dawned the day of the appointment then I started to look, right, then it gave R$ 60.00 reais and it went down, right, until when it gave at least R$ 35.00 for us to be able to call, because if it gave that price... There was no condition! (Participant 3).
>
> It's because I couldn't ride the bus, right? after the operation you can't ride the bus, taxi was R$100.00 conto R$110.00 only the uber that was cheaper (Participant 4).

The participants have an important difficulty in terms of access to the hospital from the place where they were staying, the cost of transportation to the ICDF demanded a high financial cost from these participants, incurring not only geographical barriers, but also economic barriers. In this sense, it is considered that;

[20]Support house is a nomenclature used in the region to designate governmental, philanthropic, religious, or non-governmental institutions that offer accommodation, food, and transportation so that patients and companions can stay.

> The degree of real access to health depends on resources such as knowledge and information, means to travel the distance that separates from care, time to travel and funds to cover the costs that this requires (FRANÇOIS, 2008, p.140).

These resources, when they do not exist, can imbricate access to health, considering that not all users have the availability and ease of browsing the internet and cell phone applications, while considering that even with UBER values[21] lower than traditional taxis, these are still high costs for users.

When asked about the post-transplant they said:

> Then when I left the transplant it was another difficulty for me because in a few days I caught a bacteria, it's a virus that already comes out of there with it and it develops, then when I came the doctor said it's twice to come to the hospital, take the medicine, twice a day! Then I said: doctor, I can't afford to come even once (once) every day... Then she did it right away, I was hospitalized again for 24 days again, I spent 48 days inside that hospital because I couldn't afford it and I said right away, right!? And there really wasn't, then she was hospitalized... I took the medicine at 8 am and I was going to take it at 8 pm, but I spent the whole day, straight, direct, because I said I could come but I couldn't, I couldn't afford it at all! (Participant 3).

Participant 3 talks about the difficulties faced after the transplant that were established by the high risk of the patient contracting and developing bacterial, fungal, viral infections, among others, since her body is defenseless, so one of the precautions that is recommended to patients is that they avoid crowds of people; do not stay in support houses because they pose risks to transplant recipients. The understanding of post-transplant recovery is established;

> As soon as the patient is discharged from the ward, together with his family caregiver, he receives from the team a list of recommendations to be strictly followed, such as: wear a mask daily, do not touch dirt or stay in dirty places, do not drive, do not eat raw food, only drink boiled water, do not iron clothes, do not go to places where there are agglomerations – such as churches, shopping, concerts and community parties, not exposing oneself to the sun, not having sexual relations, among other medical prescriptions that end up strongly limiting the achievement of personal satisfaction and well-being, in addition to favoring situations that can generate embarrassment, discomfort or deprivation (MASTROPIETRO, SANTOS; OLIVEIRA, 2006, p.68).

The testimony of participant 3 corroborates the notes of Mastropietro *et, al.* (2006), considering that this was the only one of the participants who reported having remained in the support house after the transplant, in addition to this the statement of the same when asked about the accommodations in the support house:

> It's bunk beds, but it's very good there, right, but the transplanted ones when it's like this have their room. It's to put it like this to stay at least a month, right, while another

[21]UBER is the name of a mobile application that relies on the services of private drivers who make trips at lower prices compared to normal taxis.

> one arrives why... Now I wasn't that lucky! Because I was right away with everyone, but God was on my side because the room was being occupied with wheelchair users, because they always put it on (Participant 3).

Participant 3 expresses the conditions presented by the place where she stayed after the transplant; characteristic of this process of philanthropization of the third sector, supported by the absence of the State, with services that equalize and level individuals, ignoring their particularities.

Considering all the difficulties presented by the interviewed participants regarding the rights to health and access to the SUS, difficulties and barriers in accessing and remaining in Brasília to perform the transplant, family and financial difficulties, it was requested by the researcher that, if they had, suggestions, additions or notes should be made in relation to the research and the performance of the transplant, Thus they answered:

> I think there... There... I can, just like there are a lot of people who don't have a place to stay and the support center I don't know if everyone will stay, right, they can stay there. And also what they complain about that is too far right, I needed ... I don't know if there was a way to have a place closer so you wouldn't spend it, right... Those who do not stay in the support house have to rent a place, if they do not have a relative (Participant 2).

> Yes, you can! If there was a support house closer to the hospital and had a car to take, wow! Oh that's it! There is no car, so if there was a car it would also be good, then it is very far so I said that if there was a support house near the hospital (Participant 3).

> But only the thing you live far away, because a support house many people stay... all kinds of people who enter go and cannot be mixed among the people or could not ride the bus (Participant 4).

These participants converge on the indication of establishing a support house or adequate place to receive HSCT patients, breaking down one of the barriers to access. It also recommends collective coping strategies that can assist the next people who will transplant, and also suggest that transportation from this support house to the ICDF be made available, in view of the difficulties faced.

Participant 1 expands his propositions:

> Access to primary care, you know, of this whole process that you go through, from being diagnosed until you start the therapeutic process, basic care is extremely necessary and important, very important, because it is in it that you will be able to identify some things and point out some paths (Participant 1).

These participants point out as a suggestion the strengthening of primary care, indicating the importance of access, diagnosis and treatment to health in a timely manner – overcoming all barriers –, and adds:

> The issue also of the remuneration of health professionals, especially frontline professionals, right because doctors will always be paid, you know? doctor always goes well paid and the others? Who are extremely poorly paid (Participant 1).

The interviews demonstrate that access to health services is a major obstacle to the guarantee of rights, falling into the search for supplementary health in the face of the life-threatening relationship that the health area conducts, especially in the particularity of patients undergoing Hematopoietic Stem Cell Transplantation (HSCT).

Regarding the complexity offered by the SUS from the performance of transplantation, it represents an advance in health, the result of struggles waged within Brazilian society. However, the offer of the service for transplantation is not the only condition for the realization of the right to access, since access is intrinsically related to geographical, financial, organizational, informational, cultural barriers, among others, a characteristic expression of the offer that, in an interrelated way, act to facilitate or obstruct people's ability to use the health service.

Thus, the realization of the right to health presupposes an articulated action in the different governmental spheres with the aim of facing the bureaucratic, institutional, cultural and conjunctural issues that permeate health policy, which present permanent challenges to users in accessing health services and inputs.

BY WAY OF CONSIDERATIONS

In view of the initial concerns, by way of considerations, it is worth bringing some notes and propositions that were constituted in the course of the work, making it possible to answer both the initial concerns and the methodological directions assumed and covered in this work. It is clear that such results obtained are far from closing the discussion; On the contrary, our intention is to trigger a debate aimed at the construction of strategies that are based on the assumptions of the realization of the rights to health.

In this sense, the present work had as its thematic centrality the right to access health services, in particularity of the right to access HSCT; thus enabling the unveiling of the real, which is assumed from successive approximations that the dialectical movement that is made with everyday life.

The thematic constellation: Social Issue, Public Health Policy, Access was the core of the conceptual foundation necessary for the understanding and analysis of the research results.

It is worth noting that capitalist relations – whose foundation is found in the relations of exploitation of capital over labor – unleash, above all, inequality. This inequality makes it

possible, by unveiling its genesis, to understand both the forms of exploitation and the responses engendered by the working class.

This process, characterized by the objective manifestation of poverty and inequality, as well as its forms of confrontation, brings to light the social issue as a political issue, requiring the State to mediate the necessary to minimize the atrocities of capitalist society.

It is in this context that Social Policies are found, among them, the Brazilian Health Policy, the result of struggles and mobilizations that have in the Health Reform Movement their greatest exposure of struggles from the perspective of health as a right, guaranteed in an integral way.

These banners of struggle were partially put into effect in the 1980s, with the promulgation of the Federal Constitution of 1988, and regulated by the Organic Health Laws (LOS) – guaranteeing principles and guidelines for health, as a right of the population and a duty of the State.

However, the antinomies expressed in this societal order take on different forms in the Brazilian reality in the face of patrimonialist, patriarchal, among other characteristics, with contours that gain materiality in everyday life, transmuting the right into favor. Regarding the focus of this study, the right to access health services ends up being weakened and guaranteed in a punctual and fragmented way, especially when considering social, geographical, political, cultural, and economic barriers, among others.

This study, by inquiring the challenges faced by SUS users in accessing HSCT at the interface of the Social Question, as well as analyzing the statements of the research participants, confirms the common thread established in the course taken in this work.

It was identified that by knowing the reality experienced by HSCT patients in the health-disease process, considering the determinants and conditioning factors that were present in their daily lives, which are interrelated with the expressions of the social issue, it is noted that it is a process that makes it difficult to perform the transplant, when sometimes it makes it unfeasible.

Contemporary to this movement, it is understood that the participants facing these challenges and impasses makes them resort to individual strategies and alternatives – in the face of gravity – in facing difficulties.

These barriers to access start from the process of becoming ill in the face of the search for private exams and consultations, due to the delay that they are carried out by the SUS. However, such access challenges run through and are aggravated by the diagnosis for the performance of HSCT, since economic, social, cultural, political, and other barriers are triggered.

Travassos and Castros (2012) point out that

> [...] Access is the factor that mediates the relationship between demand and entry into the service. It refers to the characteristics of the provision of health services that facilitate or obstruct its use by potential users and expresses the capacity of the supply to produce services and respond to the health needs of the population" (TRAVASSOS; CASTRO, 2012, p.185/186).

And, even though the participants recognize and identify the guarantees, scopes and rights expressed by the SUS, it ends up imprinting individual responses to coping with the social issue, given the seriousness that the health-disease process implies and interferes with.

In this sense, some propositions emerged from this work, namely:

- Strengthen the SUS with regard to its basic principles and guidelines.
- Consolidate primary care as a way to solidify a more efficient management in the SUS in terms of referrals and regulation.
- Revisit Ordinance No. 55/90, which institutes the TFD, as a way of adapting the price list of services according to the current needs of SUS users – expressed in the ordinance as help and not aid arising as a right to health.
- It should be noted that the proximity between the locations to which patients are referred does not always guarantee access, as was clear in the case of HC Goiânia-GO x ICDF Brasília-DF.
- To institute in Brasilia, based on a collective action in a hierarchical and regionalized way actions between the different SUS management entities, a support house or place that can receive these patients in order to contemplate their particularities, because today there is no place in Brasilia to properly welcome transplant patients before and after HSCT, which would be essential to facilitate the trip and stay of the patient and his companion in Brasília during this period.

Thus, these directions are essential to contribute to the emancipation of the subjects, expansion of rights and guarantees of access in the field of health, as well as to contribute to the construction, maturation and academic consolidation from the perspective of the social sciences.

For the above, this study recognizes and values the health policy, SUS, as the result of struggles and mobilizations of health movements, especially the Health Reform Movement. However, the antinomies of this process denote that such advances are full of challenges, especially for SUS users indicated to HSCT, who are faced with their

singularities and particularities not met, weakening the rights to health, especially access to services guaranteed by the SUS.

In this sense, the construction of public policies must be based on the reality and needs of the subjects who use it, built from processes of struggles and mobilizations that reiterate the forms of collective confrontation expressed in the social issue, having as a guiding thread the realization of the rights to health.

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FROM DNA TO CHROMOSOME: A VIEW OF BISCUIT PACKAGING

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ABSTRACT

The development of didactic models in the teaching of abstract concepts is proposed, since it allows the assimilation of content in an expanded and three-dimensional view. The present work aimed to develop three-dimensional models in biscuits addressing the packaging of chromatin into chromosomes from DNA. This work presents a qualitative approach research. The activities were developed by students of the 1st period of the Bachelor's Degree in Biological Sciences at the Federal University of Catalão, regularly enrolled in the Cell Biology discipline. Initially, the students participated in a workshop, provided by the teacher, and chose the references that supported (conceptually and pedagogically) the model to be produced and the material to be used. Then, the model was made during part of the practical classes. The proposal instigated the interest of the students. The act of choosing nuclei, position, proportionality and application in the model stimulated interest and curiosity, enabling different ways of learning the compaction of chromatin into chromosomes. I suggest that cookie modeling, with the student as the learning center, be the subject of other biology topics.

Keywords: 3D Modeling. Cellular Biological Teaching. Compaction.

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INTRODUCTION

The abstract nature of chromatin compaction, a topic of study in cell biology, combined with the fact that the discipline is included in the semester in which the student enters higher education, makes the concepts distant from the student's daily life. It is known that teaching, when supported by the process of collective construction and with the effective participation of students, becomes more effective than theoretical classes that develop as a monologue, with students being mere receivers of information. In this context, the development of didactic models, in the teaching of abstract concepts, is presented as a proposal, since it facilitates the assimilation of content in an expanded and three-dimensional view (Wommer, Michelloti, Loreto, 2019; Campos et al., 2023) in addition to enabling the student to think reflectively and autonomously (Campos, Moura, Paula, 2024). Students' participation in the creation of models from a 3D perspective increases the sharing of experiences and ideas aimed at bringing theory and practice closer together (Roque, Will, Caetano, 2020; Carneiro et al., 2016). It is believed that when students actively participate in the construction of educational material, their interest, and critical capacity are awakened. In addition, several studies report the benefits resulting from the use of didactic models, especially three-dimensional ones, in the teaching-learning process in the biological field (Souza et al., 2021; Da Silva, Rodrigues, and Campos, 2021).

The topic of chromosomes and chromatin generates doubts among students. One of the reasons is the way these concepts are addressed in textbooks. Firstly, chromatin and chromosomes are made up of DNA and proteins, but chromatin is found in the interphase nucleus and at the beginning of cell division when it is condensed into a chromosome. On the other hand, chromosomes are present from the condensation of chromatin in the prophase of cell division (Alberts et al., 2017; Junqueira and Carneiro, 2023). From the definition, students, by handling and elaborating the 3D model, follow the process and perceive the modification being constructed.

Modeling represents a promising alternative for teaching concepts related to the theme of chromatin condensation, which is part of the content taught in cell biology (Dantos et al, 2018, Da Silva, Rodrigues, Campos, 2021). However, the use of three-dimensional materials alone does not guarantee innovation; it is necessary to awaken the student's interest to expand their observation and critical capacity. Thus, the present work aimed to elaborate three-dimensional models in biscuits addressing the packaging of chromatin into chromosomes from DNA.

METHODOLOGY

This paper presents a qualitative approach to research, considering the specificities of the process of knowledge acquisition by students in the process of building three-dimensional models addressing the packaging of chromatin into chromosomes, and attempting to understand and describe what happens to students when faced with a problem situation (Lüdke and André, 1986).

The activities were developed by students in the 1st period of the Bachelor's Degree in Biological Sciences at the Federal University of Catalão, regularly enrolled in the Cell Biology discipline. This discipline is the first to address concepts of chromatin and chromosomes in the course and aims to allow students to develop an integrated view of structure and function.

STEPS IN DEVELOPING THE MODEL

After the theoretical class on the subject, the students were taken to the laboratory where they observed, under light microscopy, onion slides containing the phases of mitosis. At that moment, they observed chromosomes and not chromatin. The problem questions “How was the chromosome formed? Where is the chromatin? What is the path to get to the chromosome?” arose and from that moment the class was randomly divided into pairs, trios or individually.

A previously constructed didactic model was presented. In addition to explaining each part of the model, the teacher informed that the students should not only build a model but also explain how it could be used later in a didactic activity. The model was to be built in part of the practical class, over three weeks.

For this activity, it was necessary to master the content and be supervised by monitors and the teacher in charge. To master the content, the student had to seek support from a theoretical framework, mainly for choosing colors and exploring the structures. In the first week, the students participated in a workshop provided by the teacher and chose the frameworks that supported (conceptually and pedagogically) the model to be produced and the material to be used. The model was made during the second and third weeks of practical classes. Each practical class in the discipline lasts 1 hour and 40 minutes and 50 minutes were used for practical activities. The workshop covered handling biscuits, choosing colors and shapes, as well as complementary subjects.

WORKSHOP OFFERED FOR HANDLING BISCUIT

Biscuit dough was chosen because it is easy to handle, has good durability, and

does not alter the model. Even so, before building the models, students participated in the workshop to acquire knowledge about handling biscuits and preserving the models. In the workshop, students had the opportunity to ask questions about the model and colors.

STUDENT SERVICES

Since this is a practical activity, in addition to the classes designed for this purpose and the workshop, there was service by appointment through the Google Meet platform.

DATA ANALYSIS

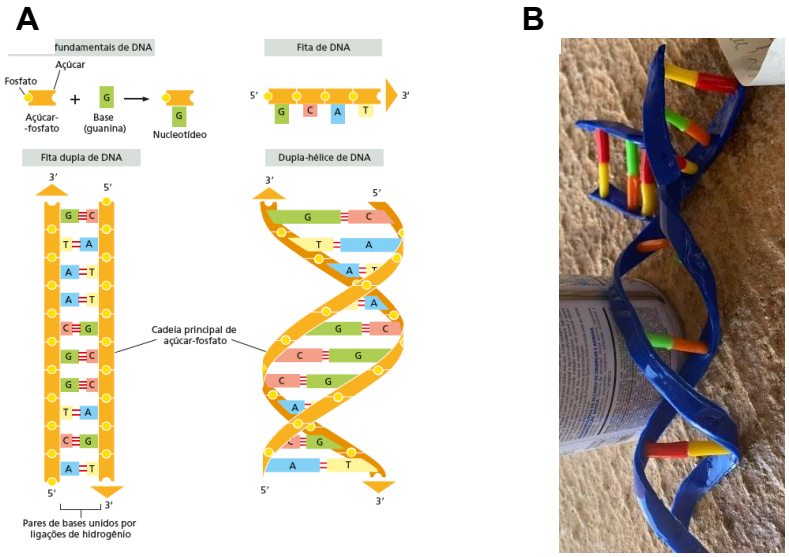
For the evaluation, the following data collection instruments were used: dialogues in the classroom, workshops, and services. To analyze the data on the students' impressions regarding the work, only the responses representative of the group were used after self-evaluation and critical evaluation of the other works developed. At the time of the reports, notes were made on the most discussed points and the discursive textual analysis (DTA) proposed by Moraes, Galiazzi, and Ramos (2012) was used. All evaluation criteria were presented to the students beforehand. It is worth noting that, in addition to the presentation of the resource in the classroom and the justification about the educational space, there was a stage in which the students were concerned with developing its evaluation, at least preliminarily, that is, based on the apparent potential of the materials produced, without considering their actual application. The evaluation criteria for the developed model were: applicability, concepts covered, and oral presentation of the model.

RESULTS AND DISCUSSION

In the teaching scenario, group work has proven to be a good strategy to support teaching work. In this study, it was observed that there was a low number of individual works. Knowing the students is essential to promote more accurate group divisions, but how can this understanding be advanced in a class of new students? Immediately after the presentation of the proposal, the students were restless. The idea that everyone does their part and then hands everything over to the teacher would not work in this modeling process. This is because building a three-dimensional model requires everyone's participation and collaboration and is not a combination of parts. During the presentation, it was possible to see that the students created a form of communication between them so that everyone could participate. The individual and group reports showed that having another person to exchange ideas with was important in building the model. Salas (2021) emphasizes that collaboration favors the advancement of learning in group work. According

to the author, the group work strategy places the student as the protagonist. During the workshop, the students doubted their ability to handle the material and raised important questions about the model itself. The members who were responsible for building the replicating DNA were the ones who asked the most questions. The doubts focused on the difficulty of representing the nitrogenous bases in three dimensions by fitting them into a twisted model. The 3D visualization of DNA replication made the students uncomfortable. This is partly explained by a certain degree of passivity among students, acting as spectators (Cezar et al., 2010) and the difficulty in establishing a connection with the world around them, a consequence of memorization learning that resulted in the false impression of learning (Ferreira and Almeida, 2013). The structure of DNA, proposed by Watson and Crick in 1972, is presented as a double helix and serves as a model (Figure 1A) for the elaboration of the 3D model (Figure 1B).

Figure 1- DNA model (A) proposed by Watson and Crick (Alberts, 2017) and the model (B) built by the students.



During the activity, the students themselves began to make suggestions about their models and those of other groups. This exchange of ideas was beneficial to the process of developing the model. In this study, discussion and pedagogical support using books were essential to transfer the 1D image into a 3D model. For some of the students who at a certain point wanted to give up, intervention with encouraging dialogue was necessary. This type of situation shows how difficult it is to leave the “comfort zone” and have to participate in the learning process (Duso, 2013). In addition, other authors report on the importance of relating theory and practice to enhance access to information to acquire knowledge (Campos et al., 2003, Carneiro et al., 2016; Paula et al., 2017).

The models were built in parts, initially the chromosome and chromatin. After each

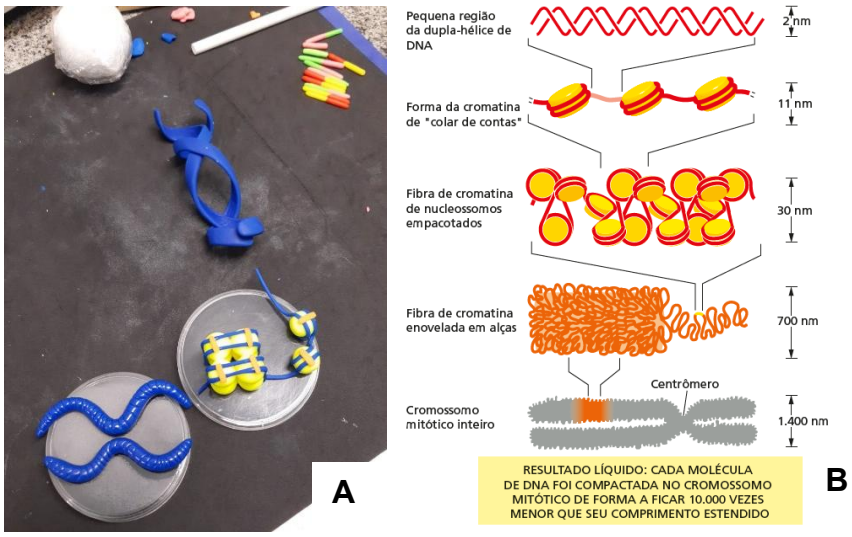
part was created, it was placed on cardboard where spray varnish was applied to better preserve the models (Figure 2).

Figure 2- Chromosome model being developed after application of varnish.



When preparing the initial chromatin packaging, doubts focused on the role of histone H1 and the lack of visualization of non-histone proteins. At this point, the students sought support in the theoretical material and raised a discussion about whether it would be interesting to present the proteins in a highlighted format. Some students tried to represent the proteins and observed that the model would have too much information. They decided to keep the model without indicating the proteins; such indication should be made at the time of explaining the model. The model developed for chromatin compaction (Figure 3A) was based on the image (Figure 3B) do Alberts et al., 2017).

Figure 3 - Chromatin compaction to the chromosome



It was observed, from this stage, that from the moment the student felt safe and stimulated, the interest in constructing learning was easier and more enjoyable. The application of play as a complement to theory contributes to more efficient teaching because it places the students in the lead. Thus, students are more committed and

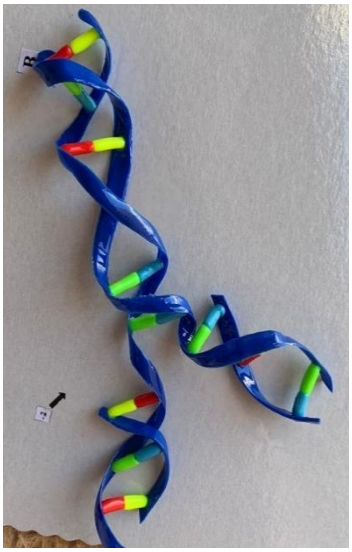
motivated to carry out the task, both as a team and individually (Camargo and Rosa, 2013).

In the subject of cell biology, students have difficulty understanding the mechanism of the processes. During the presentation of the models, the students explained how the model was made, what it is about, where and how it occurs, in addition to the importance of the event. To complement the model and facilitate its applicability, an explanatory folder was created where the students took a photo of the model and added theoretical information and tips on how to use it (data not shown). It was noted that, when the students did not participate in the workshops, or services or did not exchange experiences with their colleagues, they had difficulty explaining and understanding the process. To make the models, students needed to understand the content, have a sense of responsibility, and follow all the steps, as already pointed out by Soares et al. al. (2021).

Figure 4 – Stages and part of the models created by the students









The development of teaching models by students, as reported by Da Silva et al. (2021), helped in understanding and learning how a biological process works, in addition to stimulating curiosity and active participation. This is because the simple handling of the raw material until obtaining the pieces during the activity constitutes a form of interaction between the student and the object of knowledge (Matos, 2009). The development of models by students enabled the sharing of experiences and ideas aimed at integrating theory with practice, enabling more attractive classes than when approached in a predominantly theoretical way (Roque et al., 2020).

CONCLUSION

The proposal described above aroused the interest of students and played an important role in filling the gaps that persisted after remote teaching. The act of choosing colors, position, proportionality, and application in the model stimulated interest and curiosity, enabling different ways of learning the compaction of chromatin into chromosomes. Another point to consider with this work was the possibility of obtaining educational material, without involving digital technology, which stimulated learning enjoyably with concrete visualization of the concept studied in theory. The digital device was used only for research and image capture. In this sense, it is suggested that biscuit modeling, with the student as the center of learning, be contemplated in other curricular components.

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ANALYSIS OF THE PREVALENCE OF RESPIRATORY SYMPTOMS IN PEOPLE PRACTITIONING PHYSICAL EXERCISE IN SANTOS

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ABSTRACT

Objective. To analyze the prevalence of respiratory symptoms among exercise practitioners in Santos. Methods. A cross-sectional study was carried out through the registration of two self-administered questionnaires, one of which was a sociodemographic data questionnaire and the other a validated European Community Respiratory Health Survey (ECRHS) questionnaire for the evaluation of respiratory symptoms. Descriptive analyses of all variables, univariate and multiple logistic regression models to assess the risk of exposure, and analysis of spatial dynamics were performed. The significance level was 5%. Results. Exposure to moldy humidity (OR = 2.38; 95% CI: 1.31; 4.30), and higher education (OR = 6.96; 95% CI: 2.21; 21.45) were jointly significant factors for rhinitis. Regarding the responses to the ECRHS questionnaire, we can see that those who live in Ponta da Praia have a 2.43 (95% CI: 1.05; 5.64) times greater chance of having wheezing than those who live in other regions of Santos. The analysis of spatial dynamics shows a higher prevalence of respiratory symptoms in residents of Ponta da Praia. Conclusion. Exposure to air pollution plays an important role in respiratory symptoms such as rhinitis and wheezing among those who practice physical exercise in the region of the Rebouças Sports and Recreation Complex, Ponta da Praia, in the city of Santos.

Keywords: Cross-sectional study. Air pollution. Physical exercise. Respiratory symptoms. Rhinitis.

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INTRODUCTION

According to the World Health Organization (WHO), air pollution is a critical environmental problem that affects human health and quality of life. Sources of air pollution include emissions from vehicles, industries, and the burning of fossil fuels. Recent studies indicate that exposure to air pollutants, such as fine particulate matter (PM2.5), nitrogen dioxide (NO2), and ozone (O3), is associated with an increased risk of respiratory and cardiovascular diseases (WHO, 2022).

Approximately 99% of the world's population lives in places where air pollutant levels exceed acceptable air quality limits, exposing the population to their deleterious effects, and is considered a global public health concern by the Pan American Health Organization (PAHO, 2022).

The damage caused by air pollution is increasingly worrying, as described by PAHO (2022). Polluted air is considered one of the main environmental risks to health and is a serious problem that needs to be discussed on several fronts, and few cities have adequate air quality. Air pollution is an invisible threat to health and, in addition, generates a major economic impact. The Ministry of Health (MS) states that the benefits of practicing physical exercise are numerous and, as it improves aerobic capacity and physical function, it also reinforces the improvement of cardiorespiratory fitness, but when performed in places with high levels of exposure to pollution, it can cause harm to health (BRASIL, 2022). As the Ministry of the Environment (MMA) points out, air quality is fundamental to the well-being of the entire society and, since 2019, it has been a priority for the MMA to take care of air quality and the health of more than 80% of Brazilians, who are currently concentrated in urban centers. If air quality in large cities continues to worsen, cardiovascular and respiratory diseases will increase, even among healthy people who exercise (MMA, 2020).

Air quality is directly influenced by the distribution and intensity of atmospheric pollutant emissions, topography, land use, and meteorological conditions that hinder the dispersion of pollutants, causing an increase in their concentration levels, which can be observed by air quality monitoring networks, according to the National Environmental Council (CONAMA, 2022).

RAE KIM et al., (2021) state that together with aerobic training, it improves blood vessel compliance and reactivity, systemic immune function, and cardiac output. However, air pollution is an obstacle to active exercise, and many individuals who exercise in places with high concentrations of pollutants run the risk of having their respiratory and cardiovascular health compromised.

For the same authors, the impacts of exposure to air pollution can be aggravated during periods of faster or deeper breathing, for example, during physical exercise, because when there is a higher rate of air exchange and, consequently, an increase in the volume of inhaled air, pollutants penetrate the respiratory tract with greater intensity, not to mention the notable negative impact on the quality of life of those who practice physical exercise.

The impacts of exposure can be aggravated during periods of faster or deeper breathing, for example, during physical exercise, because when there is a higher rate of air exchange and, consequently, an increase in the volume of inhaled air, SO2 penetrates the respiratory tract with greater intensity (CETESB, 2023).

The main objective of this study is to analyze the respiratory health of those who practice physical activity and live in the Ponta da Praia neighborhood, a neighborhood very close to the port, where practitioners are exposed to a region with high levels of air pollutants.

MATERIALS AND METHODS

A cross-sectional study was carried out by recording two self-administered questionnaires, one of which was a sociodemographic data questionnaire and the other a validated European Community Respiratory Health Survey (ECRHS) questionnaire for the assessment of respiratory symptoms. The study was approved by the research ethics committee of the Catholic University of Santos (UNISANTOS).

It was carried out in the city of Santos, São Paulo - Brazil. The total area of the city is 281,033 km², the island area is 39.4 km², and the continental area is 231.6 km², with a total population of 414,029 thousand inhabitants, according to the Brazilian Institute of Geography and Statistics (IBGE, 2022).

The city of Santos has the largest port in Latin America, is responsible for the transshipment of more than a quarter of Brazil's trade balance, has an area of 3,700,000 m² on the right bank (Santos) and 4,000,000 m² on the left bank (Guarujá), totaling a pier extension of 13 kilometers (PORTO DE SANTOS, 2021).

The Rebouç Sports and Recreational Complex is located in the Ponta da Praia neighborhood, in the municipality of Santos and close to the port of Santos, with a pier extension of 16 km and a total useful area of 7.8 million m² (EMBRAPA, 2020).

The sample was calculated based on the prevalence of respiratory diseases in the Brazilian population of 20% (J. BRAS. PNEUMOL, 2006; MINISTRY OF HEALTH, 2010), with a power of 80%, a significance level of 5% and a delta of 5%, that is, the prevalence can vary between 15% and 25%, considering a total of 2,000 people practicing physical

exercise at the Rebouças Sports and Recreational Complex, adding 20% due to possible losses, a total sample of n = 240 individuals was reached.

Adults over 18 years of age, of both sexes, who practiced physical exercise and had been living in the city of Santos for at least 1 year, at the Rebouças Sports and Recreation Complex, were selected.

Participants answered the questionnaire via email, Google Forms, WhatsApp, and in person, after signing the informed consent form. Individuals who had 4 or more positive responses to the ECRHS questions, according to tested and validated criteria, were considered asthmatics. Those who answered “Yes” to the question “Do you have any allergies in your nose or allergic rhinitis?” were considered to have rhinitis or nasal allergies.

In this study, the dependent variables were rhinitis, asthma, and respiratory symptoms. The independent variables were sociodemographic, allergen block, health block, physical exercise block, post-pandemic physical exercise block, and respiratory symptoms. A descriptive analysis was performed on all study variables, transformed into qualitative variables, and presented in terms of their absolute and relative values (CALLEGARI-JACQUES, 2009).

To assess the risk of exposure, the univariate and multiple logistic regression model and spatial dynamics analysis were used. Univariate and multiple logistic regression analysis was performed by blocks, where the variables were grouped by similar characteristics.

In the univariate model of each block, the variables that presented a significance level of less than 20% ($p<0.20$) were tested in the multiple model by block, leaving only the variables that presented a significance level of 5% ($p<0.05$) in the final model.

The multiple logistic regression analysis was performed using the Stepwise method (KLEINBAUM, KUPPER, NIZAM, 2008). The significance level was 5% and the statistical package used was Statistical Package for the Social Sciences (SPSS version 24.0) for Windows.

The spatial dynamics analysis was performed by Quantum GIS (QGIS), an Open Source Geographic Information System (GIS) licensed under the General Public License, and its function is to create, edit, visualize, analyze, and publish geospatial data and health determinants and problems that can be used, in addition to detection, to eliminate problematic situations (MINISTRY OF HEALTH, 2006).

The significance level adopted was 5% and the packages used were SPSS version 24.0 for Windows and Qgis 14.

Since this is a study using secondary and public domain data, this study was approved by the Research Ethics Committee of the Catholic University of Santos (UNISANTOS), Opinion Number: 4,362,920, in accordance with Resolution No. 466/12 and 510/16 of the National Health Council (CNS).

RESULTS

Table 1 presents the descriptive analysis of the variables age group, local group, gender, education level, and profession. It can be seen that most of the participants who live in Ponta da Praia, are adults, female, white, have higher education, have partners, and are active.

TABLE 01: Descriptive Analysis of Sociodemographic Data of Physical Exercise Practitioners, Santos, 2022

Variable	N	%
Local Group		
Ponta da Praia	171	71.5
Others	69	28.5
Age Group		
Adults (18 to 59 years)	148	61.7
Elderly (60 years and older)	92	38.3
Gender		
Female	138	57.5
Male	102	42.5
Ethnicity		
Yellow/Oriental	2	0.8
Indigenous	2	0.8
Black	15	6.3
Mixed-race	58	24.2
Education Level		
Elementary School	29	12.1
High School	64	26.7
Higher Education	108	45.0
Postgraduate	39	16.3
Occupation		
Homemaker	15	6.3
Retired	55	22.9
Employed	170	70.8
Current Marital Status		
With Partner	142	59.2
Without Partner	98	40.8

The table presents risk factors and confidence intervals for rhinitis in physical exercise practitioners using the univariate model. It is observed that exposure to dust increases the likelihood of rhinitis symptoms by **1.99** (95%CI: **1.13-3.47**), and exposure to humidity/mold increases the likelihood by **2.11** (95%CI: **1.22-3.64**).

TABLE 02. Logistic Regression Analysis of Allergenic Materials in Physical Exercise Practitioners Related to Rhinitis Symptoms

Rhinitis	Univariate		
	OR	95% CI (Lower)	95% CI (Upper)
Dust			
No	1.00	____	____
Yes	1.99	1.13	3.47
Animal			
No	1.00	____	____
Yes	1.46	0.87	2.46
Humidity/Mold			
No	1.00	____	____
Yes	2.11	1.22	3.64

This table presents risk factors and confidence intervals for rhinitis in physical exercise practitioners using multiple models. It is observed that **exposure to humidity/mold** increases the likelihood of rhinitis by **2.38** (95%CI: **1.31-4.30**), and **higher education** increases the likelihood by **6.96** (95%CI: **2.21-21.45**), making them jointly significant factors for rhinitis.

TABLE 03: Multiple Logistic Regression Analysis of Significant Variables Related to Rhinitis Symptoms (Humidity/Mold and Education Level)

Rhinitis	Multiple		
	OR	95% CI (Lower)	95% CI (Upper)
Gender			
Male	1.00	____	____
Female	0.50	0.29	0.89
Humidity/Mold			
No	1.00	____	____
Yes	2.38	1.31	4.30
Education Level			
Elementary School	1.00	____	____
Higher Education	6.96	2.21	21.45

In the univariate logistic regression analysis for respiratory symptoms (Table 4), it is observed that **smoking** increases the likelihood of wheezing by **3.53** (95%CI: **1.02-12.16**) compared to non-smokers. Additionally, individuals living in **Ponta da Praia (Port)** have **2.32** (95%CI: **1.01-5.34**) times higher chances of experiencing wheezing compared to those who do not live there.

TABLE 04: Univariate Logistic Regression Analysis of Wheezing and Whistling Symptoms in the Last 12 Months

Wheezing	Univariate		
	OR	95% CI (Lower)	95% CI (Upper)
Glue/Adhesives			
No	1.00	____	____
Yes	1.88	0.76	4.60
Do you smoke?			
No	1.00	____	____
Yes	3.53	1.02	12.16

Local Group			
Other districts	1.00	____	____
Ponta da Praia	2.32	1.01	5.34

The multiple logistic regression model demonstrated that **living in Ponta da Praia (Port), having carpets/rugs at home, and smoking** are jointly associated risk factors for wheezing symptoms.

- **Living in Ponta da Praia** increases the chance of wheezing by **2.43** (95%CI: **1.04-5.65**) compared to those living in other areas.
- **Having carpets/rugs at home** increases the chance of wheezing by **2.81** (95%CI: **1.00-7.86**) compared to those without carpets/rugs.
- **Smoking** increases the likelihood of wheezing by **4.07** (95%CI: **1.12-14.80**) compared to non-smokers.

TABLE 05: Multiple Logistic Regression Analysis of Wheezing Symptoms

Wheezing	Multiple		
	OR	95% CI (Lower)	95% CI (Upper)
Local Group			
Other districts	1.00	____	____
Ponta da Praia	2.43	1.04	5.65
Carpet/Rug			
No	1.00	____	____
Yes	2.81	1.00	7.86
Do you smoke?			
No	1.00	____	____
Yes	4.07	1.12	14.80

The use of spatial analysis of health data was an important strategy for understanding the dynamics of the prevalence of respiratory symptoms among exercise practitioners at the Rebouças Sports and Recreation Complex in the city of Santos, comparing the neighborhoods of Ponta da Praia and others.

The outcomes for rhinitis and wheezing and their distribution in the Ponta da Praia neighborhood in relation to other neighborhoods were considered.

Among the study participants, the following were identified:

- 92 with rhinitis in the Ponta da Praia neighborhood
- 27 with wheezing symptoms in the Ponta da Praia neighborhood
- 119 with rhinitis and wheezing symptoms in the Ponta da Praia neighborhood and others

Georeferencing of participants with rhinitis and wheezing in the Ponta da Praia neighborhood and others (KERNEL) (Figure 1).

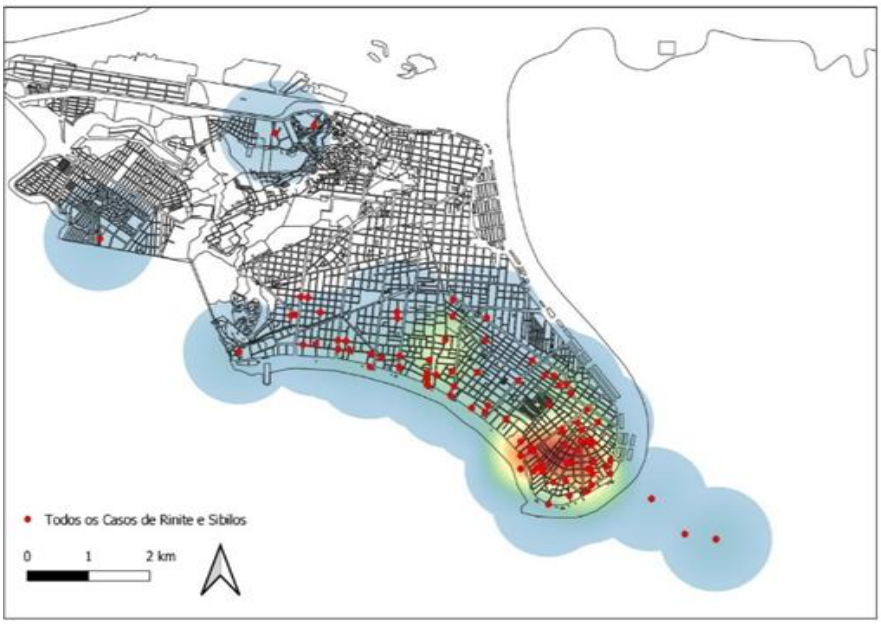
When applying the spatial autocorrelation test, positive values were detected, that is, there is a dependence between the analysis units that influence the pattern of respiratory diseases such as rhinitis and wheezing, and air pollution in a dynamic way, indicating that it is somehow associated with the practice of physical exercise and its location due to its proximity to the port.

The highest prevalences were found in the Ponta da Praia neighborhood for rhinitis and wheezing symptoms, associated with higher concentrations for the Ponta da Praia neighborhood, due to its proximity to the port of Santos.

The Kernel density map (Figure 1) or heat map, within Qgis, is used in the health area to show, through point data, where it is more concentrated and more dispersed and also shows the density of points within a radius of coverage.

The vector file of points, which are the limits of the neighborhoods of Santos, SIRGAS 2000, UTM by the Municipal Government of Santos.

FIGURE 01: Georeferencing of participants with rhinitis and wheezing, in the Ponta da Praia and other neighborhoods (kernel).



Author 2023

It can be seen that those in red represent those with neighborhoods with high respiratory diseases (rhinitis and wheezing). In the white neighborhoods, there is a low concentration of rhinitis and wheezing. In the neighborhoods in blue, there is an average concentration of rhinitis and wheezing.

DISCUSSION

The data obtained in the present study demonstrate that the majority of participants who live in Ponta da Praia are adults, female, white, with higher education, with partners, and active. The present study showed that in the period evaluated, from March 2022 to July 2022, there was a significant association between exposure to air pollution and respiratory diseases such as rhinitis and wheezing in physical exercise practitioners at the Rebouças Sports and Recreational Complex located in Ponta da Praia.

Regarding the results obtained, possible discrepancies can be explained by geographical differences, as the studies differ in terms of sampled populations, age groups, case and exposure definitions, and analytical techniques used. Air pollutants continue to be a contributing factor to the increase in cases of rhinitis and wheezing.

The present study had some limitations; the first is inherent to the project itself, as it was a cross-sectional study and, therefore, used primary data that serves to quickly assess the results through questionnaires via Google Forms, WhatsApp, and in person.

Understanding the relationship between the effect of air pollution on respiratory diseases such as rhinitis and wheezing in exercise practitioners at the Rebouças Sports Complex is an advance in knowledge that enables differentiated intervention policies for all practitioners in the location and in neighborhoods that are also close to the city's port region.

Similar results to ours were found in other studies conducted by SHI AND SUN (2022), where they systematically evaluated the effect of exposure to air pollutants on the lung function of exercise practitioners. The meta-analysis showed that exposure to air pollutants has no significant effect on forced expiratory vital capacity (FVC), forced expiratory volume in the first few seconds (FEV1), and peak expiratory flow (PEF) of exercisers ($p>0.05$); but it can significantly increase the level of iron nitrate (FeNo) of exercisers.

Exposure to air pollutants can cause allergic inflammation of the airways, increasing FeNo levels in exercised populations and adversely affecting human health. Practicing physical exercise in environments with high concentrations of pollutants can pose significant health risks.

According to a review of studies, exposure to pollutants during exercise can exacerbate the adverse effects of these pollutants, since physical activity increases the ventilation rate and, consequently, the amount of pollutants inhaled (TAINIO et al., 2021).

Another study considers air pollution to be an environmental priority in the European port sector. Therefore, there are many concerns about the adverse health and pollution

outcomes that occur due to air exposure related to the operations of large ports in Europe, which have a significant environmental impact, often not assessed or measured due to budgetary constraints (SIROKA et al. 2021).

Air pollutants increase the presence of free radicals that are not neutralized by antioxidant defenses and increase the inflammatory response with the release of inflammatory cells and mediators (cytokines, chemokines, and adhesion molecules) that reach the systemic circulation, leading to subclinical inflammation with repercussions not only on the respiratory system but also causing systemic effects (SANTOS et al., 2021).

In the research by QIN et. al, (2019), the authors explain that through their study where the objective was to evaluate the influence of exposure to air pollution and outdoor exercise. Estimates of the combined effect of exposure to air pollution and outdoor exercise were calculated in the meta-analysis.

Six studies addressed exposure to O^3 and ten to exposure to PM; seven studies reported that exposure to air pollution during physical exercise was associated with an increased risk of airway inflammation and decreased lung function. Six studies demonstrated that exposure to traffic pollution or high PM during exercise may contribute to changes in blood pressure, systemic function of the ductus artery, and microvascular function.

FINAL CONSIDERATIONS

Despite efforts to reduce pollutant emission levels in recent decades in the city of Santos, the pollutant concentrations analyzed in the period studied showed that the effects of air pollution on the respiratory health of those practicing physical exercise are still measurable and significant.

Therefore, it is recommended that efforts be intensified in the search for the lowest levels of PM concentration. Air pollution to minimize the adverse effects of exposure to atmospheric pollutants on those who practice physical exercise at the Rebouças Sports and Recreation Complex (Ponta da Praia). The presence of materials considered allergenic in the homes of the participants was observed, with an association between exposure to dust and physical exercise. There was also an association between having a stuffed toy and physical exercise, with a greater predominance in female individuals.

Evaluating the Georeferencing (Figure 1), the spatial dynamics demonstrate that cases of rhinitis and wheezing among those who practice physical exercise are concentrated within the Ponta da Praia neighborhood, in locations close to the port region. Considering that the present study was carried out with data from the CETESB Monitoring

Station located next to the Rebouças Sports Complex, it allowed for the official and targeted capture of information on the pollutants present in the atmospheric plume.

It is crucial that public policies are implemented to improve air quality and that people are informed about the potential risks of exercising in highly polluted areas. Measures such as creating low-level zones can help reduce exposure to air pollution.

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MATHEMATICS APPLIED TO THE DISCIPLINE OF ELECTRIC MOTORS: AN EXPERIENCE WITH PROFESSIONAL AND TECHNOLOGICAL EDUCATION

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ABSTRACT

The Postgraduate Course in Professional and Technological Education – DocentEPT is offered by federal institutes and aims to train teachers in the area of professional technical education. It is important to highlight that in the control and industrial processes axis there are courses that work with content that requires special attention in the area of mathematics. Among these courses, the electrical engineering course can be mentioned. In this sense, this study sought to develop an experience of pedagogical intervention in a technical and professional education school. For this purpose, an electrical engineering class was chosen where a questionnaire was applied to verify which content in the area of basic mathematics the students had the most difficulty with. The study was carried out with 18 students who answered five objective questions. The results obtained showed that half of the class had greater difficulty with trigonometry. Given this, a review of the main concepts of trigonometry such as sine, cosine, and tangent was applied. This mathematical knowledge is essential in the technical training of these professionals.

Keywords: Professional and Technological Education. Area of mathematics. Pedagogical Intervention.

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INTRODUCTION

Professional and Technological Education – EPT is subdivided into technological axes, among which we can highlight the control and industrial processes axis, which, in turn, comprises the technical courses in electroelectronics, electronics, mechanics, chemistry, electromechanics, mechatronics, and electrical engineering. The latter has subjects focused on the area of electricity such as electrical circuits, basic electronics, programming language I, electrical controls, electrical maintenance, electric motors, and electrical engineering, among others.

Therefore, according to Porto (2023), the technical course in electrical engineering is of great importance for the industrial development of a country. This is because, according to the author, electrical engineering is present in several sectors of the industrial area, such as telecommunications, electrical maintenance, energy, and maintenance of electrical equipment, among others. A characteristic present in technical courses in the industrial area is the constant use of mathematical calculations to carry out their activities.

Mathematics is a science that is present in the daily lives of human beings and its mastery is important for the development of techniques and instruments for work and the performance of other activities. Therefore, in the field of technical and professional education, mathematics becomes essential for the correct handling of tools, both in the economic aspect and for the safety of individuals. It is also known, according to Palhares (2022), that only 5% of students who finish high school have an adequate performance in the area of Mathematics. Regarding learning in physics, it is also clear that many students have difficulty understanding concepts and formulas.

In view of this, this work sought to develop a pedagogical intervention in an electrical engineering class, preparing and executing a class to review content in the area of Mathematics. The content that was reviewed refers to basic trigonometry, as indicated by most students when asked about their greatest difficulties in basic Mathematics content. This research was developed at a Technical and Professional education school.

Regarding the space where this research was developed, the school has been part of the technical education market in the municipality of Canaã dos Carajás since 2020. Therefore, its mission is to offer technical professional qualifications in several courses, such as Administration Technician, Industrial Automation Technician, Nursing Technician, Electrical Engineering Technician, Electromechanical Technician, Building Technician, Logistics Technician, Metallurgy Technician, Computer Technician, Mechanical Technician, Mechatronics Technician, Environmental Technician, Mining Technician and Occupational Safety Technician.

The municipality of Canaã dos Carajás, in its social context, is home to people from different regions of the state and the country. The last demographic census, in 2022, carried out by the Brazilian Institute of Geography and Statistics - IBGE, showed that the municipality of Canaã dos Carajás was the one that grew the most nationwide.

Regarding this research, it is the result of a pedagogical intervention, as previously mentioned. Pedagogical interventions are actions or sets of actions that enable postgraduate students to act in response to a problem identified in a given school environment. They must be carried out by postgraduate students of the DocentEPT course, from the Institute of Education, Science and Technology of the State of Tocantins. The Pedagogical Project of the Course - PPC, provides in its statute that postgraduate students Teaching for Professional and Technological Education carry out a pedagogical intervention in a professional technical education institution.

Therefore, as a student of the DocentEPT course, I see that contact with teaching practice in the professional and technological environment is essential for a good academic education because, in addition to bringing new experiences with different themes for the training of postgraduate students, the course helps us to closely monitor the reality of professional education.

In this sense, this work has a research problem to identify which are the main theoretical contents of Mathematics that students have the most difficulty learning or understanding in the context of teaching electrical engineering.

Regarding the objectives of this work, it sought to develop an intervention proposal based on the results of the research, as previously mentioned, in which it will be verified which tools the students of the electrical engineering course use to learn Mathematics contents as well as identify their difficulties and apply a content review class.

METHODOLOGY

The methodology of this research is characterized as bibliographic research. According to Marconi and Lakatos (2018), bibliographic research is research that seeks to survey bibliographies already published, such as scientific articles (printed or digital), books, doctoral theses, and master's dissertations, for example. Regarding its importance, the authors emphasize that “its purpose is to put the researcher in direct contact with what has already been written” (Marconi, Lakatos, 2018, p. 33).

The research also stands out as field research, where a pedagogical intervention will be applied in a technical school. Contributing to this theme, Marconi and Lakatos (2018) point out that field research is where “the object is approached in its environment and the

collection of information is carried out in the natural conditions in which the phenomena occur" (Marconi, Lakatos, 2018, p. 32).

As for the form of analysis of research information, it was characterized as quantitative, where there was a survey in absolute numbers and percentages of the main contents that students had the most difficulty with in the area of Mathematics. Among the contents covered in this research, the contents of numerical expressions, algebraic expressions, percentages, trigonometry, and other subjects that could be mentioned by the students were addressed.

As for the data collection instrument, a questionnaire was applied to find out which main mathematics contents the students had the most difficulty with and which they would also like to review. After verifying the students' main difficulties, a class (pedagogical intervention) was given to work on a content review with the class.

In addition to seeking to answer these questions, the electrical engineering class sought to answer some other questions regarding the way they study the mathematics content. In this sense, the first question sought to answer how each student considers themselves in terms of learning themes or contents in the area of mathematics. As for the second question, it sought to know which methods the students in the electrical engineering class use to study or learn mathematics. In the third question, the students should indicate or describe whether they use any application to help their learning. Thus, this research was conducted with a total of 18 students from the electrical engineering technical course at a Technical and Professional Education school.

PROFESSIONAL AND TECHNOLOGICAL EDUCATION: REFLECTIONS

The purpose of technical and professional education, within the scope of its existence, is to promote access to quality education inherent in the training of professionals qualified for the job market. On this subject, Moura (2008) emphasizes in his research work that, for technical education to advance in the face of its challenges, teachers, institution managers, and technical-administrative staff need to be properly trained in the professional field. In this sense, the author points out the following:

Education and training must, therefore, go beyond the acquisition of teaching techniques for transmitting content for teachers and management techniques for managers. Evidently, these aspects will continue to be important, but the macro objective is more ambitious and should prioritize training within the scope of the country's public policies, especially educational ones, with a view to overcoming the current socioeconomic

development model, so that human beings should be prioritized more than simply market relations and strengthening the economy (Moura, 2008, p. 30).

In this text, Moura (2008) brings some reflections on teacher training in EPT, according to the author, the training of these professionals should go beyond technical and didactic skills, that is, it is necessary to train in accordance with the public policies in force in our country.

From this perspective, the author also highlights that Professional and Technological Education, as well as teacher training to perform this important function, requires that the "teacher must assume another attitude, forged from another type of training, which must be critical, reflective and guided by social responsibility" (Moura, 2008, p. 30).

Still in this perspective, regarding teacher training for EPT, Moura (2008) points out that the training of this professional follows two strands or axes, namely: the initial training of the professional and the second referring to the didactic-political-pedagogical training. The first, according to the author, as it refers to the initial training of the professional, should seek continued training in the area of activity itself. The second, the didactic-political-pedagogical, deals with specificities that are related to training for EPT.

Collaborating with the ideas of Moura (2008), especially what refers to treating the teaching of EPT in line with public policies, Pacheco (2020) points out in his article, unraveling the federal institutes: identity and objectives, some particularities of the social function that the IFs have to provider before society.

Thus, according to Pacheco (2020), federal institutes, or IFs, were created by federal law no. 11,892/2008, to offer free public education in a democratic context, enabling the most excluded classes of our society to access professional and technical education. One of the objectives of IFs is to work on professional technical education in conjunction with other modalities such as distance education-EAD, for example, and also extension projects that are focused on the socioeconomic conditions in the territory where the institution operates (Pacheco, 2020).

When discussing the institutionality of federal institutes, Pacheco (2010) points out that they must contribute beyond "national technological development", but as a factor that is decisive for the inclusion of millions of Brazilians.

Thus, the author makes the following statement:

> In this context, the Federal Institute points to a new type of institution, identified and aligned with the social project underway in the country. It therefore represents a qualitative leap in a unique journey, about to complete one hundred years. It is a progressive project that understands education as a commitment to transformation and enrichment of objective knowledge capable of modifying social life and giving it greater meaning and scope in the whole of human experience, a proposal

> incompatible with a conservative vision of society. It is, therefore, a strategy for political action and social transformation (Pacheco, 2010, p. 16).

In this way, the author describes that technical institutions or federal institutes have the role of valuing "education and public institutions, aspects of current policies assumed as fundamental for the construction of a sovereign and democratic nation, [...]" (Pacheco, 2010, p. 16).

Like the other authors cited above, Pacheco (2010) highlights the idea that federal institutes arise from the need to have public and social policies that provide access to education in a more equal and democratic way. In the political sphere, the author highlights that federal institutes "represent the overcoming of reductionist views and the establishment of a public policy that contributes to the realization of a viable national project for this century." (Pacheco, 2010, p. 16).

MATHEMATICS TEACHING IN EPT

Vocational and Technological Education is an area of education focused on training professionals who are duly qualified for the job market. It is understood that EPT students should also be motivated by the development of critical thinking about their learning. Thus, according to Pontes (2022), in his studies, he highlights that professional and technological education requires that teaching practice in Mathematics has the intention of reducing the gaps between Mathematics itself and current technological tools. In this sense, the author highlights: "The teaching of Mathematics in EPT needs to follow the best strategies to associate its concepts, rules, and relationships with the new technologies of Mathematics Education, aiming at the professional qualification of the learner" (Pontes, 2022, p. 3).

This is also described by Pinheiro (2020), on the use of technology in professional education, who says:

> Using technology in favor of teaching Mathematics offers different opportunities for students to observe, create, and discuss the results. Currently, several programs assist teachers in their classroom dynamics, making it possible to create situations in which students can interact with the subject creatively. However, the professional needs to know these tools so that he can advise students skillfully (Pinheiro, 2020, p. 5).

In this sense, it is important to highlight that the existence of technological tools does not mean that everyone knows how to use such instruments as learning facilitators. Regarding technologies, Pinheiro (2020) states that:

> Through the use of computers, the ability to solve problems has increased and the ways of approaching mathematical content that were previously seen only through calculations, without illustrations, are changing, thanks to the encouragement that

> professionals have been giving to students, as it is of utmost importance that they can broaden their knowledge about the different forms of resolution and thus put into practice new plans involving interaction and simulation of data (Pinheiro, 2020, p. 6).

Thus, according to Pinheiro (2020), the use of technology is fundamental to assist students in learning Mathematics in professional and technological education, and, for this to occur effectively, it is necessary to encourage students and teachers to develop teaching-learning.

Also on the subject of teaching mathematics in professional education, there are the considerations of Gonçalves and Pires (2014) who worked on interdisciplinarity as a way of integrating mathematics learning. In this way, the authors highlight the importance of the glimpse of interdisciplinarity that functions as a requirement that is given by society itself due to the fragmentations caused by science. Thus, the authors believe that:

> For an interdisciplinary approach to Mathematics to occur in High School and Professional Education, we believe the organization of pedagogical work in schools must happen in a collective, participatory, and democratic way. Thus, teachers can glimpse other teachers' perspectives of treating concepts beyond the boundaries of the disciplines that reflect on the disciplinary training of teachers (Gonçalves; Pires, 2014, p. 246).

These authors also emphasize that teaching mathematics, whether for high school or professional education, “can be materialized from a collective pedagogical practice in the school that permeates its organization in the macro dimension and at the curricular level” (Gonçalves; Pires, 2014, p. 246).

For the authors, speaking of disciplinarity refers to the integration of disciplines, that is, their combination to teach a science. Regarding the difficulties in learning mathematics in technical education, there was a study conducted by the authors in three subsequent courses at IFMG – Instituto Federal de Minas Gerais. In this study, the authors were able to verify the difficulties in learning applied mathematics content in the courses of Mechanics, Building, and Mining. Regarding the importance of mathematics in technical education: “It is known that Mathematics is an indispensable discipline for these students due to the great applicability of its concepts and techniques in other disciplines and the future career” (Viana et al., 2017, p. 393). Through these ideas, it is possible to identify that mathematics has great relevance in the technical area, because it functions as if it were a basis for the segment of many professions. Thus, for Viana et al., (2017), according to their studies, mathematics is like a work tool, where if students have difficulty, they will be in a position to hinder their professional practice. Still, on the subject of mathematical practice in technical education, Silva (2021) highlights in his research the contributions of mathematical modeling in an electrical engineering class. In this work, the author focuses on the content

of power factor, which is a topic focused on the study of electric motors. It is worth noting that this content contains many mathematical calculations and operations to discover the power and performance of motors. In this sense, Silva (2021) was able to prove, through mathematical models, the resolution of some calculations applied to the discipline of electric motors, such as the use of Pythagoras' theorem in solving the subject of power factor.

REPORT ON THE PEDAGOGICAL INTERVENTION

The activities for the pedagogical intervention began on November 13, 2023, with two moments of classroom observation. Thus, on November 13, there was the first contact with the electrical engineering class at the Vale do Pará Technical School – ETVP. In this first moment, notes were taken on the content that was taught in the subject of the electric motor and also how the learning dynamics were constructed between the subject teacher and the students.

Likewise, on November 14, observations and notes were continued. Among the notes on the content, the demonstration of the theoretical part of the operation of electric motors and their applications can be highlighted. Descriptions were made on the types of currents used in motors, such as single-phase alternating current systems and three-phase alternating current systems. Regarding the observed content, we can also mention the following topics that were covered: the relationship between power torque, efficiency, frequency, maximum current voltage, maximum current, series and parallel connections, delta connection, line current, stator and rotor, and slip of an electric motor.

Having made these considerations, regarding the calculations to determine the slip of an electric motor, some students had some difficulty concerning the sequence of procedures to perform the mathematical operations of the aforementioned subject.

Therefore, as a better way to measure the students' difficulties with the basic mathematics content, a questionnaire was applied on November 20th to the electrical engineering class. The questionnaire had 5 objective questions that aimed to identify at what level of learning the students considered themselves to be and which tools they used to study questions. Es mathematics, which applications they used to study mathematics, which content they had the most difficulty with, and which content they would like to see reviewed. Among the basic mathematics content, the following content was given to the electrical engineering class: Numerical expressions, Algebraic expressions, Percentage, and Trigonometry. If the students had any other content that they had more difficulty with, a blank option was left in which the students could describe it.

It is worth noting that the electrical engineering class at the Vale do Pará Technical School has around 40 students. However, the survey was conducted with only 18 students.

ANALYSIS OF RESULTS

The first question aimed to verify at what level of learning, in mathematics content, the students of the electrical engineering technical course considered themselves to be. Thus, the options were described as a) Excellent, b) Good, c) Regular, and d) Insufficient. Thus, the following table shows the results obtained.

Table 1 – Level of Learning in Mathematics Among Students

Level of Learning	Absolute Frequency	Relative Frequency (%)
Excellent	0	0
Good	8	44.44
Average	10	55.55
Insufficient	0	0
Total	18	100

Source: The Author (2023).

From the data shown in the table, it is possible to verify the perception that students have of themselves when it comes to Mathematics in their learning. Thus, in absolute numbers, there were 8 students who considered themselves good at Mathematics content, totaling 44.44% of the students interviewed. Regarding the students who considered themselves average when it comes to Mathematics content, 10 were found to have average knowledge in this subject.

These results describe the levels of knowledge of the class and show that no student considers themselves excellent in the area of Mathematics. Thus, there is a need to work more on Mathematics content and create actions such as extension projects or continuing education for technical and professional training.

The second question aimed to verify which tools the students in the electrical engineering class used in subjects that involved the use of calculations. In this sense, the options were scientific calculators, regular calculators, applications, software, or whether they usually performed calculations by hand. A blank option was also inserted so that students could mention another form or tool. Table 2 describes the results achieved in the interview.

Table 2 – Tools Used in Calculation Subjects

Tools	Absolute Frequency	Relative Frequency (%)
Scientific Calculator	2	11.11
Regular Calculator	11	61.11
Apps	1	5.55
Software	0	0

Manual Calculation	4	22.22
Total	18	100

Source: The Author (2023).

As described in Table 2, only two students reported using scientific calculators in calculation subjects, totaling 11.11% of the respondents. Meanwhile, 11 students use regular calculators or their smartphones, corresponding to 61.11% of the class. Regarding the use of apps, only one student declared using this type of tool, representing just 5.55% of the interviewed students. No students reported using the software. Concerning manual calculations, only four students stated that they practiced this learning method, making up 22.22% of the class.

These results reveal students' practices concerning Mathematics-related content. The majority rely solely on regular calculators to solve problems in class. In this sense, software or programs are not utilized as learning tools, highlighting a potential area for improvement in Mathematics teaching and learning in technical and vocational education.

Regarding the third question, which refers to the type of apps students use in electrotechnics classes, the following results were obtained, as described in Table 3.

Table 3 – Apps Used by the Electrotechnics Class

Apps	Absolute Frequency	Relative Frequency (%)
PhotoMath	0	0
Symbolab	0	0
Mathematics Calculator	8	44.44
Mathway	0	0
Other	1	5.55
Not Applicable	9	50
Total	18	100

Source: The Author (2023).

Based on the results shown in the table above, eight students use the Mathematics Calculator app, representing 44.44% of the class. In absolute numbers, nine out of the 18 students responded that they do not use any apps, totaling 50% of the class. Only one student stated they use a different type of app or technology, specifically mentioning ChatGPT.

The results indicate that the most commonly used apps are simple mathematical calculation tools, such as the Mathematics Calculator app. This suggests that students in the electrotechnical class rely on these tools solely for performing basic arithmetic operations.

Regarding the fourth question, which aimed to determine which Mathematics-related content students in the electrotechnics class struggle with the most, the results are shown in Table 4.

Table 4 – Mathematics Topics Students Struggle With

Difficulty	Absolute Frequency	Relative Frequency (%)
Numerical Expressions	0	0
Algebraic Expressions	7	38.88
Percentage	2	11.11
Trigonometry	9	50
Other	2	11.11
Total	20	111.1

Source: The Author (2023).

Regarding the greatest difficulties reported by the electrotechnics students in basic Mathematics, the results were as follows: no students reported difficulties with numerical expressions. For algebraic expressions, seven students stated they had difficulties, making up 38.88% of the respondents. Only two students reported struggling with percentages, representing 11.11% of the class. Regarding trigonometry, nine students declared they had difficulties with this subject, accounting for 50% of the class. Additionally, two students mentioned difficulties with other topics, such as logarithms.

The table shows that two students struggled with two different topics, which explains why the absolute frequency total appears as 20 instead of 18, and the relative frequency reaches 111.1% instead of 100%.

According to the data, many students struggle with algebraic manipulations and trigonometry-related content. This indicates that in subjects like electrical motors—which require knowledge of sine and cosine functions to calculate, for example, a motor's power factor—students may face difficulties if they do not grasp the fundamental concepts of trigonometry.

For the fifth and final question, which asked students which topics they would like to be reviewed, the results are shown in Table 5.

Table 5 – Topics Students Would Like to Review

Review Topic	Absolute Frequency	Relative Frequency (%)
Numerical Expressions	3	16.66
Algebraic Expressions	7	38.88
Percentage	2	11.11
Trigonometry	9	50
Other	2	11.11
Total	23	127.76

Source: The Author (2023).

The data in the 5th table show that 3 students requested a review of numerical expressions, representing 16.66% of the class. For the content of algebraic expressions, there were 7 identifications, that is, 38.88%; for the content of percentages, 2 students requested a review of the given content, totaling 11.11% of the class.

In the context of trigonometry, 9 students expressed themselves in favor of a review of this content, that is, 50% of the class. Once again, 2 students, or in relative numbers 11.11% of the class interviewed, identified the content of the logarithm in the blank space, this time for a content review. It is also possible to see in Table 5 that, of the 18 students who answered the questionnaire, 2 students requested 3 reviews (algebraic expressions, percentages, trigonometry), (numerical expressions, algebraic expressions, trigonometry) and 1 student requested two reviews (numerical expressions and algebraic expressions). Hence, there is an absolute and relative frequency difference between 18 and 100%, respectively.

Through these results, it is understood that there is a need to review these concepts since trigonometry serves as a basis for understanding the subject of electric motors. Furthermore, as perceived during classroom observations and the teaching of the subject teacher, the content of electric motors that were seen also addresses trigonometric functions, explaining how they work.

REVIEW OF TRIGONOMETRY CONTENT

According to the data obtained in the research, a class on the content of Trigonometry was demonstrated for the electrical engineering class. The aforementioned class took place on November 27, 2023, at the Vale do Pará Technical School, under the supervision of the professor of the electric motors discipline.

This theme contributed to the electrical engineering class some content and topics related to the electrical motors discipline, such as what the sine, cosine, and tangent of an angle are. Because, according to the discipline's demand, these topics were applied in mathematical formulas to solve some problems, such as finding the power or efficiency of an electric motor which, in this case, uses the cosine ratio of angles.

Thus, during the class, the sine, cosine, and tangent ratios in a right triangle were worked on. There was also a demonstration of some properties of trigonometry, such as trigonometric ratios; the relationship between sine, cosine, and tangent of acute angles; sine and cosine of complementary angles; the fundamental relationship of trigonometry; the relationship between sine, cosine, and tangent and sine, cosine and tangent of notable angles.

During the class, it was noticed that many students had difficulty with basic mathematics, such as the addition of fractions with the same denominators, rooting, and also with respect to division.

Therefore, the class was developed in an interactive way, seeking to discuss the difficulties of the students regarding the methods used to solve the questions. Therefore, in order to better follow the class, an activity was distributed to each student to be answered. In this activity, there were some applied questions of the right triangle and also demonstrations of trigonometry regarding the concepts of sine, cosine, and tangent.

FINAL CONSIDERATIONS

The work intended to show the results of research carried out with an electrical engineering class at a technical education institution subsequent to high school. The research was carried out at a technical and professional education school from November 13 to 27, 2023.

From the results obtained, it is possible to infer that most students had difficulties with mathematics content, such as algebraic expressions (38.88%) and trigonometry content (50% of the class had difficulty), respectively. Based on these results, a class was given to the aforementioned class on trigonometry content. In this class, students were able to recall some concepts such as sine, cosine, and tangent, which were used in the electrical engineering course subjects in an applied way.

It was also possible to provide a diagnosis of the profile of the electrical engineering class about the way they study and learn content in the area of Mathematics. Thus, most students considered themselves to have regular learning in Mathematics. Given this, it is possible to confirm the difficulties pointed out by some authors about the low Mathematical performance of high school graduates in basic learning.

Another point to be noted was the study tools used by students for mathematical calculations. Half of the class indicated that none of the tools such as applications and software were used to learn Basic Mathematics. Only part of the class described using the Math Calculator application, or they only use a calculator to perform calculations in the classroom. Discipline. Thus, it is possible to conclude that there is a need to develop new techniques or tools for learning electrical engineering content or even encourage the initiative of seminars for the development of applied themes that encompass Mathematics and the electrical engineering course.

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IMPLEMENTING THE CIRCULAR ECONOMY IN THE TEXTILE AND CLOTHING INDUSTRY: BARRIERS AND OPPORTUNITIES

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ABSTRACT

The circular economy (CE) model has been widely studied by the scientific community as a viable solution to reconcile economic growth with environmental sustainability. What exists today in the textile and clothing area is a model that extracts, manufactures, uses and discards incessantly. Through the analysis of several recent studies, this work intends to analyze what has been produced in the literature to point out the barriers that prevent the implementation of CE in the textile field, as well as the opportunities to execute it. Mistakes in the manufacturing process, design phase, disregard for the extension of product life cycles, as well as the need for collaboration of those involved in the supply chain, as well as the demand for product tracking, are some of the problems diagnosed. As a result, there is the identification of samples of the mistakes that have been causing environmental disasters around the world. After all, clothes and textiles accompany practically all human beings worldwide and their poor disposal has proven devastating.

Keywords: Circular Economy. Sustainable design. Textile industry.

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INTRODUCTION

For many years, threads and fibers have accompanied the life of the human being. However, this company has charged an exorbitant price. It is not only waste that textile production causes. The process used for its manufacture has serious consequences for the environment, such as excessive use of energy and water, in addition to causing chemical pollution, soil degradation, and emissions of harmful gases (SHIRVANIMOGHADDAM et al., 2020; HUANG et. al, 2021; KAZANCOGLU et. al, 2020).

When linked to the linear system of consumption, the concern with the abundant generation of waste rises in the face of the fact that we have finite resources on our planet. What is seen in this model is the manufacture of products that extract natural resources, are manufactured, little used and discarded (FRANCO, 2017). To this end, environmental capital is disregarded, prioritizing consumption and revenue generation in order to correspond to ephemeral desires.

In this sense, *fast fashion* poses a threat, as it is responsible for about 10% of all global carbon emissions (WEF, 2023). Producing parts in huge quantities, quickly and at an affordable price (CHEN et al. 2021; IKRAM, 2022), contributes to the consumer believing that they are buying disposable products (RATHINAMOORTHY, 2019). This causes clothes and textile products to generate an uncontrollable production of toxic waste, ending up in landfills or being incinerated (FISCHER; PASCUCCI, 2017). For example, companies such as the multinational Zara launch 24 collections per year (KOSZEWSKA, 2018).

However, the literature has been presenting something that seems to be able to put an end to this pattern. The Circular Economy (CE) model has been widely discussed as a way to eliminate these problems, through the zero waste culture (SAHA; DEY; PAPAGIANNAKI, 2021; FISCHER; PASCUCCI, 2017; KAZANCOGLU et al., 2020; KAZANCOGLU et al., 2022; KOSZEWSKA, 2018). This debate goes hand in hand with the need for a more sustainable and environmentally balanced life (KAZANCOGLU, 2020).

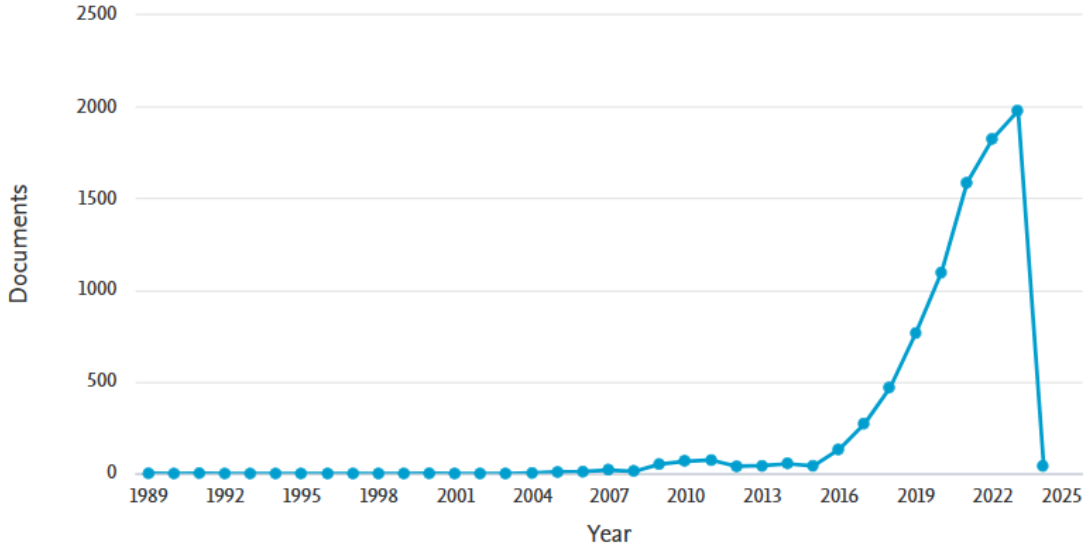
Kirchherr et al. (2023) analyzed 221 definitions of CE to understand what are the current understandings of its concept in the scientific community. They concluded that CE is a regenerative economic system that should replace the concept of end-of-life, among other possibilities, with reuse, with the objective of maintaining value and sustainable development for the benefit of current and future generations. CE is synonymous with a regenerative industrial economy without the use of virgin raw materials (FRANCO, 2017), giving meaning to waste, which becomes a resource (JIA et al. 2020). In view of this, abandoning the linear consumption model seems to be essential.

JUSTIFICATION

The work is justified by the urgency of finding elements that bring a feasible result to a serious problem that has confronted the world as a whole. The implementation of CE can represent a hope that brings strength to the search for a life in a world closer to sustainability. For this, it must be scrutinized and no one better than the scientific community to compile and critically process works that focus on this objective.

The EC study has attracted the attention of researchers around the world. In consultation on the Scopus platform in the title of articles, 8,583 documents were found, 1,979 in 2023 alone.

Figure 1 – Number of papers that contain the term Circular Economy in the title in the Scopus database.

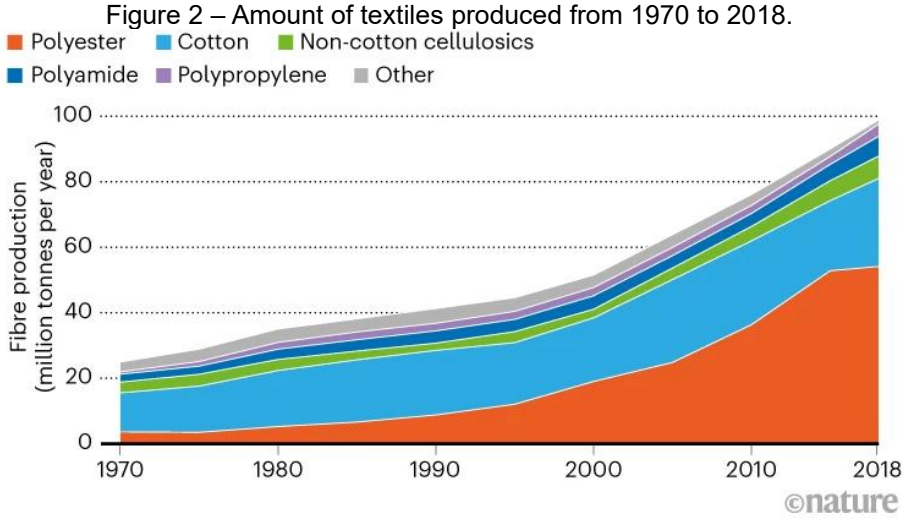


Source: SCOPUS, 2023.

Much of the value of labor lies in the fact that in the last 20 years, the use of textile products has grown from 7kg to 13kg per person annually, representing a total of 100 million tons per year consumed worldwide. However, although these numbers are expressive and apparently financially positive, they contrast with the fact that more than 60% of textile waste is treated as garbage and only 15% is recycled (SHIRVANIMOGHADDAM et.al, 2020). There are about 92 million tons produced every year that end up in landfills or incinerated, which is raw material that could be reused (SAVAGE, 2022). Between 2000 and 2015, world clothing production doubled, but the average number of times garments were worn before being discarded decreased by 36% (NATURE, 2022; WEF, 2023). The textile industry is considered one of the most polluting in the world, along with civil construction, transportation, and the food industry (LEAL et al., 2019). Around 35% of microplastics dumped into the waters come from the textile industry (EUROPEAN PARLIAMENT, 2023).

Globally, textile production has been growing since the 1970s. The fiber that grows the most is polyester (SAVAGE, 2022).

Figure 2 – Amount of textiles produced from 1970 to 2018.



Source: (SAVAGE, 2022).

Not even natural fibers come unaccompanied by harmful effects on the environment. To give a practical example, to make a single cotton T-shirt, 2,700 liters of water are needed, enough to meet the needs of a person for two and a half years (EUROPEAN PARLIAMENT, 2023). The use of pesticides, herbicides and fertilizers in the cultivation of natural fibers is high (FRANCO, 2017; PATTI; CICALA; ACIERNO, 2021). In addition, according to Giacomin, Soares and Pacca (2022), for every 1 million dollars demanded in textile products, there is a global emission of 643.6 tCO2e.

Therefore, generating more and more textile products is incompatible with a healthy life. The world needs to be aware of the fact that linear consumption needs to come to an end, and it is elementary and urgent to close the consumption circuit. The topic has been researched in several renowned scientific journals around the world, as shown in the table below. Hence the need to bring this possibility closer to our reality through existing studies and to follow the unfolding of the world literature.

SYNTHESIS OF THE FUNDAMENTAL BIBLIOGRAPHY

Textile fibers can be divided into two main categories. On the one hand, natural ones, such as cotton, wool, sisal and silk, among others. On the other hand, there are synthetic fibers, such as polyester, *nylon* or acrylic, to exemplify. The latter are not biodegradable and, as they are very small in size, they are more harmful than plastics, and can dump microplastics into waterways (IKRAM, 2022). In addition, synthetic fibers are

extracted from non-renewable sources and use fossil fuels. They represent more than 68% of current fibers (CHEN et al., 2021).

Going further, there seems to be a lack of commitment to fostering initiatives that question the manufacture of textile products. To cite a practical case of this disregard, it is currently easy to find textiles made with mixed fibers on the market. However, mixing them can be harmful. Polyester-based fibers, an umbrella term for petroleum-derived materials (SAVAGE, 2022), commonly come mixed with natural fibers. This makes the recycling process difficult, in order to maintain the quality of this post-consumer waste (FRANCO, 2017; JIA et al., 2020; SANDVIK; STUBBS, 2019; PATTI; CICALA; ACIERNO, 2021; LEAL et al., 2019; KAZANCOGLU et al., 2022; KOSZEWSKA, 2018).

In the case of the mixture of isolated synthetic fibers, it is possible to recycle them through a process that breaks them down chemically. After this, they are fused into new fibers with properties exactly similar to virgin fibers. However, this process is expensive and, therefore, recycled fibers will be priced higher than the original ones (CHEN et al., 2021; DISSANAYAKE; WEERASINGHE; 2021). It is important to note that synthetic fibers are more polluting, dumping three times more carbon dioxide into the atmosphere than natural fibers (RATHINAMOORTHY, 2019; IKRAM, 2022).

The design of the fibers plays an essential role, since it is responsible for its destiny. Commonly, if a product is generated with low-quality characteristics, it loses added value when recycled and has to be used in lower-priced goods, such as elements used in thermal and acoustic insulation, cushion filling, in the production of bricks (SHIRVANIMOGHADDAM et al., 2020; SANDVIK; STUBBS, 2019; DISSANAYAKE; WEERASINGHE; 2021), stuffing for teddy bears, shoe insoles, for carpet bases (LEAL et al., 2019), mattress filling (CHEN et al., 2021) or cleaning cloths (WEF, 2023).

When fabrics have quality in their first life, the greater the possibility of them being used to make new fabrics of greater value (FISCHER; PASCUCCI, 2017). Therefore, thinking about creating durable goods and extending life cycles should be a goal from the beginning of the design of a textile product (FISCHER.; PASCUCCI. 2017; SHIRVANIMOGHADDAM et al., 2020; SANDVIK; STUBBS, 2019; FRANCO, 2017; CHEN et al., 2021, RATHINAMOORTHY, 2019; DISSANAYAKE; WEERASINGHE; 2021). Creating items made to be reused has to be a function of the *designer* from the conception of a good (GOLÇALVES-DIAS; YUMNA; CIPRIANO), since about 80% of the environmental impact of a product is determined in its design stage (DISSANAYAKE; WEERASINGHE; 2021). The ease or difficulty that recycling partners will encounter will be determined from the choice of

materials, dictating their possibility of separation, for example (FRANCO, 2017; KAZANCOGLU et al., 2022; KOSZEWSKA, 2018).

When creating the product, the *designer* must keep in mind that his choices may include his work in the possibility or impossibility of being part of a circular system. The choice of environmentally compatible raw material with recycling and non-hazardous disposal, selection of dyes, solvents and finishes will be decisive in defining their entire life cycle, and may make it less likely that they will end up in landfills (KOSZEWSKA, 2018; JIA et al., 2020). Businesses have to be thought of, from the beginning, to be circular (NATURE, 2022 – author not informed). However, *design* for an extended life or for a second life is rarely taken into account (LEAL et al., 2019). Therefore, the components of a commodity are decisive, affecting the variety of new goods that can be developed with their existing resources (JIA et. al, 2020). It is designing thinking about dismantling (DISSANAYAKE; WEERASINGHE; 2021).

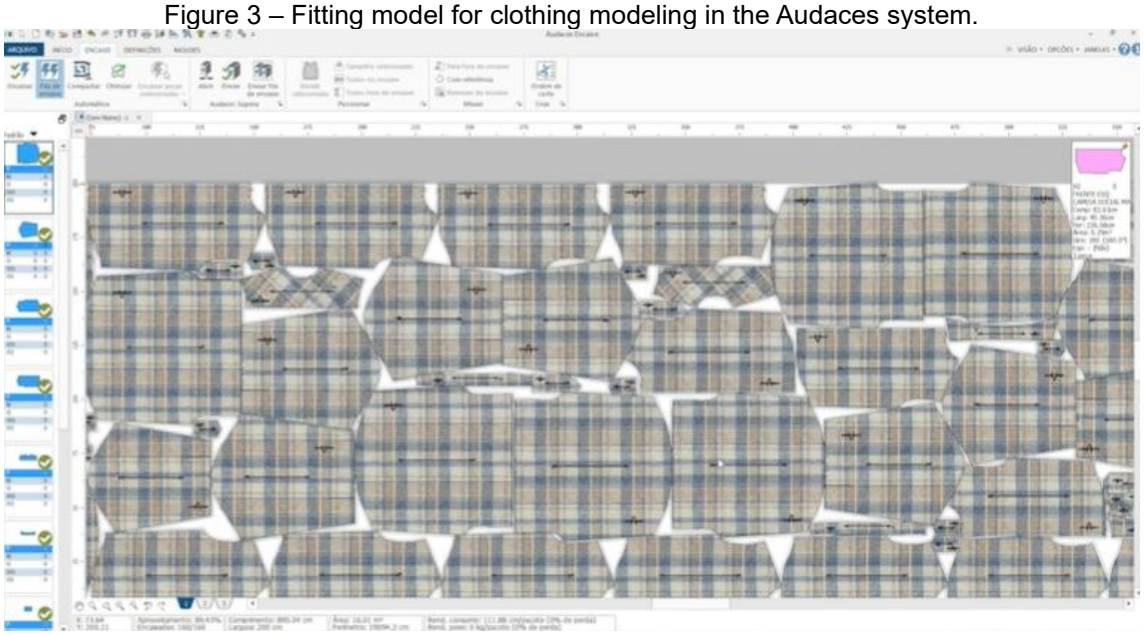
Following this logic, the more components a product has, the more challenging its circularity process will be (KAZANCOGLU et. al, 2020). After all, in addition to fabric, clothes can carry trimmings, zippers and labels that are difficult to recycle (SANDVIK; STUBBS, 2019). It is a complex mixture of materials, not only different natural and synthetic fibers, but also dyes and chemical coatings, which must be separated (SAVAGE, 2022). A bra has fins, fabrics of different compositions, foam cups and rings, for example (FRANCO, 2017). In this way, the need to train specialized personnel is also essential. For Kazancoglu et al. (2022), the textile recycling process requires significant knowledge in order to deal with different components and materials existing in this process.

In this case, only the elements contained after the production of the product are being considered. Before this, the dyeing process pollutes the soil, water, and atmosphere due to the large amount of toxic waste used (LEAL et al., 2019). There are also phases of fiber production, yarn production, pre-treatment, printing and finishing. Again, during them, toxic chemicals, excessive water use, atmospheric emissions, or abundant energy consumption may be present. In addition, companies producing textile materials are often located in countries far from consumers. In order for them to reach their final destination, fossil fuels are used, ensuring more pollution. To make matters worse, it is common for products to come packaged in non-biodegradable plastic bags (PATTI; CICALA; ACIERNO, 2021).

Going further, the fit of the modeling also plays a fundamental role. An elementary process in the manufacture of a garment can be responsible for about 15% of fabric

disposal (DISSANAYAKE; WEERASINGHE; 2021). *Modeling* nesting software such as Audaces Encaixe (AUDACES, 2023) can reduce this waste.

Figure 3 – Fitting model for clothing modeling in the Audaces system.



SOURCE: Audaces, 2023.

In addition to thinking about the concrete manufacture of a fabric, to achieve circularity, there must be collaboration between the supply chain (CS) and the partners involved in it, in order to create innovative materials (JIA et al., 2020). For this, new business models must also be conceived (FRANCO, 2017; LEAL et al. 2019; KAZANCOGLU et al., 2022; KOSZEWSKA, 2018; EUROPEAN PARLIAMENT, 2023; DISSANAYAKE; WEERASINGHE; 2021). To adopt a circular model, companies must establish a relationship with each other, reformulating property rights and laws, jointly identifying sustainable solutions (FISCHER.; PASCUCCI. 2017), in addition to promoting the emergence of industrial, technological and classification standards common to all of them (LEAL et al., 2019). For this to occur, the governmental role can also be decisive, creating laws that encourage standardization to achieve sustainable practices (DISSANAYAKE; WEERASINGHE; 2021).

Textile CS is long and involves different participants. They are *designers*, raw material suppliers, clothing manufacturers, brand owners, merchants and retailers. The improvements that lead to CE require that all those involved, directly or indirectly, are integrated in terms of standardization, collaboration, communication, and coordination, avoiding loss of control or trust among them (KAZANCOGLU et al., 2022).

In order to create standards, initiatives such as Cradle to Cradle (C2C) are welcome. C2C is a certification program conferred by the non-profit organization Cradle to Cradle

Products Innovation Institute for producers who intend to implement CE. Since 2005, when it began, the program has already granted more than 400 certifications for materials, products and systems in the areas of civil construction, interior *design*, paper and textiles, among others, for those who intend to optimize their materials and the *design* of their products (FRANCO, 2017; FISCHER.; PASCUCCI, 2017).

Saha, Dey, and Papagiannaki (2021) highlight that, in addition to the technical and technological difficulties that discourage the implementation of CE, the excessive focus on becoming financially viable intimidates the investor. Low-cost manufacturing is often accompanied by cheap labor in large quantities, in countries that prioritize economic performance over environmental commitment. For Dissanayke and Weerasinghe (2021), many entrepreneurs do not see waste as a resource, since recycling is often more expensive than buying new raw materials.

With a globalized, complex and extremely fragmented CS, with several *stakeholders*, the textile sector needs communication, engagement and commitment among stakeholders (DISSANAYAKE; WEERASINGHE; 2021). After all, there are many cases in which the same textile product is produced in different countries, subject to different laws, which makes it necessary to have a record of the processes that accompanied its design. For example, a chemical component may be allowed in one country and banned in another.

In this sense, product tracking is also a necessity. The use of technology can facilitate this process in order to make it feasible to know the location or condition of an asset, enabling its reverse logistics, wherever it is (FRANCO, 2017; DISSANAYAKE; WEERASINGHE; 2021). This can be done by placing bar codes and radio frequency identifiers (FRANCO, 2017) so that, at the end of the cycle, it is possible to know the composition of the material used and other manufacturing conditions (JIA et al., 2020; KAZANCOGLU et al., 2022). The transparency allowed by digitalization makes it possible to create product identification standards for the moment they are to be recycled (SANDVIK; STUBBS, 2019).

In cases like this, *Blockchain* technology can be a tool capable of providing traceability and transparency to CS (IKRAM, 2022). It allows you to record, in an auditable and secure way, information such as origin, what materials it contains or certifications granted to that product. *Blockchain* is capable of providing *compliance*, transparency, traceability, error reduction, among other advantages such as archiving important information throughout CS (LEAL et al., 2019).

What seems to be a problem, in fact, is a great opportunity. For the European Commission, the reuse of waste through EC can even represent a financial advantage. For

her, the reuse of waste and the "implementation of additional measures to increase resource productivity by 30% by 2030 could increase GDP by about 1%, while creating more than 2 million jobs" (EUROPEAN COMMISSION, 2023).

For all the above, it is clear that it is essential to face the current reality of textile disposal and the possibilities of mitigating losses and knowing the opportunities that it entails. Academic studies on the subject have been produced worldwide, offering the opportunity to research this scenario within academia with current information.

OBJECTIVES

The main objective of the project is to answer the following question: what are the barriers and opportunities for the implementation of CE by the textile industry? Thus, this study intends to scrutinize the literature and studies focused on this purpose, presenting components to find the answer to this guiding question.

After all, there is no more time to learn from mistakes. Otherwise, the consequences can be disastrous. There is no more time to make mistakes. Planet Earth has limited resources and it has responded, in practice, to the aggressions it has been suffering. Climate change is a response to every offense to the environment. The result is constant flooding, drought or excessive heat, for example.

MATERIALS AND METHODS

A systematic review was carried out and the preliminary review pointed out works, mostly in English, all seeking to outline the problems and resources available for the implementation of CE in the textile area. The general objective was to map what has been worked on CE in the textile field worldwide, since, in order to find the solution, it is necessary, first of all, to diagnose this lesion that has affected the whole world in such a resistant way. For this, it is essential to establish possible paths for consumption so as not to cause environmental degradation. The specific objectives are to recognize the general characteristics of the researched field, the world textile scenario, to demonstrate the aggressive potential to the environment of the textile area, to briefly define the CE, as well as to quantitatively contextualize the consumption of textiles in the world.

In view of this, the project, of a descriptive exploratory nature, adopted a systematic literature review method. This type of research allows for a comprehensive, transparent analysis with reflective interpretation (OKOLI; SCHABRAM, 2010). The focus was not to exhaust the bibliometric analysis on the subject, but to know the general characteristics of the problem, as advised by Silva (2017).

For the systematic review of the literature, the Web of Science and Scopus databases were used. The choice for these platforms lies in the fact that they contain a vast number of journals, all peer-reviewed, published continuously, and capable of reaching an international audience. The inclusion and exclusion criteria followed the table below:

Table 3 – Criteria for Systematic Review of the Project's Literature.

FIELDS SEARCHED	*Abstract* and title
SEARCH STRING	*Circular* AND *economy* AND *textile*
INCLUSION CRITERIA	Peer-reviewed articles that dealt with textiles, open access, or were available using VPN, and that were cited more than 50 times.
EXCLUSION CRITERIA	Articles from the materials area.

Source: prepared by the authors, 2023.

As a result, after the systematic review, 11 articles were found, published between 2017 and 2022.

Table 4 – References and number of citations of each article included in the Systematic Review of Literature.

DATABASE	AUTHORS	TITLE	NUMBER OF CITATIONS
Scopus	Saha, K; Dey, P; Papagiannaki, A. (2021)	Implementing circular economy in the textile and clothing industry	55
WoS			58
WoS	KOSZEWSKA, M. (2018)	Circular economy – chalenges for the textile and clothing industry	107
Scopus			132
WoS	Shirvanimogaddam, K.; Motamed, B.; Ramakrishna, S.; Meenu, N. (2020)	Death by waste: Fashion and textile circular economy case	152
WoS	FISCHER, A.; PASCUCCI S. (2017)	Institutional incentives in circular economy transition: The case of material use in the Dutch textile industry	175
Scopus			218
WoS	FRANCO, M. (2017)	Circular economy at the micro level: A dynamic view of incumbents' struggles and challenges in the textile industry	196
Scopus			246
WoS	SANDVIK, I; STUBBS, W. (2019)	Circular fashion supply chain through textile-to-textile recycling	107
Scopus			128
Scopus	PATTI, A.; CICALA, G.; ACIERNO, D. (2021)	Eco-sustainability of the textile production: Waste recovery and current recycling in the composites world	63
WoS	KAZANÇOĞLU, İ.; KAZANCOGLU, Y.; HERO A.; YARIMOGLU, E.; SONI, G. (2022)	Investigating barriers to circular supply chain in the textile industry from Stakeholders' perspective	52
WoS	KAZANÇOĞLU, İ.; KAZANCOGLU, Y.; YARIMOGLU, E.; HERO A. (2020)	A conceptual framework for barriers of circular supply chains for sustainability in the textile industry	60
Scopus			72
Scopus	JIA, F.; YIN, SY.; CHEN, L.; CHEN, X. (2020)	The circular economy in the textile and apparel industry: A systematic literature review	254

WoS	LEAL, W.; ELLAMS, D.; HAN, S.; TYLER, D.; BOITEN, VJ.; PACO, A.; MOORA, H.; BALOGUN, AL. (2019)	A review of the socio-economic advantages of textile recycling	135
Scopus			166

Source: prepared by the authors, 2023.

The authors decided not to use statistics and numbers provided by the authors systematized before 2020, since the year of publication of the articles could compromise their temporal reliability. To this end, material was collected from globally recognized gray literature sources, such as the European Parliament, the World Economic Forum, and the European Commission, all from 2022 to 2023.

It is important to emphasize that the date of publication of the analyzed articles is quite recent, showing the topicality of the theme.

Table 1 – Studies studied in this project, as well as year and journal of publication.

JOURNAL	2017	2018	2019	2020	2021	2022	2023
Nature						2	
Resources, Conservation and Recycling							1
Circular Economy and Sustainability					1		
Journal of Cleaner Production	2		1	1			
Green and Sustainable Chemistry						1	
Sustainable Development					1		
International Journal of Logistics-Research and Application						1	
Materials Circular Economy					1	1	
Autex Research Journal		1					
Polymers					1		
Circular Economy in Textiles and Apparel			1				
Business Strategy and the Environment					1		
Journal of Fashion, Marketing and Management			1				
Science of Total Environment				1			

Source: prepared by the authors, 2023.

CONCLUSION

Linear consumption disregards environmental capital, so it extracts natural resources, manufactures them, and discards them. However, it is essential to replace this model with CE, which allows for the reconciliation of economic growth and sustainable development, since a change in basic logic becomes paramount: garbage must be transformed into a resource. The current textile system represents a huge burden for the whole world.

Globally, since the 1970s, textile consumption has almost quintupled (SAVAGE, 2022). The result is a gigantic generation of non-recycled waste, contamination of the seas by microplastics and aggressive chemicals. According to the World Economic Forum, the

textile and apparel industry is responsible for 4% to 10% of global carbon emissions, which could rise to 26% by 2050 (2023). The disarray, disrespect or ignorance of the producer market causes natural fibers to be mixed with synthetic ones, in a way that makes recycling practically impossible. Low-quality goods are created unlimitedly, resulting in products that, at the end of the first life cycle, are already fated, at best, to be recycled in the form of objects of lesser value, such as pillow filling, for example.

The great contribution of the article is to question new ways of producing, but for this, information and concrete data are needed. For example, the timing of the *design*, as demonstrated, is decisive. The stage of the project is definitive to decide the history of an object, whether its end will be reborn in the form of a new article or whether it will be dumped in a landfill. Product life cycles can be extended and this depends on those who create them. However, little is studied on the subject. The need for collaboration of those involved in the supply chain, in addition to the demand for product tracking, are some of the problems diagnosed. Generating less waste is possible using technology, trained human capital, developing business models that allow reuse or recycling through tools that provide information about the item to be remanufactured, such as *blockchain*.

The general and specific objectives were met, resulting in a frightening panorama. Due to negligence or lack of knowledge or, worse, the union of the two, environmental capital is being despised in a field that is practically omnipresent around the world. Clothing and textiles are embedded in every human being. Therefore, it is necessary to face this reality head-on in order to find ways out of a problem that is planetary. What has happened so far is indifference, as if a textile product or clothing were something superfluous, but they are not.

Finally, it is important to consider the growing awareness of consumers about what they buy. The industry is responsible for manufacturing, but the choice and demand are generated by the customers. Thus, transparency in the sharing of data on SC between them seems to be essential (GIACOMIN; PACCA, 2021).

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EPIDEMIOLOGICAL PROFILE OF NURSING STUDENTS AT A PUBLIC UNIVERSITY: A FOCUS ON MATERNITY

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ABSTRACT

Motherhood can generate great challenges for students in the health area, since the child requires affection, time, attention and care together with the extensive study routine and workload imposed by the training process. This study aimed to evaluate the epidemiological profile of nursing students along with the impact of motherhood on academic performance, and to analyze the main perceptions, motivations and challenges during academic training. This is a descriptive, cross-sectional study with a quantitative approach. It was possible to conclude that the students who are mothers have particular difficulties when experiencing motherhood and dealing with graduation, having limitations regarding the two workdays study/maternity.

Keywords: Teaching. Students. Nursing. Profile. Motherhood.

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INTRODUCTION

Public educational institutions, managed by the State, meet the basic needs of society, which is education, being present in the largest centers in the country. The university concentrates a stock of technical and scientific knowledge available to a country and this stock is divided between written material, human capital and research records, but the identity of the university is inserted in its representativeness in society and its participation in social transformations (Senkevics, 2019).

As stated by Tartaruga (2010), universities have an important role in research and services to the community, with the knowledge generated, the main product for professional training. In addition to education, the institutions train qualified labor in the most different areas and also requalify the workforce already inserted in the market with the improvement of productive activities.

The process of academic training in undergraduate studies is directly linked to the quality and lifestyle of an individual, as it requires a study routine at a university, which ranges from an academic position of ups and downs, to dictate their academic index, as well as their emotional, physical, social and economic status, their financial acquisition, marital status/relationship, and number of people per family, such aspects influence thoughts of others, thus acquiring a perception of profile (Hill, 2018).

As every university receives and welcomes students from various places and cities in the country, such as neighboring regions and municipalities, there may be locomotor and financial difficulties regarding the journey to the institution, calling into question the mental and emotional health of these students, who are far from their families (Ly, 2020).

When passing a public university, and starting an academic life, there are changes and interventions in behavior and thoughts, interfered routine and adaptation of coexistence (Brito, 2016). Generating several stressors, from financial issues, teaching and assessment concerns, anxiety, conciliation of work and study (Acharya, 2018). And, it was stated in a recent literature review that evaluated the prevalence, severity, and factors associated with depression in university students, that fears, boredom, uncertainties, concerns about health, family, and financial loss have increased with the covid-19 pandemic, currently influencing the scenario of academics in institutions (Santos, 2021).

A relevant difference between universities is the characteristics between full-time and part-time students, as they differ in terms of work, housing, food, family support, social life and means of transportation. Students in each period have opposite difficulties and facilities (Júnior, 2022).

In the midst of such a dispute for insertion in the academic environment, winning a place becomes the beginning of the realization of a dream and the expectation of new experiences. However, concomitantly, difficulties may arise along the way, such as ignorance of the academic routine that does not match the reality of the expectations created (Bruffaerts, 2018).

Thus, the academic experiences experienced by university students become predictors that can directly influence the student's development, whether or not they remain in the course and even in the higher education institution (Al-Khani, 2019).

In this same scenario, it is important to emphasize that the university is one of the most desired fields by women in this century, even facing challenges with motherhood, as it makes it possible, through higher education, to take the first step towards learning and achieving professional recognition (Santos, 2014).

Vieira, Souza and Rocha (2019) observed that university mothers have feelings such as stress, powerlessness and lack of motivation, and that they are more susceptible to interrupting or giving up academic training because they do not have the necessary social support. Therefore, having an adequate social and institutional support network is necessary for these young women to be able to reconcile the demands of motherhood, as well as to persist and resist at university (Moreno, Duarte, D'affonseca. 2020). The institutional support network is ensured in Brazil, by legal aspects, according to the federal constitution, the student in a state of pregnancy is guaranteed the regime of home exercises instituted by Decree-Law No. 1,044, of 1969 (Brasil, 1975).

However, the right to exceptional treatment is given to the student, so that the educational institution becomes responsible for monitoring the home exercises, as compensation for absence from classes, in a period of three months, from the eighth month of pregnancy. This leave may occur for a longer period in particular cases, proven by means of a medical certificate (Brasil, 1975)

In Brazil, another epidemiological study, nationwide with a larger audience in the Northeast region, identified in its results that medical students with children, despite reporting limited ability to associate personal and academic tasks and responsibilities, were proud of the double shift, in addition to presenting academic performance similar to that of students without children. They also highlighted that the support network is essential for carrying out academic activities (Brito, 2021).

In this context, this research is justified by the importance of knowing the profile of academics, providing higher education institutions and managers, technicians and professors with the ability to develop and implement strategies aimed at social issues of

academics. And, in this way, contribute to the degree of learning, reduce the dropout rate and even propose new financial aid that will help keep students in their respective courses.

In addition, the results found in this investigation can bring contributions to scientific and social knowledge, helping in the elaboration of strategies that can intervene in the biopsychosocial scope of these academics, and the construction of strategies for institutional policies of student support at the local and macro levels, in the face of motherhood.

The results of this research may bring advances in scientific knowledge, as it will serve as content to support the development of actions that provide improvements for the students who make up this institution, also contributing to the establishment of scientific evidence on the profile of pregnant students and mothers and the difficulty they face to attend higher education, in addition to establishing possible strategies to reduce these difficulties.

Thus, the present proposal seeks to evaluate the profile of nursing students at a public university in the state of Mato Grosso, and other factors such as maternity during this period.

METHODOLOGICAL PROCEDURE

TYPE OF STUDY

This was a descriptive, cross-sectional study with a quantitative approach. Descriptive research aims to describe the characteristics of a given population, and this group includes research that aims to survey the opinions, attitudes and beliefs of a population (Marconi, 1996). The cross-sectional observational study performs the analysis of quantitative data collected over a given period of time. Data are collected from a sample population or in a predefined subset that have common characteristics, except for the variable being studied. This variable is the one that remains constant throughout the study (Medronho, 2006).

PLACE OF STUDY

This is a matrix study, carried out at the University of the State of Mato Grosso Carlos Alberto Reyes Maldonado (UNEMAT), a state public higher education institution, founded on July 20, 1978, in Cáceres, Mato Grosso. Based on Law No. 703, Municipal Decree No. 190 was published, creating the Institute of Higher Education of Cáceres (IESC). Currently, it offers undergraduate, graduate and extension courses in all areas of knowledge, in the face-to-face and distance modalities, has more than 22,000 students

enrolled, more than 1,340 professors, 140 undergraduate courses and 52 units in the state of Mato Grosso; among them is Diamantino-MT, located in the northern mesoregion of Mato Grosso and in the Parecis microregion, 184km from the state capital, Cuiabá-MT, and consists of 4 undergraduate courses: Nursing, Law, Physical Education and Administration (Unemat, 2022).

The nursing course is currently offered in a bachelor's degree, and is the only course on the Campus offered with a full workload.

STUDY POPULATION

The research is part of a matrix project entitled "Profile of students from a public university in the state of Mato Grosso" that was carried out with all students of the Nursing course at UNEMAT on the campus of Diamantino - MT. The population selected for this study were students duly enrolled in the nursing course, with a total of 309 students in the 2023/1 academic semester, of which 78 accepted and participated in the research. The population chosen was the nursing course, as it has more women than other courses provided at the institution.

The inclusion criteria were defined: Be duly enrolled, with an active link; students from the 1st to the 10th phase; age equal to or greater than 18 years; being a mother; accept to participate by signing the term the Informed Consent Form - ICF.

The exclusion criteria were students who had communication difficulties (aphasia, cognitive impairment and severe hearing loss); away from academic activities due to illness and/or who were in institutional exchanges.

STUDY VARIABLES

The study variables come from the following digital instruments: I) Research questionnaire, containing: sociodemographic profile, housing, education and health conditions and II). A scale to evaluate the quality of research teaching at this institution, respecting the disciplines of each student's semesters.

Instrument I. Identification, enrollment number, which course is enrolled, which semester he was attending.

Block A: (Sociodemographic Profile): Gender, Date of birth, PWD, weight, height, marital status? Do you live in Diamantino? If not, which municipality. Age of the children? Did you get pregnant in college? Do you use contraception, if so, which one? How do you go to college? Do you have children, if so many? Where do children stay when they are in

university? Did you get pregnant in college? Are you pregnant? If so, what period? Do you perform prenatal care in Diamantino?

Do you think pregnancy interferes with your graduation? Do you use contraception, if so, which one? Do you have family support or support network? What are your difficulties in dealing with motherhood and graduation? How *do you* classify yourself in terms of color or race? What is the family's monthly income?

Block B: (Teaching): Have you ever thought about giving up the course? If so, for what reason? What made it continue? Did you receive support or seek help? Do you have internet at home? Do you use any digital resources for studies? (notebook, tablet and cell phone).

Block C (Health Conditions): How do you evaluate your health today? Have you been diagnosed with any chronic disease: hypertension, hypertension, diabetes mellitus DM, obesity, asthma or bronchitis, cancer what type, chronic kidney diseases, COPD, cardiovascular disease? Do you have a diagnosis of any mental health problems? Do you use any medication? Do you use the SUS or do you have any health insurance? Do you have little interest or pleasure in doing the things that involve training? Have you ever felt down, depressed or without perspective with the training course? Do you have leisure?

Block D: Are you satisfied with your sleep? What time do you usually go to sleep? What time do you usually wake up to go to college? How many hours do you sleep a night? Which semester did you have the most difficulty with sleep? Do you feel tired when you wake up and during the day? Would you say that sleep deprivation alters your academic performance?

DATA COLLECTION

Data collection was carried out through an electronic self-administered questionnaire, created on the *Google Forms platform* and sent to the students of the university's nursing course, through the e-mail of the course coordination, so that access to these students could occur in a comprehensive way. The date of the start of data collection occurred in the first half of 2023.

One of the strategies used to capture the largest possible number of answers was the active search during class hours, in the classrooms of each semester. The use of class leaders to share the link in WhatsApp conversation groups was also a great ally for this research, as well as the use of this communication application to access more students to gain access to the link.

ORGANIZATION AND ANALYSIS OF DATA

The data were typed and organized into a table in the *Microsoft World program.*

Then, the data were exported, processed and analyzed in the IBM SPSS *Statistics Base* program (version 22.0). The variables were described using absolute (n) and relative (%) frequency tables and mean values (means, medians, standard deviations, and interquartile range).

ETHICAL CONSIDERATIONS

All ethical aspects in research with human beings were respected, in accordance with Resolution No. 466/2012 of the National Health Council (CNS). This study was approved by the Ethics Committee for Research with Human Beings in the Health Area of the State University of Mato Grosso under Opinion No. 6,079,034, in May 2023. All participants signed the informed consent form (ICF).

RESULTS

SOCIODEMOGRAPHIC CHARACTERISTICS

The data of the present study were organized through the analysis of the 78 questionnaires answered by the nursing students. The characteristics of the study population were predominantly composed of female students, totaling 65 (83.3%) women who answered the questionnaire. Regarding race/color, about 50 students (64.1%) answered that they were brown. By age, 65 (83.3%) students with a higher prevalence of age between 18 and 29 years. Regarding marital status, 56 (71.8%) students answered that they were single. About 19 (24.3%) answered that they have children, where 15 (19.2%) have between 1 and 2 children, and 4 (5.1%) have more than 2 children. However, 2 (2.6%) students who answered that they had children were men. Regarding the age of their children, 15 (19.2%) said that they are between 1 and 10 years old. Regarding family support, 40 (51.2%) students answered that they have family support and/or family support and 30 (48.8%) do not have any support. Regarding the monthly family income, the result was that 25 (32%) nursing students have an income of 1 to 2 minimum wages, followed by 23 (29.4%) students with 1 minimum wage, 3 (3.9%) students with no income (Table 1).

Table 1 - Sociodemographic characteristics among UNEMAT nursing students. Diamantino- MT. 2023.

Variables	N (78)	%
Gender		
Male	13	16,7
Female	65	83,3
Age group		
18 to 29 years old	65	83,3

30 to 49 years old	13	16,7
Race/color		
White	15	19,2
Brown	50	64,1
Black		11,5
Yellow		
Indigenous		
Marital status		
Single	56	71,8
Married	11	14,1
Stable union	10	12,9
Widower		
Divorced		
Do you have children?		
Yes	19	24,3
No	59	75,6
How many children?		
1 a 2	15	19,2
More than 2		
Children's age		
1 to 10 years	15	19,2
11 to 20 years	11	14,1
20 years or older		
Do you have family support?		
Yes	40	51,2
No	38	48,8
What is the family's monthly income?		
No Income	3	
Up to 1 minimum wage	23	29,4
From 1 to 2 minimum wages	25	32,0
From 2 to 3 minimum wages	14	17,9
From 3 to 5 minimum wages		
From 5 to 10 minimum wages		
From 10 to 20 minimum wages		

Source: Prepared by the authors themselves, 2025.

CHARACTERISTICS REGARDING MATERNITY IN UNDERGRADUATE COURSES

Regarding motherhood during graduation, of the 78 students, 83.3% are female. A total of 2 are pregnant (3.1%). Of these women, 35 (53.8%) use contraception and 30 (46.2%) do not. Of those who are mothers, 15 (23.1%) answered that they have someone to leave their child with and only 2 (3.1%) stated that their children are alone while they are in college. When asked if these women became pregnant in college, 57 (87.7%) women answered no, a total of 8 (12.3%) reported that they became pregnant in college. In this same context, when asked if motherhood interferes with undergraduate studies, 41 (63.1%) women answered no, while 24 (36.9%) reported that it does, that motherhood interferes with the undergraduate period (Table 2).

Table 2 - Characteristics regarding maternity in undergraduate studies among UNEMAT nursing students. Diamantino- MT. 2023.

Variables	N (65)	%
Are you pregnant? If so, what period? Yes	2	
No	63	96,9
Do you use any contraceptive method? Which? Birth Control Pill	22	33,8
Condom		10,8
SAYS		
Injectable		
Not used	30	46,2
Where do your kids stay while you're in college? Nursery/School		10,8
Grandmother		
Father		
Babysitter		
At home, alone		
Older siblings		
Known		
If you have children, did you get pregnant in college? Yes.		12,3
No	57	87,7
Do you think pregnancy interferes with graduation? Yes.	24	36,9

Source: Prepared by the authors themselves, 2025.

When asked to the students who are mothers to describe the difficulties in dealing with motherhood in graduation, 4 (23.5%) of the 17 (100%) students described the absence in the lives of their children, 3 (17.7%) students reported the overload as a difficulty, followed by 3 (17.7%) mothers with difficulty in reconciling home/study/children, 2 (11.7%) described the lack of time for studies, 2 (11.7%) talked about the lack of a support network, 1 (5.9%) described the lack of understanding of the educational institution, 1 (5.9%) reported that the difficulty is not having someone to leave the child with, 1 (5.9%) said that the difficulty is in cases of children's illnesses (Chart 1).

Table 3 - What are your difficulties in dealing with motherhood in undergraduate studies?

Variables	n(17)	%
What are your difficulties in dealing with motherhood in graduation? Describe: Overload	3	17,7
Absence in the lives of children	4	23,5
Reconciling home/studies/children	3	17,7
Time for studies	2	11,7
Lack of support network	2	11,7
Lack of understanding of the institution	1	
Have someone to leave your children with	1	
Case of diseases	1	

Source: Prepared by the authors themselves, 2025.

DISCUSSION

The findings of this study reveal the difficulties of students who are mothers in trying to reconcile their studies at the university with the triple journey of "being a mother", wife and housewife. Thus, of the 78 (100%) students who responded to the questionnaire, 65 (83.3%) are female students, and 17 (21.8%) are mothers, who reported that motherhood

interferes in the undergraduate period, thus, there is a hegemonic perception among the female participants in relation to the influence of motherhood in their studies.

This study brought the sociodemographic profile of nursing students from a public university, highlighting a number of students who face the challenges of motherhood, and what are the difficulties they face during the undergraduate period, as well as showing studies in the states of Rio Grande do Sul (Saalfeld, 2019), Rio Grande do Norte (Cardoso, 2013), Bahia (VERAS, 2020), Espírito Santo (Fiorotti, 2010), Minas Gerais (Ribeiro, 2011), São Paulo (Pontes, 2022), Mato Grosso (Bitterncourt, 2017), Rio de Janeiro (Pessanha, 2021) and New York (Heilman, 2008).

Like Britto (2021), this study reveals the prevalence of female students in the nursing course (83.3%), as we possibly have more female engagement in research on this topic, and that, despite the considerable number of male students, it is possible to analyze a feminization of the nursing course, as well as other courses in the health area, as medicine (Cardoso, 2013). As for the guiding questions regarding age and marital status, a study that evaluated the profile of students at a medical university in Rio Grande do Norte was within the national standard, with a mean age of 19 to 24 years and marital status single, while this study evaluated the age of 18 to 29 years, with 65 students (83.3%) and 56 single students (71.8%) (Cardoso, 2013).

According to the data collected, with regard to the number of children, the majority (n=15; 19.2%) have between 1 and 2 children and only 4 (5.1%) have more than 2 children. As for the age of the children, the highest prevalence was from 1 to 10 years, thus evidencing the harsh reality of women who still have children who are children and still depend on extra attention in their daily lives, in addition to depending a lot on a support network, such as family members, daycare centers and schools to continue their studies at the university, as Rapoport and Piccinini (2004) cite, "alternative care is a requirement due to the need to work".

It can also be highlighted that the monthly income of the nursing students in this study ranged from 1 to 2 minimum wages. Taking into account that the nursing course is full-time and this can make it difficult for women to work and help with the family income, which puts them in a possible underprivileged social situation, so that this condition brings more need for a family support network or public school network, as shown in a psychology study at the University of Campinas (Pontes, 2022).

Regarding the results of motherhood in the school environment, of the 17 student mothers (21.8%), a total of 8 (12.3%) said they had become pregnant in college, a factor that is of great relevance in undergraduate studies, seen in a negative way, since several

factors can be considered during pregnancy for the interruption of the study period (Pontes, 2022). As Soares (2017) points out, the very factor of physiological changes in a woman's pregnancy state, such as malaise, pain, hormonal changes, and after that, breastfeeding, are considered unpleasant and uncomfortable to reconcile with university, often leading to abandonment of the undergraduate course. Within this same context, Saalfeld (2019) in his study reported that within the academic environment there can be judgment and lack of understanding from colleagues and professors when unexpected pregnancies occur, and this can cause students to give up due to the mishaps of motherhood.

A study carried out at the Faculty of Medicine of the Federal University of Minas Gerais (UFMG) by Ribeiro (2011), shows that the support network helps to contribute to planning within this situation experienced by motherhood/graduation, in this context table 2 brought results that the majority (n=15; 88.2%) of the students who are mothers (n=17; 100%) have someone to leave their children with, and only 2 (11.8%) have no one to leave them with, even though they are the minority, they showed feelings of guilt and frustration for often not being present at important moments in their children's lives and dividing themselves between the functions of motherhood and studies, as shown in Table 3, where 4 (23.5%) of the 17 (100%) mothers described the absence in their children's lives as a difficulty in dealing with motherhood and graduation.

Table 3 showed the difficulties reported by the mothers in relation to living with their children, 1 (5.9%) mother reported that she has difficulty in having someone to leave the child with and this is in line with the study by Pessanha (2021) who also identified that regarding the place/with whom to leave the child, it results in the academics, feelings of guilt, sadness, anguish and anxiety, thus resulting in a lack of concentration in studies due to concern for their children.

Other difficulties described by the mothers in the questionnaire were: overload (n=3; 17.7%), having to reconcile home/studies/children (n=3; 17.7%), cases of diseases (n=1. 5.9%) and lack of understanding of the institution (n=1. 5.9%), in this way, Bittencourt (2017), portrays that these situations in having to choose between family or studies, shows the trajectory of these women mothers and students within the university with so many empirical-emotional factors, in order to be able to engage in the labor market valued in the future with a diploma and graduation, translated by the student mothers of this research as a mix of emotions in relation to the reconciliation of studies with personal life, tiredness, mental exhaustion, incomprehension, due to the excessive load of studies and the self-perception about the low academic performance due to the responsibilities of motherhood.

FINAL CONSIDERATIONS

It is concluded that the students who are mothers have particular difficulties in experiencing motherhood and dealing with graduation, have limitations regarding the two study/maternity shifts. The importance of the support network to carry out academic activities is highlighted, as well as family income. Pregnancy in the academic trajectory puts at risk the permanence of these women in the academic environment and the university itself is shown to be flawed in terms of policies to help these mothers, as they do not offer a support structure adapted to this target audience. And in all studies, similarities in perceptions are noted when comparing variables such as gender, marital status, and academic cycle. Finally, despite believing that the obligations of motherhood compromise academic performance, it is possible to see the ability to satisfactorily associate personal and academic tasks and responsibilities.

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ATRIAL FIBRILLATION: DIAGNOSIS, THERAPEUTIC MANAGEMENT AND PREVENTION OF THROMBOEMBOLIC COMPLICATIONS IN CARDIAC PATIENTS

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ABSTRACT

Atrial fibrillation (AF) is one of the most prevalent cardiac arrhythmias, often associated with structural heart and lung disease, and is a significant risk factor for thromboembolic complications such as stroke and heart failure. This study aims to review the diagnosis, therapeutic options, and prevention strategies for thromboembolic complications in patients with AF. The research was carried out through a systematic review of the literature, following the PRISMA guidelines, and covers studies published in the last 15 years, extracted from the PubMed, SciELO, and Web of Science databases. The diagnosis of AF is predominantly performed by electrocardiogram, which allows the identification of irregularity and high frequency of ventricular activity. Therapeutic management includes control of heart rhythm and rate, with the use of antiarrhythmic drugs, beta-blockers, and direct oral anticoagulants (ACODs). The choice of treatment is personalized, considering the clinical form of AF and the risk factors of each patient. Anticoagulation plays a crucial role in preventing thromboembolism, especially in patients at high risk of stroke. In addition to pharmacological treatments, non-pharmacological approaches such as electrical

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cardioversion and ablation may be indicated in certain cases. Adherence to treatment and continuous monitoring are essential to reduce complications and improve the quality of life of patients. This study also discusses the challenges and current guidelines for the effective management of AF.

Keywords: Atrial fibrillation. Diagnosis. Therapeutic management. Anticoagulation. Thromboembolism.

INTRODUCTION

Atrial fibrillation (AF) is one of the most prevalent supraventricular arrhythmias, characterized by a complete disorganization of atrial electrical activity, resulting in the loss of the effective contraction capacity of the atria. The change in atrial rhythm leads to an increase in heart rate, with the atria performing irregular, high-frequency movements, which can reach up to 300 beats per minute. This electrical disorganization is often associated with an equally irregular ventricular response, since the high number of atrial impulses that reach the atrioventricular node causes a refractoriness to subsequent stimuli. As a result, ventricular response is unpredictable and can cause a range of clinical complications, including hypotension, pulmonary congestion, angina pectoris, and loss of cardiac output efficiency.

Although atrial fibrillation can occur in previously healthy people, especially in situations such as emotional stress, surgeries, intense physical exertion, excessive alcohol consumption, or vasovagal stimuli, AF is most commonly seen in patients with structural heart and lung disease. Underlying conditions that increase the risk of developing AF include valvular heart diseases such as rheumatic heart disease, non-rheumatic mitral disease, hypertensive heart disease, and heart failure, as well as chronic lung diseases such as pulmonary hypertension and chronic obstructive pulmonary disease (COPD). These factors contribute to the structural and electrical remodeling of the heart, creating an environment conducive to the installation and maintenance of AF.

The morbidity associated with atrial fibrillation is significant and multifaceted. High ventricular rate can lead to a reduction in cardiac output, generating symptoms such as tiredness, dyspnea, and difficulty performing daily activities. In addition, AF episodes may be followed by periods of cardiac pause, which may result in episodes of syncope or presyncope, putting patient safety at risk. Another critical aspect of AF is the risk of intracavitary thrombi, especially in the left atrium, where blood stasis favors thrombogenesis. Embolization of these thrombi into the systemic circulation can result in serious complications, such as ischemic stroke, one of the most feared events in patients with AF. The loss of the contribution of atrial contraction to cardiac output also aggravates heart failure, particularly in patients with cardiac comorbidities.

In addition to physical complications, atrial fibrillation significantly impacts patients' quality of life. The discomfort generated by palpitations, the fear of the recurrence of arrhythmia episodes, and anxiety related to the risk of thromboembolic complications are factors that contribute to the psychological distress of patients. Effective management of AF,

therefore, should not only focus on controlling rhythm and heart rate, but also consider the emotional and psychosocial aspects associated with the disease.

The diagnosis of atrial fibrillation can be made through clinical examinations, such as electrocardiogram (ECG), and other complementary tests, which aim to assess the nature and severity of the arrhythmia, as well as identify associated conditions. The therapeutic management of AF includes a multifaceted approach, which involves restoring sinus rhythm, controlling ventricular rate, and using anticoagulants to prevent thromboembolic complications. The choice of treatment depends on the patient's characteristics, the comorbidities present, and individual risk factors.

Prevention of thromboembolic complications in patients with atrial fibrillation is a top priority in the management of the disease. The risk of thrombus formation is substantially increased in patients with AF, especially in those with additional risk factors such as advanced age, hypertension, diabetes mellitus, and heart failure. In this context, the use of direct oral anticoagulants (ACODs) has been shown to be an effective strategy in reducing the incidence of thromboembolic events, replacing traditional anticoagulants, such as warfarin, which require continuous monitoring and present a high risk of drug interactions and bleeding complications.

In view of the above, this study aims to conduct a comprehensive review of the literature on the most recent aspects of the diagnosis, therapeutic management, and prevention of thromboembolic complications in patients with atrial fibrillation. The evolution of treatment strategies will be discussed, with emphasis on pharmacological and non-pharmacological approaches, including cardioversion, catheter ablation and the use of anticoagulants. In addition, current guidelines and evidence-based recommendations for the management of this complex arrhythmia will be addressed, with a focus on best practices for reducing the risk of complications and improving patients' quality of life. Through this review, it is hoped to provide a solid foundation for clinical practice, as well as identify areas that need further studies and innovations in the treatment of atrial fibrillation.

METHODOLOGY

The present study is a systematic review of the literature with the objective of addressing the diagnosis, therapeutic management and prevention of thromboembolic complications in patients with atrial fibrillation. The methodology was structured according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, seeking to ensure the transparency and reproducibility of the results obtained.

The search was performed in the PubMed, SciELO, and Web of Science databases. The keywords used included combinations of the terms "atrial fibrillation", "diagnosis", "therapy", "thromboembolism", and "complications", associated by Boolean operators (AND, OR, and NOT). Specific criteria were applied to the search, restricted to articles in Portuguese, English and Spanish, published in the last 15 years, with access to the full text. In addition, recognized books in the area were also consulted to provide a broader theoretical basis and support the information presented.

Inclusion and exclusion criteria were defined based on the relevance to the theme and the methodological quality of the studies. Studies that addressed adult populations with atrial fibrillation, presenting data on diagnosis, therapies and prevention of thromboembolic complications were included. Non-systematic reviews, studies involving exclusively experimental or pediatric models, and studies that did not present quantitative data were excluded.

The selection process followed three stages. First, all titles and abstracts identified in the searches were independently screened by two reviewers. Then, potentially eligible articles were fully evaluated for adherence to the inclusion and exclusion criteria. Disagreements between the reviewers were resolved by consensus or by a third evaluator. The selection process was described in a PRISMA flowchart.

To extract the data, a standardized spreadsheet was used that included information such as authors, year of publication, type of study, population, interventions, outcomes evaluated, and main results. The methodological quality of the studies was assessed using validated instruments, such as the Newcastle-Ottawa scale for observational studies and the Cochrane Risk of Bias tool for clinical trials.

The extracted data were analyzed in a narrative manner, considering the methodological and outcome heterogeneity between the included studies. Whenever applicable, a comparative discussion was held between the results, considering the clinical impact and the recommendations of current guidelines, such as those of the Brazilian Society of Cardiology (SAMESIMA et al., 2022; TEIXEIRA et al., 2022).

RESULTS AND DISCUSSION

Atrial fibrillation (AF) is a common and frequently observed cardiac arrhythmia in elderly patients, with an increasing prevalence as age advances, especially among those with structural heart disease. It is characterized by a disorganization of atrial electrical activity, leading to an irregular and rapid ventricular response. The diagnosis is primarily made through an electrocardiogram (ECG), which reveals a heart rate between 90 and 170

bpm, with no visible P waves and irregular R-R intervals. The presence of f-waves, small irregular ripples at the baseline of the ECG, is a common feature of atrial activity during AF, reflecting disorganized atrial electrical activity.

In addition, the QRS complex on the ECG is usually narrow and similar to sinus rhythm, except in cases of conduction disorders, such as atrioventricular block. When there is intact atrioventricular conduction, the ventricular response is usually rapid and irregular, ranging between 100 and 160 bpm. This response is influenced by a number of factors, including atrioventricular nodal activity, vagal and sympathetic tone, use of medications, and the presence of accessory pathways, as occurs in Wolff-Parkinson-White syndrome, where the ventricular rate can exceed 300 bpm, which represents a high risk situation for degeneration into ventricular fibrillation.

The classification of AF plays an important role in therapeutic management. It is divided into four main categories: initial (first episode), paroxysmal (episodes of short duration, less than seven days, that cease spontaneously), persistent (episodes that last more than seven days and require intervention for reversal) and permanent (when AF cannot be reversed or chooses not to do so). Recurrent AF is characterized by two or more episodes, and may be associated with rheumatic or non-rheumatic AF, depending on mitral valve involvement, particularly in cases of rheumatic disease.

AF can also occur in young patients, with solitary or isolated AF, who usually do not have structural heart disease, hypertension, or lung disease. In some cases, AF occurs paroxysmally in patients without structural lesions, and this condition may be more frequent in people with sinoatrial nodal syndrome or Wolff-Parkinson-White syndrome. The duration of AF episodes is a critical factor in assessing the risk of thromboembolic complications. When episodes last less than 48 hours, the risk of thrombus formation is relatively low, and reversal to sinus rhythm can be done more safely. On the other hand, when episodes last longer than 48 hours or the duration is not well defined, there is an increased risk of thromboembolism, which requires strict precautions in reversing the arrhythmia.

In terms of risk factors, systemic arterial hypertension, diabetes, valvular heart diseases, and increased atrial size are the main predictors of AF. Increased atrial size favors electrical reentry, which is an important mechanism in the pathogenesis of AF, and myocardial remodeling, with replacement of myocytes by fibrotic tissue, further compromises the electrical properties of the heart. Atrial hypertrophy also contributes to this remodeling process, making it difficult to recover sinus rhythm. Accurate diagnosis and classification of AF is essential for the choice of appropriate treatment, including

anticoagulation to prevent thromboembolism and strategies for heart rate control or conversion to sinus rhythm.

CLINICAL AND DIAGNOSTIC EVALUATION OF ATRIAL FIBRILLATION

The initial evaluation of patients with atrial fibrillation (AF) should prioritize the characterization of the arrhythmia as paroxysmal or persistent, in addition to analyzing the tolerance to the episodes and the impact on quality of life, which is often compromised in comparison with individuals without AF in the same age group. It is essential to investigate cardiac and extracardiac factors that may act as triggers or maintainers of arrhythmia. Among the most relevant etiologies and predisposing factors, the increase in atrial pressure, associated with mitral and tricuspid valve diseases, systemic or pulmonary arterial hypertension, atrial ischemia, and fibrotic changes related to aging, stand out. Other conditions, such as myocarditis, amyloidosis, and intracardiac tumors, should also be considered.

During the anamnesis, it is essential to look for potentially reversible causes, such as alcohol consumption, recent surgeries, acute myocardial infarction, or hyperthyroidism, since management should be directed to the underlying disease. In addition, it is necessary to investigate structural cardiac diseases associated with AF, including valvular heart diseases, particularly mitral valve diseases, congenital heart diseases, dilated or hypertrophic cardiomyopathies, and coronary artery disease. Although less common in healthy young people, AF can be triggered by precipitating factors such as alcohol libation, use of adrenergic substances (cocaine, amphetamine) and electrolyte disturbances.

The investigation should also include the analysis of family history, considering genetic susceptibility to AF. Genetic mutations can cause primary electrophysiological alterations or predispose to the development of comorbidities such as hypertension, diabetes, or heart failure of familial origin. On physical examination, irregularity of the pulse, variation in the intensity of the first heart sound, and absence of the fourth heart sound (B4) are observed. Obesity, an important risk factor, should also be evaluated, especially due to the correlation between body mass index and left atrial size.

The clinical picture of AF is widely variable, determined by factors such as the underlying cardiovascular condition, ventricular rate, and loss of atrial contraction. Patients may present with palpitations, syncope, dizziness, chest pain, and dyspnea to thromboembolic phenomena or be completely asymptomatic, with the diagnosis being made in routine electrocardiographic examinations. In symptomatic cases, palpitations tend to disappear over time in patients who progress to the persistent form, whereas prolonged

episodes of AF with high ventricular response may lead to ventricular dilation (tachycardiomyopathy), especially in asymptomatic patients.

The minimum investigation includes laboratory tests such as evaluation of thyroid, renal and hepatic function, ionogram and blood count, as well as complementary tests, such as electrocardiogram (ECG), chest X-ray and transthoracic echocardiogram. Radiography allows the evaluation of pulmonary circulation and the size of the left atrium, whereas transthoracic echocardiography is essential for the functional and anatomical analysis of cardiac chambers and valves, with a sensitivity of 33% to 72% for intracavitary thrombi. In specific cases, other tests may be necessary, such as the 24-hour Holter monitor, useful to document the dynamics of the episodes and assess the mean ventricular rate. Transesophageal echocardiography, with a sensitivity of 97% to 100% for the detection of intracavitary thrombi, is a valuable diagnostic tool in more complex situations.

THERAPEUTIC STRATEGIES IN ATRIAL FIBRILLATION

The management of atrial fibrillation (AF) involves two main strategies: restoration and maintenance of sinus rhythm or heart rate control, both associated with the prevention of thromboembolic phenomena. The initial choice between these approaches depends on the clinical pattern of presentation, the patient's underlying conditions, and the reported symptoms. If the initial strategy is not successful, you can alternate between them, expanding the therapeutic possibilities. In addition to pharmacological options, invasive interventions such as catheter ablation, surgical procedures, or permanent pacemaker implantation may be considered in refractory or specific cases.

The therapeutic decision is supported by robust evidence from studies such as AFFIRM, RACE, PIAF, STAF, and HOT CAFÉ, which compared the outcomes between rhythm control and frequency control. In general, these studies did not identify significant differences in mortality, incidence of cerebrovascular accident (CVA), hospitalizations, recurrence of arrhythmias, or thromboembolic complications. For example, the AFFIRM study demonstrated similar mortality and stroke rates between the two strategies, while the RACE study reinforced the absence of significant benefits in terms of morbidity and mortality. In addition, none of these studies pointed to relevant differences in the quality of life of the patients treated.

The choice of therapeutic approach is often influenced by the patient's age and clinical conditions. In older adults with persistent AF, often associated with systemic arterial hypertension and structural heart disease, heart rate control is generally preferred, given its safety and efficacy profile. On the other hand, in younger patients, particularly those with

paroxysmal AF alone, restoration and maintenance of sinus rhythm may be more indicated, considering the potential favorable impact on quality of life and the lower risk of complications.

In cases of permanent AF, where restoration of sinus rhythm has not been possible or has not been attempted, treatment is based on close heart rate control and prevention of thromboembolic complications. This approach is currently the most adopted in clinical practice, considering the absence of consistent benefits demonstrated by the sinus rhythm maintenance strategy in comparative studies. Thus, the therapeutic focus in patients with permanent AF is on effective symptom management, reduction of adverse events, and optimization of quality of life.

PHARMACOLOGICAL CONTROL OF HEART RATE

Heart rate management in atrial fibrillation (AF) involves medications that prolong the refractory period of the atrioventricular node, resulting in reduced ventricular response. Although this reduction does not usually impair left ventricular function, there may be adverse effects, such as bradycardia and heart blocks, which, in severe cases, may require temporary pacemaker implantation. These adverse events are more common in elderly patients and those using drugs such as beta-blockers, amiodarone, digitalis, or calcium channel blockers.

The choice between oral or intravenous administration depends on the need for rapid heart rate control. In cases of inadequate response to the isolated use of medications, pharmacological combinations can be implemented, both in the acute and chronic phases. In cases refractory to medical treatment, nonpharmacologic strategies should be considered, including catheter ablation or device implantation.

Particular attention should be given to patients with AF associated with Wolff-Parkinson-White syndrome, in whom the use of agents that decrease atrioventricular nodal conduction (such as beta-blockers, digitalis, adenosine, and non-dihydropyridine calcium-channel blockers) is contraindicated. These drugs can potentiate conduction through the accessory pathway, increasing the risk of exaggerated ventricular response and possible progression to ventricular fibrillation. In this condition, the use of class I antiarrhythmics or amiodarone is preferred, provided that the patient is hemodynamically stable.

The objective of heart rate control is to achieve values close to those observed in sinus rhythm, based on the premise that lower frequencies promote better hemodynamic performance, lower risk of tachycardiomyopathy and reduction of symptoms. Traditional guidelines recommended strict goals such as resting heart rate (HR) below 80 bpm and up

to 110 bpm during moderate physical activity. Epidemiological studies have also associated high frequencies, even sinus frequencies, with higher cardiovascular mortality.

However, data from studies such as AFFIRM and RACE have not demonstrated benefits in terms of mortality or quality of life when comparing tight control with more flexible HR control. More recently, the RACE II study compared two therapeutic targets: a rigid one (HR < 80 bpm) and a more flexible one (HR < 110 bpm, both at rest) during two years of follow-up. The results indicated that there were no significant differences in mortality, serious adverse events (including congestive heart failure), or arrhythmia-related symptoms between the approaches. In addition, less strict control was more easily achieved, with less need for medication, without compromising the safety or efficacy of treatment in the medium term.

Although the RACE II study did not identify disadvantages in more flexible heart rate control in the short and medium term, the safety of this strategy in relation to the development of long-term tachycardiomyopathy in patients with higher CF remains uncertain. In any case, the pharmacological control of heart rate in AF should be individualized, considering the clinical characteristics of the patient, his/her tolerance to the medications, and the possible risks associated with each approach.

PREVENTION OF THROMBOEMBOLISM

Prevention of thromboembolism in patients with atrial fibrillation (AF) is an essential component of clinical management, especially in those at high risk of cerebrovascular disease. Regardless of the therapeutic strategy adopted, whether it is the restoration of sinus rhythm or the control of ventricular rate, anticoagulation is mandatory for individuals with a greater propensity to develop thromboembolic complications.

The main risk factors associated with the occurrence of cerebrovascular accident (CVA) in patients with AF include a previous history of stroke (whether permanent or transitory), episodes of thromboembolism, congestive heart failure (CHF), rheumatic heart disease, systemic arterial hypertension, diabetes mellitus, age over 65 years, and significant increase in the size of the left atrium (greater than 5 cm).

The use of echocardiography plays a fundamental role in risk stratification, complementing the clinical evaluation with structural and functional data. Echocardiographic parameters, such as the presence of intracardiac thrombus, spontaneous contrast in the left atrium, reduced flow in the left atrium and the identification of complex atheromatous plaques in the aorta, are indicative of greater thromboembolic risk. In addition, the test is useful for etiological diagnosis, especially in cases of AF of rheumatic or valvular origin, as

well as in the identification of left ventricular failure. However, the absence of these abnormalities on echocardiography does not exclude the need for anticoagulation, particularly in patients with other significant risk factors.

For the stratification of the risk of systemic embolism, the Brazilian AF guidelines recommend the application of scoring models, such as the one proposed by the American Heart Association/American College of Cardiology and the CHADS2 score (Cardiac failure, Hypertension, Age, Diabetes, Stroke). The CHADS2, widely used, assigns points to specific clinical factors, with scores equal to or greater than 2 indicating the need for anticoagulation. Studies have shown a direct correlation between higher scores and increased rates of thromboembolic complications, reinforcing the importance of careful and systematic evaluation to define the most appropriate preventive therapy.

Therefore, the early identification of risk factors, combined with the use of stratification tools such as CHADS2 and echocardiographic support, is essential for therapeutic decision-making and for the reduction of AF-related complications. Anticoagulation remains the pillar of thromboembolic prevention in high-risk patients, ensuring the reduction of morbidity and mortality associated with this condition.

ANTITHROMBOTIC STRATEGIES FOR PREVENTION OF SYSTEMIC THROMBOEMBOLISM

The prevention of systemic thromboembolism in patients with atrial fibrillation (AF) is an ongoing challenge, being addressed by a variety of antithrombotic strategies, including the use of vitamin K antagonists, antiplatelet agents, and low molecular weight heparins, as well as by non-pharmacological methods. Each of these approaches has its advantages, limitations, and clinical impacts, which must be carefully evaluated in order to choose the most appropriate treatment.

The use of vitamin K antagonists, such as warfarin, remains a widely used strategy for the prevention of stroke in patients with AF. Most studies have shown that oral anticoagulation adjusted according to INR values (between 2 and 3) is effective in reducing the risk of stroke, although the possibility of bleeding complications although rare, it cannot be ignored. The incidence of bleeding in the elderly, especially those with adequate control of anticoagulation and systemic arterial hypertension, has decreased significantly in recent years. On the other hand, the RE-LY study evaluated dabigatran, a direct thrombin inhibitor, at doses of 110 mg and 150 mg, comparing it with warfarin in patients at high risk for cardioembolic events. The results showed that the 110 mg dose had a similar rate of ischemic stroke and systemic embolism to warfarin, but with a lower rate of major bleeds.

The 150 mg dose was associated with a lower incidence of embolic events, but with similar rates of bleeding. The main advantage of dabigatran over warfarin is its greater pharmacological predictability, less interaction with other drugs, and the lack of need for constant INR monitoring. However, the high incidence of acute myocardial infarction (AMI) observed in the dabigatran group raises the hypothesis of platelet activation, suggesting the need for caution in the use of this drug, especially in patients at high risk of AMI. In addition, the high cost of dabigatran may be a limitation for its large-scale implementation.

Regarding antiplatelet agents, acetylsalicylic acid (ASA) and clopidogrel are frequently used in patients with AF, although their efficacy in preventing stroke is modest. Its action is more pronounced in hypertensive and diabetic patients, although protection against events of cardiac origin, such as stroke, is limited. The combination of oral anticoagulants with antiplatelets has not demonstrated additional benefits in terms of reducing the risk of thromboembolic events, but may in fact increase the risk of bleeding complications, especially in the elderly, with an increased risk of intracranial hemorrhages. The ACTIVE study showed that the combination of ASA and clopidogrel reduced the risk of major vascular events, such as stroke, in patients who could not use oral anticoagulants, although the risk of major bleeding events was higher. Brazilian guidelines for the treatment of AF do not recommend double platelet aggregation in patients unable to use oral anticoagulants.

Low molecular weight heparin (LMWH) is another valid therapeutic option, especially in acute situations or in patients with contraindications to the use of oral anticoagulants. LMWH has several advantages, including an extended lifespan, improved bioavailability, and a predictable antithrombotic response, allowing it to simplify treatment and reduce the need for hospitalization to start anticoagulation. In pregnant women with AF, particularly those at high risk of thromboembolism, LMWH is the only safe anticoagulation option, as warfarin is contraindicated due to its teratogenic potential.

In addition to pharmacological options, non-pharmacological strategies, such as obliteration of the left atriautette, have gained prominence. Although studies on this technique are limited, it is based on the removal of the main site of thrombus formation, providing an alternative for patients with AF and high risk of thromboembolism, especially when anticoagulation is not a safe option. This approach is commonly reserved for patients undergoing cardiac surgery, who have concomitant AF at increased risk of thromboembolic events.

Antithrombotic strategies for the prevention of systemic thromboembolism in patients with AF involve a multifaceted approach, with the choice of appropriate therapy depending

on the risk profile of each patient, the comorbidities present, and tolerance to certain treatments. Anticoagulation remains the main pillar in the prevention of thromboembolic events, although clinical management should always be individualized, considering both the benefits and potential risks associated with each therapy.

PROGNOSIS AND MANAGEMENT OF PATIENTS WITH ATRIAL FIBRILLATION

Atrial fibrillation (AF) is a condition associated with a significantly increased risk of stroke, heart failure (HF), and all-cause mortality, especially in women. Patients with AF have a risk of death approximately twice as high as those with normal sinus rhythm, as evidenced in the ALPHA, COMET and Val-Heft studies, which identified AF as a strong and independent risk factor for morbidity and mortality. The severity of the underlying heart disease has a close correlation with the presence of AF, since this arrhythmia aggravates the clinical picture, promoting a worse prognosis for patients with cardiac dysfunction. The rate of ischemic stroke (LVA) among patients with nonvalvular AF averages 5% per year, representing a risk two to seven times higher than in individuals without AF. It is estimated that one in six strokes occurs in patients with AF. In addition, the prognosis of stroke is aggravated by the presence of AF, with a mortality of 25% in 30 days, compared to 14% in cases of stroke without AF. Neurological sequelae also tend to be more severe, since cerebral infarction tends to be of greater extent in cases of cardioembolic embolism.

In patients with acute myocardial infarction (AMI), the occurrence of AF triples mortality, especially in the first year of follow-up, which suggests a relationship between this arrhythmia and the presence of left ventricular dysfunction. The Framingham study also showed that in patients with rheumatic heart disease associated with AF, the risk of stroke is 17 times higher compared to controls of the same age group, with an attributable risk five times higher in those with non-rheumatic AF. The risk of stroke increases with age, ranging from 1.5% in patients aged 50 to 59 years to 23.5% in patients over 80 years. This reflects the urgent need for effective strategies for the management and prevention of complications in patients with AF, especially as the population ages.

The growing aging of the population and the high incidence and prevalence of YF in older age groups indicate that, in the near future, there will be a true "epidemic" of this condition. This makes it essential for cardiology specialists to possess a deep understanding of the proper management of AF in order to effectively treat patients. Patients with failure to control heart rate (HR), persistent symptoms, or progressive decompensation of the underlying heart disease should be referred to a specialist, especially in cases that require more complex interventions, such as the use of multiple

therapeutic regimens, the prescription of antiarrhythmics, or even the indication of non-pharmacological intervention, such as ablation of the atrioventricular node and implantation of a permanent pacemaker.

Patients with permanent AF generally need only outpatient follow-up, aiming at HR control and the maintenance of adequate anticoagulation. However, those who have excessive increases in the international normalized index (INR), with a high risk of severe bleeding, should be hospitalized. In addition, throughout the natural course of AF and the underlying heart disease, the decision to admit the patient should be based on clinical criteria, particularly in episodes of evident decompensation.

Continuous follow-up of patients with permanent AF is essential to ensure adequate control of the INR, which is often complicated, leading to its underutilization in a significant portion of patients. In addition, it is important to regularly assess HR control, using complementary tests such as the stress test or 24-hour Holter ambulatory monitoring, to adjust treatment and improve the patient's prognosis.

CONCLUSION

Atrial fibrillation (AF) is one of the most prevalent arrhythmias and poses a significant public health challenge due to its association with serious complications such as heart failure and thromboembolic events. This study reviewed essential aspects related to the diagnosis, therapeutic management, and prevention of complications in patients with heart disease, with the aim of contributing to a deeper understanding and more effective clinical practices.

Early diagnosis of AF is essential to mitigate its complications. In this sense, the use of modern diagnostic tools and continuous monitoring are indispensable, especially in populations at higher risk, such as the elderly and patients with comorbidities. However, even with advances in technologies, there is still a relevant underdiagnosis, which reinforces the need for educational strategies and public health policies that encourage screening in vulnerable populations.

The therapeutic management of AF should be patient-centered, with decisions based on an individualized assessment that takes into account factors such as thromboembolic risk, symptom severity, and the presence of associated diseases. Combined rhythm and frequency control strategies have been shown to be effective in improving clinical outcomes. In addition, anticoagulation remains the mainstay for the prevention of thromboembolic complications, with direct oral anticoagulants offering a safer and more effective alternative in many cases.

On the other hand, despite therapeutic advances, important challenges remain. Knowledge gaps exist regarding the long-term efficacy of nonpharmacologic approaches, such as catheter ablation, in specific subgroups of patients. In addition, adherence to treatment, especially the use of anticoagulants, is still a critical obstacle, requiring strategies to improve patient awareness and medical follow-up.

As the prevalence of AF continues to rise, especially due to the aging population and increasing cardiovascular risk factors, it is essential to invest in translational research and large-scale clinical studies that explore innovative interventions. Integrated care models, with multidisciplinary teams that include cardiologists, neurologists, geriatricians, and public health specialists, should also be expanded to optimize the management of patients with AF and reduce the socioeconomic impact of this condition.

It is therefore concluded that the approach to AF requires a careful balance between early diagnosis strategies, personalized therapeutic management, and prevention of complications. The advancement of knowledge, combined with the implementation of effective public health policies, will be crucial to minimize the burden of this condition and improve clinical outcomes, especially in cardiac patients.

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FAMILY AND COMPANIONSHIP: THE ESTABLISHMENT OF PROTECTIVE AND WELFARE SOCIAL RELATIONS IN BELÉM IN THE BELLE ÉPOQUE

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ABSTRACT

This text is based on the socio-historical approach regarding the value of family life established by marital relations and godparenthood, understood as spiritual kinship. As references sedimented by the relations between individuals and groups in the society of Pará in the Belle Époque. Historical context constructing and affirming social networks between groups located horizontally and/or vertically. Social places of reaffirmation of power and dominance, as well as of dependence and subordination. Social relations are mediated by the practices or obligations of "giving, receiving, and reciprocating" the gifts received. A relational system is very present in the Brazilian coronel system. In this context, family life as an interactive social space reveals the social plots and networks in the social, political, and economic spheres, which guide obligations between peers and other social groups through protective and welfare actions present in family and godparenthood relations. The text is based on analyses by Brazilian historians, sociologists, and researchers from Pará who substantiate the problematization and understanding of Brazilian and Pará society.

Keywords: Family. Patronage. Protective Relationships.

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INTRODUCTION

Since colonial times, the family has played a fundamental role in the organization of Brazilian society. Conceived as an expanded social group and endowed with a social identification constructed and defined by relationships intertwined with other social groups.

A process of social construction and identification that is structured as an ordering parameter of a prominent social representation in the surrounding society, as it constitutes a dynamic field and builder of networks and webs of social, economic, and political significance. This points to a dialectical relationship of affirmation, inclusion, or exclusion of family groups based on the establishment of articulations that organize and sediment networks of social relationships, affirming dominance and subordination. Social differentiation becomes a founding element of social contradictions and a determinant of relational and social positions as power relations. A contradictory context formed by distinct groups that position themselves based on family relationships imbued with value and morality. A hierarchically structured organization permeated by relationships of rights and duties in which reciprocity involves relationships of consanguinity and compadres. A system of solidarity that places people and groups in mutual obligations. Reciprocity is a symbolic basis for protection, morality, and ways of life. In a scenario in which the family reveals and is revealing of the social place in which it is inserted, of the senses and meanings that demarcate its representation as an important space in society.

An important social issue, considering that this social conformation found fertile ground in the structural bases of Brazilian and Pará society. Structure-based on agrarianism and ruralism, then promoters of processes of social insertion and ascension, even in an extremely hierarchical and unequal context, mediated by relations of reciprocity and solidarity that link people and groups in relations of reciprocal obligations. In other words, traditional structural bases organize a patriarchal society.

> The large estates, in this context, function as the determining pole of all relations between people, groups, and the land; consequently, its possession became synonymous with prestige and power, determining in this period of Brazilian history, (with) eminently feudal characteristics, to the extent that it presented itself as “a patriarchal (and patrimonial) society” (CORREA, 1982, p.7)

In this understanding, Guimarães (1981) points out that the latifundium became a central aspect in sociohistorical studies regarding Brazilian society. Becoming a driving and fundamental cause in the economy and national political life. Therefore, large extensions of land became private property and a reference for the power of large landowners. A colonial legacy that instituted the “feudalization” of the land. In this territoriality, the recognized power of the lord over free people. In the Republic, large landowners took on the social,

economic, and political position, as holders of the rank of Colonels. Which assured them of coercive actions over other large landowners and their residents.

This text refers to the initial study “Favoritism as a dominant trait in northeastern society during the Old Republic”. Corresponding to the final course work (TCC) in a Bachelor's Degree in History; UFPA, 1982. As a guiding question for understanding the socio-historical reality of Brazilian society throughout the Old Republic. This is an analysis based on the coronel system from the perspective of the exchange of favors that were so striking and decisive in the northeastern reality. With the support of historians who studied the coronel system and the role of family relationships and cronyism. The study was based on research and studies by great Brazilian historians and sociologists, such as JANOTTI (1981), FAORO (1977), GUIMARÃES (1981), and the sociologists, GOLDEMANN (1972), and MAUSS (1974). As theoretical and methodological guidelines for the construction of the enunciative question that guided the entire academic construction process.

The update of this initial study was guided by studies already initiated and through new studies regarding the research object and was directed towards studies and research by professors and historians who center their investigations on the city of Belém-Pará. Highlighting the research by professor Cristina Donza Cancela that addresses Marriage and Family Relations in Belém do Pará in the period (1870-1920), and by researcher Daniel Barroso: Marriage and Compadrio in Belém in the mid-nineteenth century. (2012), as well as initial studies by Izabel Augusto (2005). Important reference works for localized and very recent perception, which correspond to the locus of updating and temporality. They are important references for the resumption of this theme in its specificity regarding protective and welfare relationships within the scope of “giving, receiving, and reciprocating” relationships as social conditioning under the understanding of concepts worked by Marcel Mauss in the field of sociology and anthropology (1974). Contributions brought by the concept of DOM and COUNTER-DOM and the counter-DOM as behaviors that guide protective social relationships between subjects and groups in a given community are especially very present in the Brazilian and Pará scenarios.

This text brings the understanding regarding family relationships, especially relationships of compadres, which materialize through practices inserted in the protectionist context because they give rise to the search for social security at a historical moment in which the Brazilian State did not prioritize the political-social commitment to the popular classes.

A social reality that gave rise to social relationships mediated by benefits and reciprocity in the context of the extended family, especially between compadres.

Relationships established between socially distinct groups. An important aspect observed by Souza (1981) in his studies on vertical relationships within the family environment, especially in relationships of cronyism. In this scenario, the godfather is placed in the place of the "powerful, the richest (who) patronizes the subordinates, the poorest (...) A dominant relationship in Brazilian patriarchal society." (SOUZA, 1981, p.29)

In this context, considering that the network of cronyism was the guarantee of the social, economic, and political power of the farmers, and when they were legally invested with the rank of colonels, they incorporated the power of the militia, as a step towards accessing a new social position, that of political godfather, seen then as having greater powers to resolve emergency and personal situations. Thus, having under their control a stronghold of different groups that, given the favors received, ally themselves with the colonels in their ventures, in the political sphere with full support through the "voto de cabresto" (vote of halter) as a reward for the benefits of the crony colonels. In this scenario, the establishment of the coronel system in Brazilian politics, because in addition to land ownership, the support of relatives and the loyalty of numerous cronies guaranteed local power in Brazilian politics. (IDEM, page 33)

This text updates the initial text by problematizing family and cronies relations in the city of Belém-Pará, in times of Belle Époque. In the transition from the 19th century to the 20th century. Considering that academic research is located in the temporality of the 19th century extending to the 1930s. A temporality corresponding to the Old Republic. Studies that clarify the family context of Belém amidst tradition and the changes arising from local economic and political transformations.

THE BRAZILIAN FAMILY CONTEXT AND THE ESTABLISHMENT OF PROTECTIVE SOCIAL RELATIONS

The constitution of the family in Brazil is subject to the approval of the Catholic Church, which legitimizes it through marriage through a marriage bond and through spiritual kinship arising from godparenthood, which "softens" the relationships strengthened by consanguinity, as "quasi-relatives". Marriage and baptism have become articulating elements of sociocultural relations since colonial times. The family became the center that radiated consanguinity and solidarity ties as pillars that underpin family relations. Religious rites endorsed the structuring of an extended family, a social space for the administration of the religious rites of marriage and baptism as rituals that determine "being" and "belonging" to a family. This family concept persisted in the following centuries. The family is understood as a social organization formed by the master and his legitimate offspring and extended by

the kinship formed by godparents, godmothers, godchildren, friends, dependents, servants, exposed people, and slaves. In this extended family context, godparenthood is established beyond the bonds of friendship by becoming a space for social coexistence and inclusion of godparents and godchildren in the family of natural relatives. A network of lifelong alliances is established between godparents and godchildren through relationships of reciprocity and support, especially in times of difficulty. This network of alliance and protection has been confirmed by research on the subject of family and godparenthood, which has proven that the subsistence of many godchildren was guaranteed by their godparents and relatives.

In the patrimonial and patriarchal Brazilian society, the dominance and power of command were in the hands of the master, the head of a large family. The issue of protection, security, and the resolution of life's difficulties is assumed by adult individuals, the male heads of families, seen as social actors who are protagonists of social relations, with the power to ensure protection, insertion, and social advancement. Catholic cronyism, so present in Portuguese families, The godfather, the godfather of slaves, freed slaves, and free populations, became an institution that promoted protection, care, and affection. Among the captives, it was a condition of liberation and assistance in times of illness and difficulties in life. In all social classes, the godfather assumes the role of “benefactor”, “protector” and “guardian” of his godchildren.

FROM THE ORIGINS TO THE INSTITUTION OF THE GODFOOD IN BRAZIL

The godfather is directly linked to the actions of the early Catholic Church, with similarities to the characteristics of the Roman clientele and feudal society. Clientelistic relationships were associated with the process of social inequality present in these societies. The clients, socially excluded classes, who, in seeking protection and subsistence, became “clients” with the aristocratic classes. In search of protection, they became loyal followers, available for this protection and dominion of their aristocratic “lord”, who should repay them with obedience, submission, respect, and provision of services in exchange for remuneration, donations, and assistance. In ancient times, the Church was governed by Roman Law, which in the absence of direct descendants assured the right of inheritance to neighbors, however, this condition was abolished in the 6th century. This contributed to the increase in the Church's assets.

Regarding clientelism, SOUZA (1981) notes in his research that there was a pious relationship between patron and client that involved relations of reciprocity, in exchange for

the assured protection that was given through the client's performance of duties. Among them, daily visits to their masters.

The most arrogant bosses demanded that their clients kneel before them and, once they were close, kiss their chest or right hand (...) which would have given rise to the custom of the godson asking for the godfather's blessing. (SOUZA, 1981, p. 20)

> The bosses were obliged to pay in cash or food, as well as invite their clients to sit at the table, in recognition of the services rendered. This demonstrated a certain closeness in the relationships established. These social relationships became widespread, becoming a distinctive element and marker of social status in Roman society. With the barbarian invasions and the reorganization of the Roman territory, changes were observed in the cultural sphere and matters related to property and inheritance law. A ninth right was instituted that guaranteed economic and social stability to vassals and their relatives by guaranteeing the right of inheritance to their relatives. This will contribute to the preservation of their territorial domains by not fragmenting their lands and thus maintaining large feudal areas.

The social order of medieval society was based on protectionist and welfare standards, becoming a reference for the creation of godparenthood by the early Catholic Church. The protectionist and welfare parameters will become a reference for the creation of the godparenthood of baptism created by Pope Saint Hyginus (138-141) with a protective function to be assumed by godparents about their godchildren.

Initially, parents were the godparents of their children because they were considered exceptional at the time of baptism. However, the reality of orphaned children and the fact that godparenthood establishes a kinship relationship between godparents, godparents, and godchildren will encourage godparenthood beyond the parents. It will even be forbidden for parents to godparent their children because spiritual kinship makes sexual relations between parents as godparents illicit. This prohibition became universal at the Council of Trent in 615.

In Medieval Society, the number of godparents was expanded as a way of reducing conflicts, confrontations and wars between fiefdoms. Since godparenthood was seen as an effective means of reinforcing loyalty between vassals and suzerains, choosing nobles or wealthy bourgeoisie as godparents guaranteed material advantages for their children. With the weakening of the State, the family became the basic cell of society and the relationship established by godparenthood began to be characterized as a relationship of spiritual kinship between godparents.

In the period from the 9th century to approximately the 16th century, medieval society was consolidated and the Catholic Church played a decisive role in organizing and maintaining the European Feudal system. Feudalism, as a system of order based on the possession and production of land, gave the lords who owned it an effective social,

economic and political position over other social groups. Each fiefdom brought together several social classes that overlapped one another, in a hierarchical logical, and harmonious structure. Between the suzerains and their vassals there were reciprocal rights and duties based on fidelity and formally assumed commitments.

In modern times, the Council of Trent (1545-63) passed to establish rules on godparenthood as the basis and guiding axis of security in social life at the beginning of the colonization of Brazilian society. At baptism, each individual was to be given the name of a saint so that he or she would have a protector in heaven. The local community was to have a patron saint, a protective saint who would intercede for everyone. Each individual was to have godparents as second parents, to whom he or she could turn in times of difficulty or in the absence of his or her parent. Under the ideal of protection, godparenthood expanded to reach later generations and remained dominant, especially in regions marked by the vulnerability of the poorest classes. In this system, favoritism was used as a way of maintaining the relationships of dependence of the lower classes on the local powers. 3 BRAZILIAN SOCIETY UNDER THE ORGANIZING VIEW OF RELATIONS OF COMPADRES

The solemn institution of compadrio in Brazil occurred in the mass held by Father Serafim Leite on the Island of Itaparica on the day of the Exaltation of the Holy Cross on September 14, 1561. On this occasion, the Ouvidor Geral became the godfather of all baptized Indigenous people, with the protectionist model of compadrio. Characterized as a vertical relationship in which the socially powerful, politically, sponsors the subordinates and the excluded

For OLIVEIRA VIANA (1949), compadrio is:

> [...] more than consanguinity, the most fruitful source of family solidarity [...] it constitutes a kind of ideological and spiritual kinship, because of its religious nature; but by the strength of the dominant precepts in our hinterland institutions [...] it creates interpersonal bonds as strong as those of blood itself. (VIANA, 1949, p.2630)

In the colonial context, godparenthood was common among the population of households and the patriarchal family. Women who were mothers of children from illicit relationships sought the sponsorship of landowners as a guarantee of help and protection for their children. In the case of the free population, having a sugar mill owner, a captain-major, a colonel, or a baron as a godfather represented a condition of distinction or dignity for the godchildren and their parents, even if they were positioned at a “lower” social level than the chosen godfather.

In Brazilian society, positions are determined in terms of “possessions” and are redefined by the privileges and power arising from this position. Ownership of “goods” becomes a discriminatory and/or affirmative element of social classes, classifying and positioning them in this social scenario as rich, poor, included, or excluded. “Possession” is a reference point for social inequalities and establishing relations of dominance and subordination. Considering that the acquisition of economic assets implies prestige, power, and authority over the hierarchically “inferior” classes, economic power will ensure that individuals and groups dominate other areas of society.

Prestige and power are determinants of social relations that articulate a process of reciprocity, although without achieving a balance since the dominant group imposes itself and becomes accepted with a certain legitimacy, and actions of control and influence are recognized and consented to by society through the use of control, subjugation, and manipulation of the popular classes.

In societies where there is traditional domination based on a patriarchal or patrimonial system, the power of influence is personal, since the separation between the private and public spheres is ignored. In this type of society, it is worth noting that the family and alliance groups constitute central nuclei, in which degrees of interdependence are established based on commitments and reciprocity. It is clear in this social structure that the group that obeys submits to individuals and groups with economic and political autonomy.

Brazilian society, at this time traditional, relationships in the family context will be “clientelist” based on the obligation to give and receive, to return a favor received. Thus, from the colonial period until the first twenty years of the Republic, our society has presented a social organization based on a traditional structure, both patriarchal and patrimonial, arising from an economy centered on agricultural activity, as the pillar of social organization.

Latifundia functioned as a determining pole of all relationships between individuals and groups. A relationship with the power of coercion influences the determination of roles and positions between unequal people and groups. The protection offered by one group and the loyalty and services provided by other groups determine the dialectical context of clientelist reciprocity. An unequal context in which reciprocal relationships originated and maintained extended family, the locus of family relationships and compadres. Relationships that brought together and solidified family ties. In northeastern society, the figure of the colonel appears as the controlling element of these relationships, to the extent that the establishment of the solidarity network takes place in a hierarchical context that maintains political control and the subordination of popular groups. In a relationship based on the logic

of reciprocity through a tacit contract of obligations in which one offer always corresponds to another offer.

Crony will become an essential institution in the political history of the Northeast by defining the social status of equals and the integration of unequal. In this society, favors become responsible for the expansion and solidification of the power of the coronel. A power measured by the ability to provide favors, since their privileges were related to a series of obligations to be provided to their dependents. In coronelismo, a system of mutual commitments, exchanges of favors, and benefits between political leaders and their clientele is implemented, perceived as the basis for supporting and expanding the electorate.

Coroneiroismo was affirmed and reaffirmed at the time of voting. Control of the vote is a goal to ensure the colonel's power at the local level, as well as defining his position at the state level. In this sociopolitical context, coronelismo via cronyism becomes a political mechanism for the protection and social advancement of impoverished groups. It constitutes an end that justifies any relationship of exchange of favors, in which the vote becomes a good in exchange, amidst a structure marked by electoral bargaining. The vote as a good in exchange is similar to the “Gift and Counter-Gift system” because it involves reciprocity of favors and, on the other hand, an emotional relationship brought about by cronyism that mystifies this entire relationship of giving and receiving.

In the political sphere, CORRÊA (1982) states that:

> The vote does not manifest itself as an unconscious act, but rather as part of a tacit contract, used to obtain benefits, ranging from the acquisition of material goods, such as social advancement within the stratification of kinship, or even to resolve issues of various kinds, such as marriage, financing, employment, among other favors. (CORREA, 1982, p.12)

In the political arena, large relatives become clients who secure political positions and strength. Thus, the large family becomes a political stronghold, an electorate that softens autocratic domination through gentle friendship. In this context, understanding Brazilian society involves understanding the ordering process of its economic, political, and social bases that were established during the country's colonization process. These factors explain the formation and expansion of our society. A formation that maintains its dominant roots to this day.

At the beginning of the Republic, society maintained its agrarian base, servile labor, land concentration, and an oligarchic system with its vertical social structure. The latifundium was the economic base that maintained the lordly and caudillist mentality of rural landowners, the colonels, albeit under a new image of a businessman, but a defender

of the security of the family group. Seen as the most well-off, with prestige and power in the face of a population with a precarious standard of living, passive and accommodated in their misery, ignorance, abandonment, without free will, and with a distorted and magical worldview, thanks to the process of manipulation suffered. Because they only see the world that surrounds them in its most immediate circumstances. Since the broader context becomes something distant, far away, something incomprehensible, which they only relate to through the intervention of their protective lord, the colonel, generally their godfather. A benevolent protection that takes away all perception of the relationship of domination, because it occurs in a context based on friendship that infers in them the duty to reciprocate. However, JANOTI (1981) clarifies that there was “a paternalistic attitude about “his group” relatives and clientele, but oppressive, violent about the clients of his adversaries”.

BRAZILIAN SOCIETY AND AGRARIANISM

Understanding Brazilian society involves understanding the process that organized its economic, political, and social bases, which was established during the colonization process. In this context, its organizational base was based on authoritarian relations through the recognition of the role of dominant economic and political groups. In this recognition, the organizational base was based on the ownership of properties, an element that radiated prestige and power.

A power structure that favored the place of the Brazilian aristocracy, composed of landowners. In this structure, social and political evolution is based on the ownership and exploitation of large estates. A system in which land ownership meant and continues to mean the use of land as “feudal privileges”.

Rural life took place within the boundaries of large estates and beyond their boundaries, other large estates with their organizations and laws. A portrait of an agrarian structure marked by “local bossiness”.

With the headquarters With the establishment of Brazilian agrarianism, the rural aristocracy began to direct the entire Brazilian political base during the first years of the republic. In this economic and political systematization, the landless and unemployed populations established alliances with the dominant groups, in search of protection and subsistence, becoming servile labor. This reveals the persistence of the feudal structure, the basis of republican society. There is a mere political change from the Empire to the Brazilian Presidential Republic, given the continuity of the latifundium as the economic base and the lordly and caudillo mentality.

According to Vilaça (1978), the rural landowner has the same prestige and power, inherited from colonial times, although he is vested with the role of farmer, businessman, and defender of his family group. He exercises an increased influence as society diversifies into houses, villages, and farms that surround them. (VILAÇA, 1978, p. 25)

In this context, coronelismo became dominant, although there are variations in different Brazilian regions. However, in this locus the presence of "a mass of people who derive their subsistence from their land, living in the most lamentable state of poverty, ignorance, and abandonment. (LEAL, 1978, p. 24)

A population that from a very early age throws itself into work, as a condition of survival, without caring about the conditions of domination and oppression. A subjection that reinforces the processes of dependence, is then naturalized.

THE LEGITIMATING ACTION OF THE FATHERHOOD

Parental relationships, whether of kinship or godfatherism, constitute mechanisms of domination and subordination, considering that they are relationships engendered in verticality and horizontality. They are relationships between equals and relationships between unequal. Observing the social, economic, and political strengthening of the majority group. A prerequisite for exercising leadership and social control.

Crowd relationships are rooted in our social history and have been present since the beginning of the nascent Brazilian society. A primary relationship, with the appearance of affection, Catholic religiosity, and the idea of helping godparents, godmothers, and godchildren in adverse situations. In a society that emerged without the idea of citizenship, of having rights; the Church and the colonizing State instituted godparenthood. For, the recurring discourse was that:

> Each individual should have godparents, according to their parents, to whom he can turn in case of difficulty or the absence of his parents. [However, a] vertical relationship, through which the powerful, richest, sponsors the poorest, has been reproduced since the beginning of our social formation, until today. (SOUZA, 1981, p.29,30)

Considering that godparenthood was established in Brazil with the arrival of religious people together with the colonizers to establish the political, economic, and religious dominance of the Portuguese metropolis in Brazilian lands,

FAMILIES AND GODROUGHT IN THE CITY OF BELÉM IN THE BELLE ÉPOQUE

The updating and extension of the initial studies on family and godparent relationships are based on research carried out by researchers from Pará. Studies carried

out by Augusto (2005)4; Cancela (2006)5 and Barroso (2012)6, reveal family and godparent relationships in the city of Belém-Pará, in the transition from the 19th century to the early years of the 20th century.

Augusto's studies (2005) are based on analyses of marriage and baptism records. Focusing on systems of alliances and social networks, as means to achieve social advancement and assistance of all kinds. The table below references the social place of baptized subjects. The author states that there are few studies on the topic addressed.

Baptized Population Between 1810-1822

Population – Social Group	Social Status	% of Baptism
70 White People	Legitimate	23.9%
40 White People	Illegitimate	16.3%
13 Enslaved People	Legitimate	4.4%
57 Enslaved People	Illegitimate	16.3%
48 Enslaved People	Adults	19.4%
4 Free People of Color	—	1.4%
36 people	Illegitimate	11.9%
3 Indigenous People	Legitimate	1.0%
5 Indigenous People	Illegitimate	1.7%

Source: AUGUSTO (2005)

The table summarizes data that reveal the city of Belém as a diverse social space in terms of the origin and social status of the baptized people. It portrays the concentration of the white population, which according to the author, exerts dominance over the city and its people, as it reveals in this period studied, the baptism of 90 legitimate children, 145 people considered illegitimate, and 48 adults. In her analyses, she observes that prominent positions were concentrated among wealthy whites, especially from Portuguese families. In this social reality, marriage and baptism, in addition to being a religious sacrament, are social events that, due to their relevance, rely on collective participation. A time for establishing social arrangements, and commitments of solidarity, friendship, and support. Thus, marriage and baptism are understood as social events for the affirmation of family ties. For groups of free men, slaves, and Indigenous people, a time for guaranteeing improvements for children, was made possible by relationships of godparenthood. Barroso (2012) studied family groups, focusing on the intersection between marriage and godparenthood in Belém-PA, between 1840 and 1870. His extensive research highlights family and godparenthood relationships as a social space for building sociability and solidarity. A context in which family ties are built and solidified. In this perception, he considers the family context as a space for establishing ties between individuals and the surrounding society. Considering it as an essential structure, because “Baptisms and marriages, at the same time, indicate some particularities and general trends that serve as

indicators of social relations and cultural patterns". (BARROSO, 2012, p. 1) In the Amazon, as the 20th century progressed, families, a space that radiated social, economic, political, and cultural alliances, although socially and culturally diverse, continued to represent the founding foundation of demographic and cultural dynamics in times of consolidation of the rubber economy. Amidst the changes, the family continues to be fundamental in the processes of social reproduction, demarcating social positions, and material and cultural assets in the region. The wedding witnesses and godparents were chosen within the family environment. It was the locus that maintained the bonds of marriage and godparenthood. Among the elite of Pará, marriage and godparenthood occurred in horizontal and endogenous relationships. This contributed to the strengthening of the family. (IDEM, 2012, p. 56)

Among the elite, godparenthood relationships were made effective by expanding alliances between equals. Among the free or poor captive population, baptism was a time to establish bonds with individuals with better material conditions or influence to obtain help, assistance, and security for a better future for their children. In this context of protection, the extended family was considered a fundamental institution for the biological and social reproduction of the population. In the case of godparenthood, when the elite sponsored children from less privileged social backgrounds, they sealed their recognition of prestige and power by expanding their family by protecting their godchildren. This guaranteed the structuring and maintenance of their social status. According to Barroso (2012, p.108), in the baptism of free children, godfathers and godmothers were profiled in the most prominent classes. He identified that "60% of godfathers were associated with some military rank, 30% with the exercise of liberal professions (doctors), 0.5% with predicates of great social distinction (such as noble titles or those linked to the Orders of Christ or the Rose) and the remaining 0.5% with various occupations (judges, for example)". The godmothers followed the same ranks as the godfathers. It is worth noting that 24.5% of the godmothers of free children were attributed to Our Ladies. The elite, standing before the baptismal font, reinforced their power, and the impoverished free population groups sought out a godfather and guardian from the elite. The godfather was invested in the power of protection, care, affection, and social interaction that was so important for the development of poor and disadvantaged children. By becoming the basis for the construction of broad parental networks beyond the baptismal ceremony, even though they were vertical relationships, the godfathers, godfathers, and godchildren became spiritual relatives. An institution to promote benefits of all kinds, from the acceptance of the godchild by the godfather's family group to economic and political aid. It was configured as a network of reciprocal relationships, of

mutual support, especially in times of difficulty that were so necessary in a patriarchal, slave-owning, lordly society. Among slaves, this ritual reveals the sociability of these individuals and their social relationships experienced inside and outside of captivity. Relationships intertwined with family relationships and the social conditions of slavery. Relationships are established to strengthen this group through broad alliances. With relatives or allies of the master. In a search for support and protection from people in a better social position. In general, support was sought from freed people or those with social influence. Baptism records from 1840 in the parish of Sé in Belém demonstrate the tendency to choose godparents among free individuals. In 1842, of the 350 baptisms, 123 children were slaves. And the preference for choosing godparents in the free condition. However, the larger the number of slaves in a slave farm, the greater the possibility of choosing slave godparents. In the central area of Belém, the choice of godparents was addressed to the free population. In more remote areas, the incidence of slave godparents was greater. In the city, there was a greater interactive process with other slaves, the local free population and migrants from other regions, and foreigners who arrived with the expansion of the rubber economy. (IBDEM, 2012. 123, 125)

CANCELA's (2006) research focuses on understanding family relationships in Belém between 1870 and 1920, a period in which the rubber economy was consolidated. During this period, marital and kinship relationships were impacted by economic, social, and political dynamism.

Belém and Manaus experienced an intense process of urbanization, migration, population growth, and changes in architectural and landscape layouts, as well as the adoption of lifestyles associated with cultural refinement, especially the “French” model of civilization. This transformed the Amazonian capitals into “tropical cities of light”.

In this context, social life expanded due to economic dynamism, which transformed the Amazon into a global supplier of natural rubber for industrialized nations. Economic growth and the circulation of capital brought with them the ideals of “progress” and “splendor” to the region. The families of Belém find themselves facing a context of transformation and tensions brought about by the Rubber Era. The traditional elite, until then, was made up of high-ranking officials, military personnel, and owners of sugar mills and farms. Before 1870, rubber exploitation was carried out by the local caboclo population, indigenous people, and mamelucos. This production was combined with the cultivation of food products. In the caboclo model, the rubber tapper and his family worked to survive. However, the automobile industry demanded large-scale exploitation in the region.

Gradually, the Portuguese began to incorporate the exploitation of rubber plantations and commercialization through aviation companies into their activities.

The expansion of rubber production generated a multiplicity of owners of rubber plantations, aviation companies, and export companies. The merchant elite gained strength and assumed economic leadership over the traditional elite, which restructured itself and began to seek new opportunities through alliances with the merchant elite, creating a web of relationships that included marriage and family relationships as strategies to ensure commercial arrangements and support networks in the family and social context to maintain control and power.

The elite of Pará made up of farmers, merchants, rubber tappers, men of wealth, prestige, and power, and together with their families, began to represent a lifestyle according to the “civilizing standards” of progress and new forms of sociability expressed in public social life, in social clubs and family gatherings, social spaces for meeting, refinement, and reaffirmation of alliances and social networks established in a social hierarchy that outlined a new identity for Belém society. It should be noted that at this time of enrichment, the relationships between the rubber tapper elite and the poor workers excluded from growth changed and took on a new sociability. On the one hand, rubber brought economic growth, urbanization, the circulation of capital, and the enrichment of the majority groups. On the other hand, progress did not bring improvements in the lives of the popular classes, as there was an increase in “social ills” arising from the living conditions of those excluded from progress and wealth. Poverty and the abandonment of families and their dependents represented the other side of the imposing rubber society. Considering that large-scale rubber production reduced the production of basic agricultural products for the local population, there was an increase in imports and the difficulty of acquiring these products for the poor population. In rural areas, the aristocratization of rubber plantation owners and the degrading situation of rubber plantation workers. In the city, modernization and the exclusion of popular groups from the benefits of the growth engendered here.

In popular circles, family arrangements were made through marriage and/or consensual unions and relationships of godparents. In times of intense change, they were a means of ensuring security, protection, and mutual aid. In this social class, kinship and friendship relations were strengthened. And neighborhood as strategies that minimized the vulnerability and survival situations of these groups. Solidarity relationships became stronger through the establishment of marriages, support networks, and godparenthood. Considering that population growth generated a new demographic profile of the inhabitants due to the large waves of migrants from the Northeast and abroad, Belém became an

expression of both wealth and poverty expressed in luxurious houses, the mansions in the central and peripheral areas, the tenements and ranches.

Life and coexistence in the popular context changed in terms of conjugality, the networks of sociability, and the alliances between individuals and families to obtain help. Given the new circumstances of instability and vulnerability of the popular groups. Regarding this information, Raposo (1997, 135) reaffirms this adverse context experienced by the popular groups. In which families affected by poverty began to live in the same household. These are examples that reveal the new networks of sociability in the face of situations experienced or represented situations of injustice.

Carcela (2006, p.201) reports the case of a minor named Odorico registered with ATJEP, 4th district, which portrays the situation of a minor from the countryside "who suffered punishment" (a spanking and a beating) by the director of the São José school where he was a boarder. When he felt wronged, he sought out the "representative" of his father who lived in the capital; who took all the necessary steps with the police to have the case investigated. This fact highlights the role of the godfather from the capital in providing help and protection to the son of a friend in a difficult situation, in need of help. Networks of friendship and solidarity functioned as a strategy for support and survival in the city. Assistance between relatives and friends is covered by protection and a reference of solidarity to friends, relatives, and children of godfathers.

When it comes to marriage proposals, the friend or godfather would be the reference for the intentions, character, suitability, and seriousness of the suitor and the security of welcome for those relatives or friends who have recently arrived from the countryside and other areas or regions of the country, who seek to settle in this city. From these social networks, the establishment or expansion of kinship relations, alliances, and godfather relationships was established as a strategy for the survival and biological and social reproduction of these social groups marginalized in the urban space.

CONCLUSIONS

In the early years of the Republic, the Brazilian economic base was still rooted in large estates, which contributed to the lack of basic changes in society, since all power was still concentrated in the hands of rural landowners. During this period, the important figure of the "coronel" stood out, who positioned himself at the political base of the republican structure, thus revealing the still "feudal" nature of society. The latifundium, located as the economic base of the political system, considering that in this period the power of the rural aristocracy as the dominant class was reinforced, thus observing a "mere" political

transformation from the Empire to the Republic, since the economic structure was based on large land holdings. The latifundium, as an economic base, contributed to the permanence of the lordly mentality. The rural landowner maintained the same prestige that was assured to them in the Colony and the Empire.

In the early years of the Federal Republic, it continued to represent the political expression of the pre-capitalist latifundium, although at that time, under the ideals of progress, the landowner assumed a new role, now also as a businessman, but firmly maintaining his power over the family group and his role of dominance about the land, its workers, agriculture and cattle. This interference expanded, through the diversification of towns, cities, and economic activities.

In Brazil and the state of Pará, during the expansion of rubber exploration, cronyism signaled the establishment of networks of social protection, assistance, inclusion, and expansion of new social, economic, and political possibilities. Based on the alliances that are established and strengthened through marital relationships and cronyism, they promote support for economic, political, and social businesses by expanding the networks of social protection that were established through family relationships.

Crony under the ideal of protection expanded to reach later generations and remained dominant, especially in regions marked by the vulnerability of the poorest classes, functioning as a reproducer of social relations and maintaining the dependence of the popular classes on local powers. For decades, Belém remained elitist, aristocratic, and subsidized by conservative sociocultural standards, maintaining the traditional role of the family. And all networks of sociability, including relationships of godparenthood.

Although the text refers to a timeline distant from the present, in Brazil, in the state of Pará, family relationships and relationships of godparenthood are still important references in the family environment in contemporary times. Although family life has become nuclear, parental reference is very present, especially in times of difficulty. As are relationships of friendship and godparenthood, especially in the Catholic environment. In this sense, in the country, and Belém do Pará, networks of alliances are present, although with a new focus: Friends who become brothers, uncles/aunts who sponsor nephews. There is a network of alliances in everyday life, of support for different causes. Although relationships of religious godparenthood are more relaxed, we can see the legacy of relationships of support that pass through different fields, as they emanate meaning, support, and belonging. In large capitals and consequently in urban spaces, the presence of alliances that update the meaning of sponsorship, which in some way refers to the legacy of cronyism. In this new context, people and groups associate, support each other, and become defenders and

supporters. It is still common to hear the saying “He who has a godfather will not die a pagan” or “he will not die of hunger”. This ideology is very present in party politics, where candidacies and elections are negotiated. Characterized as an exchange of favors and reciprocity; being a sponsor means a condition of access to receive benefits, resolutions of causes, and employment, among other requests. In the legal sphere, the presence of the protectionist ideology is strengthened by Law No. 13,509 of November 22, 2027, which includes in the Statute of Children and Adolescents (1990), the implementation of “Emotional Sponsorship” as a judicial measure as an instrument to promote family and community coexistence for children and adolescents in shelters awaiting adoption. With the central objective of creating safe, lasting bonds that enable family life, through the establishment of effective family ties.

Thus, in this observance, the permanence of the ideology of protective and welfare family relationships is very present in contemporary Brazilian social reality, regardless of formats and rearrangements; the bonds of godparenthood, although emerging, remain as organizing support for social relationships, in the family and political spheres, and especially in the digital support network, as support relationships in contemporary times.

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NEURODIGITAL PROTOCOLS AND PARAMETERS FOR ASSESSING MOTOR SKILLS IN ELDERLY PEOPLE: AN INTEGRATIVE LITERATURE REVIEW

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ABSTRACT

This study aims to investigate neurological protocols used to assess motor skills in older adults, with special emphasis on active digital games or exergames. The integrative literature review was conducted based on automated searches using descriptors by area of interest. The time frames were searched between January 1, 2022, and August 29, 2024, on the Scopus, PubMed, Scielo, and Periódicos Capes platforms, chosen for their relevance in the areas of motor development and control. The search strings were: ("Elderly") AND ("motor skill") AND ("exergames") OR (exergaming) AND ("assessment"). Initially, 109 articles were found by title. After applying the inclusion and exclusion criteria, 31 articles remained, of which 20 had full text available. Next, the titles, abstracts, and full texts were analyzed. During this process, one repeated study, one incomplete study, and one study related to children were excluded, thus 17 articles were selected for final analysis. As a result, exergames show great potential to stimulate and improve health in the elderly, with proven efficacy in most of the studies analyzed. However, their use as an assessment tool has not been explored, highlighting a gap in the literature. There is a need for research that investigates their application for more accurate assessments and comparisons with traditional methods. Exploring this potential can optimize the use of exergames and expand their benefits for this population.

Keywords: Elderly. Motor skills. Exergames. Assessment.

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INTRODUCTION

The aging process is a phenomenon that occurs in all societies. It is dynamic and progressive, manifesting itself through a series of biological, psychological, and social changes. These changes can vary from individual to individual and, in turn, can affect well-being and quality of life in old age. With the increase in the elderly population, it becomes essential to consider aspects such as fullness, wisdom, quality of life, and rebirth for this new phase of life (NAKANO, MACHADO, ABREU, 2019). The authors report that family support, subjective perception of health, and satisfaction with life also play significant roles. According to the Brazilian Institute of Geography and Statistics – IBGE (2021), demographic trends are related to population aging. Recent discoveries have provided important information about the specific changes in motor skills resulting from aging. Research conducted by Johnson et al. (2021) demonstrated that older people tend to have a decrease in walking speed and balance ability, which can increase the risk of falls and injuries. Furthermore, a systematic review conducted by Chen et al. (2020) highlighted that aging is associated with a reduction in precision and coordination of movements.

The decline in motor skills can have a significant impact on the functionality and quality of life of older people. Studies have shown that older people with impaired motor skills have a higher risk of functional disability, dependence, and early mortality (PETERS et al., 2019). In addition, the loss of independence in activities of daily living can lead to a decrease in self-esteem and psychological well-being.

Several factors can contribute to changes in motor skills during the aging process. Sarcopenia, for example, is a common phenomenon in older people, characterized by the loss of muscle mass and strength, which can negatively affect the ability to perform motor tasks (CRUZ-JENTOFT et al., 2019). Furthermore, changes in the central nervous system, such as decreased neural plasticity and deterioration of sensorimotor pathways, also play a significant role in the changes observed in motor skills (SEIDLER et al., 2022).

Seidler et al. (2022) assess that protocols and parameters for assessing motor skills in older adults play a crucial role in identifying functional deficits and designing appropriate therapeutic interventions. With a comprehensive approach and the use of validated protocols and relevant parameters, it is possible to perform an accurate and reliable assessment of motor skills in older adults.

In addition to specific protocols, several parameters are considered in the assessment of motor skills in older adults, including speed, range of motion, coordination, balance, and endurance. These parameters provide detailed information about motor performance and can be used to monitor progression over time (SEIDLER et al., 2022).

Balance testing is crucial in assessing motor skills in older adults, as balance is a fundamental component for performing activities of daily living.

Bravo et al. (2019) highlight that among the balance assessment protocols, the Timed Up and Go (TUG) is widely recognized as one of the most cited tests in the literature when it comes to assessing the risk of falls in older adults while walking. In parallel, the Tinetti balance scale, known as the Tinetti Balance Assessment: Performance Oriented Mobility Assessment (POMA), is also frequently referenced to assess balance. About ten years after the validation of the TUG, the Four Square Step Test (FSST) emerged, a clinical test to assess dynamic balance. This test is notable for its ease of scoring, speed of administration, minimal space requirements, and lack of need for special equipment.

Despite the challenges associated with aging, appropriate interventions can help minimize the decline in motor skills and promote active and healthy aging. Physical exercise programs, balance and coordination training, and multidisciplinary interventions have shown benefits in improving motor skills and reducing the risk of falls in older adults (GILLESPIE et al., 2022). In this sense, the search for themes related to the assessment of motor skills in elderly people, through neurodigital parameters and protocols, is of significant importance, given the growth of this population worldwide. In this context, the objective was to collect articles in which JDAs were used to assess motor skills in elderly people.

The adaptive nature of JDAs allows for the customization of activities according to the needs and individual capacities of older adults, thus improving the accuracy of the assessment. Despite the potential benefits, assessment through JDAs also presents challenges and limitations. For example, issues related to accessibility, familiarity with technology, and adaptation to cognitive abilities can influence the effectiveness and validity of the results (BOLETSIS and McCALLUM, 2020).

For Schneider, Berlese, and Barbosa (2023), active digital games emerge as a beneficial tool for improving motor and cognitive skills. Thus, future research must focus on the development and validation of assessment protocols based on JDAs, which must be sensitive, reliable, and culturally appropriate for this population. In recent years, JDAs have stood out as a promising alternative for stimulating various capacities in older adults, offering an interactive and engaging approach.

Although JDAs appear to be a promising tool for stimulating and rehabilitating motor skills, there are still challenges to be faced. Research is needed to better understand the long-term effects of JDAs, in addition to exploring forms of assessments through JDAS, as well as making interventions accessible and personalized for different populations (MOLINA et al., 2022); thus, it is in this sense that this work is developed. Thus, the present study has

as its research problem the following question: how do neurological methods and protocols, particularly JDAs, stimulate and assess motor skills in older people? This article aims to investigate neurological protocols used in the assessment of motor skills in older people, with special emphasis on active digital games or exergames.

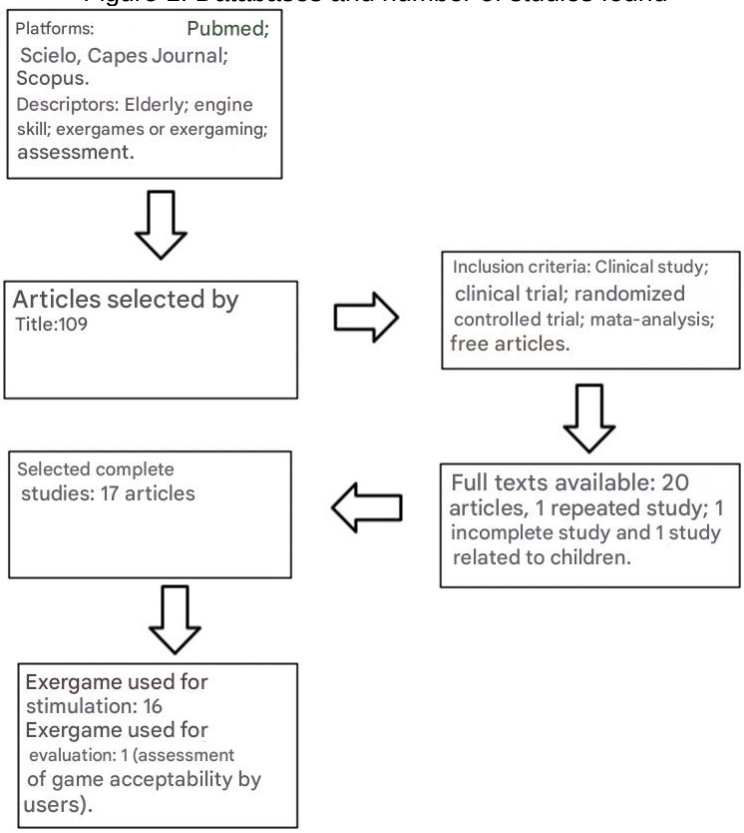
METHODOLOGICAL PROCEDURES

This study is characterized as basic research in terms of its nature and, in terms of the approach to the problem, as qualitative, aiming to locate how many and which are neurological parameters and protocols used to assess motor skills in older people. Regarding the technical procedures, this is an integrative literature review article.

For this integrative literature review, the process of defining the automated search strings was based on the use of descriptors, separated according to their set of interests. The time frames were performed between January 1, 2022, and August 29, 2024, on the Scopus, PubMed, Scielo, and Periódicos Capes platforms. These databases were chosen for their relevance in the areas of motor control. The following strings were established for the search for articles: (“Elderly”) AND (“motor skill”) AND (“exergames”) OR (exergaming) AND (“assessment”).

A total of 109 articles were found, with 3 exclusion criteria. After applying the first criterion, which consisted of only Clinical Study, Clinical Trial, Randomized Controlled Trial, and meta-analysis studies, 31 articles were found. As an exclusion criterion, only free full-text articles were selected, thus leaving 20 articles. After reading the titles, abstracts, and full text and excluding one repeated study, one incomplete study, and one related to children, 17 articles remained, which were used for the study. Figure 1 shows the flowchart with the databases found.:

Figure 1: Databases and number of studies found



SOURCE AUTHORS.

PRESENTATION AND DISCUSSION OF RESULTS

The results obtained from the Integrative Literature Review will be presented and discussed to identify studies that utilized neurological protocols and parameters to assess motor skills in older adults. The initial analysis focuses on presenting the selected studies, followed by a systematization of the main findings, allowing for a deeper understanding of the approaches and methodologies employed in the reviewed investigations. Table 1 presents the selected studies according to the inclusion and exclusion criteria.

Table 1 – Selected studies considering the study's inclusion and exclusion criteria

AUTHORS / TITLE / YEAR	OBJECTIVES	METHODS AND EXERGAMES USED
Peláez-Vélez, Francisco-Javier, et al. "Use of Virtual Reality and Videogames in the Physiotherapy Treatment of Stroke Patients: A Pilot Randomized Controlled Trial", 2023.	Analyze the effects of combining traditional neurological physiotherapy with a VR program in the treatment of post-stroke patients.	Pilot Randomized Controlled Trial with immersive virtual reality simulation using Quest goggles.
Turoń-Skrzypińska, Agnieszka, et al. "Impact of virtual reality exercises on anxiety and depression in hemodialysis", 2023.	Assess the relationship between virtual reality physical activity and symptoms of anxiety and depression in hemodialysis patients.	Meta-analysis. Exergame used for stimulation: prototype of the NefroVR system.

MacIntyre, Erin et al. “Get Your Head in the Game: A Replicated Single-Case Experimental Design Evaluating the Effect of a Novel Virtual Reality Intervention in People With Chronic Low Back Pain”, 2023.	Evaluate the effects of a gamified VR-graded activity intervention in individuals with chronic low back pain, using both commercially available and customized VR programs.	Experimental study. Exergames used for stimulation: Three exergames were used in the intervention: HoloBall, HoloDance, and RoBow Agent.
Campo-Prieto, Pablo, et al. “Feasibility and Effects of an Immersive Virtual Reality Exergame Program on Physical Functions in Institutionalized Older Adults: A Randomized Clinical Trial”, 2022.	Assess the satisfaction of using IVR-based exercises among older adults.	Randomized clinical trial. Exergame used for stimulation: immersive virtual reality (IVR) TheBlue: Steam VR Home.
Tuan, Sheng-Hui, et al. “Assessing the Clinical Effectiveness of an Exergame-Based Exercise Training Program Using Ring Fit Adventure to Prevent and Postpone Frailty and Sarcopenia Among Older Adults in Rural Long-Term Care Facilities: Randomized Controlled Trial”, 2024.	Evaluate the effectiveness of an exergame program administered via RFA in improving muscle mass and functional performance in older adults in LTCFs.	Randomized clinical trial. Exergame used for stimulation: exergame – RFA.
Fluet, Gerard, et al. “The influence of scaffolding on intrinsic motivation and autonomous adherence to a game-based, sparsely supervised home rehabilitation program for people with upper extremity hemiparesis due to stroke. A randomized controlled trial”, 2024.	Examine motivation, adherence, and motor function improvement in two groups undergoing an upper-limb home rehabilitation program.	Randomized clinical trial. Exergame used for stimulation: Home Virtual Rehabilitation System (HoVRS).
Wu S, Ji H, Won J, Jo E, Kim Y, Park J. “The Effects of Exergaming on Executive and Physical Functions in Older Adults With Dementia: Randomized Controlled Trial”, 2023.	Investigate the effects of exergames on executive and physical functions in older adults with dementia compared to regular aerobic exercises.	Randomized Controlled Trials using the game *Alchemist’s Treasure*, a racing game based on *Talesrunner IP*, co-developed with *ExerHeart*.
Seinsche, Julia, et al. “A Newly Developed Exergame-Based Telerehabilitation System for Older Adults: Usability and Technology Acceptance Study”, 2023.	Evaluate the usability, acceptance, engagement, and safety of the modified COCARE system for older adults and healthcare providers, identifying facilitators and barriers to its home implementation.	Mixed methods, including qualitative (think-aloud) and quantitative (EEQ, SUS, and UTAUT) analyses of system perceptions and home implementation barriers. Exergame used: Dividat Senso Flex.
Nuic, Dijana, et al. “Home-based exergaming to treat gait and balance disorders in patients with Parkinson’s disease: A phase II randomized controlled trial”, 2024.	Evaluate the effectiveness of a personalized exergaming system for patients with PD and gait or balance disorders resistant to dopamine treatment.	Phase II randomized controlled trial using RGB-D Kinect® motion sensor and the exergame Toap Run for stimulation.
Hajebrahimi, Farzin, et al. “Clinical evaluation and resting state fMRI analysis of virtual reality-based training in Parkinson’s disease through a randomized controlled trial”, 2022.	Investigate the therapeutic effects of VR-based exergaming on motor and cognitive symptoms of PD and its influence on neuroplasticity.	Randomized controlled trial. Exergame used for stimulation: NW Fit Plus games.
Tiba, Alexandru, et al. “T-RAC: Study protocol of a randomized clinical trial for assessing the acceptability and preliminary efficacy of adding an exergame-augmented dynamic imagery intervention to the behavioral activation treatment of depression”, 2023.	Assess the acceptability and preliminary efficacy of adding an exergame to behavioral activation treatment for depression.	Randomized controlled trial. Exergames used for stimulation: (Xbox Kinect™).

Zhang, Bingyu, et al. “Study protocol on the efficacy of exergames-acceptance and commitment therapy program for the treatment of major depressive disorder: comparison with acceptance and commitment therapy alone and treatment-as-usual in a multicenter randomized controlled trial”, 2024.	Assess the effectiveness of the e-ACT program with exergames in reducing depressive symptoms in patients with MDD, comparing it to ACT and control (TAU) at three points: pre-intervention, post-intervention (8 weeks), and 24 weeks later.	Multicenter randomized controlled trial. Exergame used for stimulation: e-ACT training program.
Van Santen, Joeke, et al. “Cost-effectiveness of exergaming compared to regular day-care activities in dementia: Results of a randomized controlled trial in The Netherlands”, 2022.	Evaluate the cost-effectiveness of exergaming versus regular day-care activities for people with dementia and their informal caregivers.	Randomized clinical trial. Exergame used for stimulation: e-Health 'Exergaming'.
Huber, S K et al. “PEMOCS: Evaluating the effects of a concept-guided, Personalized, Motor-Cognitive exergame training on cognitive functions and gait in chronic Stroke-study protocol for a randomized controlled trial”, 2024.	Evaluate the effect of a personalized motor-cognitive exergame on cognitive and motor functions in chronic stroke survivors.	Randomized controlled trial. Exergame used for stimulation: Dividat Senso (Dividat AG).
Sonbahar-Ulu, Hazal, et al. “Active video gaming in primary ciliary dyskinesia: a randomized controlled trial”, 2022.	Investigate the effects of active video games (AVGs) on lung function, muscle strength, exercise capacity, muscle oxygenation, physical activity, ADL, and quality of life in PCD.	Randomized clinical trial. Exergame used for stimulation: Xbox-Kinect-360.
Skrzatek, Anna, et al. “Brain modulation after exergaming training in advanced forms of Parkinson’s disease: a randomized controlled study”, 2024.	Investigate the effects of a home-based exergame training protocol on brain volume and resting-state functional connectivity (rs-FC) in people with PD.	A randomized controlled study using a customized full-body movement exergame with an RGB-D Kinect® motion sensor.
Kircher, Eva, et al. “A Game-Based Approach to Lower Blood Pressure? Comparing Acute Hemodynamic Responses to Endurance Exercise and Exergaming: A Randomized Crossover Trial”, 2022.	Determine whether an exergaming session in an innovative fitness game can be as effective as moderate endurance exercise in improving blood pressure.	Randomized crossover trial. Exergame used for stimulation: ExerCube.

Source: prepared by the author (2024).

RESULTS AND DISCUSSION

When systematizing the data from the 17 articles identified in this systematic review, it was observed that, in 16 of them, the authors used exergames as a simulation tool, while only one study applied exergames as an evaluation method. Of the articles analyzed, three investigated patients who had suffered a stroke, two focused on patients with dementia, three explored individuals with anxiety disorders and depression, three evaluated functional capacity, two examined the quality of life of participants, and one study each was dedicated to Parkinson's conditions, rehabilitation, blood pressure control, and neuroplasticity. It is worth noting that, in the 16 studies that used exergames for stimulation purposes, the evaluations of the results were carried out through traditional protocols, such as cognitive function tests and physical capacity assessments, demonstrating the predominance of the use of exergames for therapeutic and rehabilitation purposes. Only one study stood out for using exergames specifically as an evaluation tool. Below is a summary of the articles

selected for this study. The study by Peláez-Vélez et al. (2023) investigates the use of virtual reality (VR) as a non-invasive therapeutic tool that creates immersive three-dimensional environments through varied sensory stimuli. VR allows users to interact and navigate in a convincing virtual space, recreating experiences close to reality. The authors explain that, during the use of VR, mirror neurons are activated, which generates motor responses similar to real actions, promoting physical improvements. Although VR is considered promising as a complement to traditional treatments, the authors emphasize the need for further studies to prove its effectiveness. Based on these concepts, the authors conducted a pilot clinical trial with 26 patients in an outpatient clinic in Murcia, Spain, who had undergone rehabilitation after a stroke. The study combined traditional neurological physiotherapy with VR stimulation, using Quest glasses to generate an immersive virtual environment. The results suggest that the integration of VR with traditional physiotherapy can be an effective strategy in the motor recovery of patients, standing out as a promising approach for the rehabilitation of individuals who have suffered a stroke (PELÁEZ-VÉLEZ et al., 2023). In this sense, Turoń et al. (2023) highlight that virtual reality (VR) offers the opportunity to modify the environment and isolate the user from visual and auditory stimuli that may negatively affect their mood. VR programs are widely used in the treatment of balance, coordination, and mobility disorders in neurological diseases. However, there are few studies on its use in the rehabilitation of patients with chronic kidney disease. In the study with 85 hemodialysis patients, the authors applied VR exercises with the NefroVR prototype, observing a significant reduction in anxiety and depression. They recommend encouraging this practice and exploring its use in other therapies for kidney patients. According to MacIntyre et al. (2023), virtual reality (VR) is an increasingly accessible technology that can improve adherence to exercise programs through gamification. Using VR to make exercise more enjoyable and motivating can, in turn, improve clinical outcomes. In this sense, the authors concluded that the VR-graded activity intervention led to a significant reduction in pain intensity (effect estimate = −1.0, standard error = 0.27, $P < 0.001$), with four participants showing a pain reduction greater than 30%, considered a minimal important change. The intervention also had a significant effect on pain catastrophizing, although it showed no impact on measures of pain-related fear or anxiety. These findings provide preliminary support for the efficacy of a VR-graded activity program in reducing pain in people with chronic low back pain (CLBP).

Campo-Prieto et al. (2022) emphasize that physical activity plays a crucial role in active aging, being one of the fundamental pillars for maintaining health and functionality in

older people. However, adherence to physical exercise programs among this population has historically been low, which represents a significant challenge for promoting healthy aging.

In this context, immersive virtual reality (IVR) emerges as an innovative and attractive solution for physical training, particularly given the increase in the elderly population, characterized by frailty, comorbidities, and disabilities that affect quality of life and increase social and health costs. The study conducted by Campo-Prieto et al. (2022) demonstrated that IVR is a valuable tool reliable and effective for implementing personalized exercise programs, promoting improvements in physical function, and contributing to healthier and more active aging.

The intervention using exergames combined with physical resistance exercises (RFA) demonstrated significant improvements in muscle mass, strength, and functional performance among older adults in rural long-term care facilities (LTCFs), offering a new approach to address frailty and sarcopenia (TUAN et al., 2024). For the authors, exergames overcome the limitations of repetitive and monotonous physical exercises by providing attractive and multisensory game environments with an immersive experience in which interaction occurs through full-body movements. The gamified approach and immersive scenarios encourage older individuals to commit more to exercise and rehabilitation. Thus, the use of exergames not only reduces the time required by the team for intervention but also motivates patients to perform higher-intensity movements and increases their motivation for physical activity (TUAN et al., 2024).

Fluet et al. (2024) point out that game mechanics, which influence the flow, presentation of information, and feedback on success or failure, affect the frequency of use, playing time, and continuity of players. These mechanisms provide feelings of self-efficacy and progressive challenge, which is linked to motivation, and reinforced by clear feedback. Despite this, the study concluded that increasing challenges did not improve adherence compared to difficulty control. However, both treatments resulted in significant improvements in motor and cognitive function and daily activities.

In the study conducted by Wu et al. (2023), the effects of exergames, specifically the Alchemist's Treasure game, were investigated on the executive functions and physical condition of 24 elderly individuals with moderate dementia, comparing them with regular aerobic exercise. The authors define executive functions as a set of essential cognitive abilities, responsible for the execution of complex tasks and the suppression of interference, classified into two levels. The first level, called core, encompasses inhibition, working memory, and cognitive flexibility. The second, higher level, encompasses planning and problem-solving skills, both strongly associated with the frontal lobes.

Executive dysfunction, frequently observed in cases of dementia, significantly compromises independence in daily activities, aggravating the loss of autonomy. Although previous evidence suggests that exergames can improve executive function and reduce the risk of falls in elderly individuals with preserved cognition, the specific impacts of this intervention in elderly individuals with dementia, as well as the neural responses associated with executive function, are still little explored areas. However, the authors conclude that exergaming can be an effective intervention for this population, offering improvements in both cognitive functions and physical capabilities of elderly people with dementia (WU et al., 2023). In this sense, Seinsche et al. (2023) highlight the significant growth in the development of health technologies, with ICTs emerging as fundamental tools for the telerehabilitation of elderly people and other patients. Telerehabilitation involves the provision of rehabilitation services remotely, using technologies for remote training and management. Although exergames such as the Nintendo Wii and Xbox Kinect are widely used, they were not specifically designed for elderly people, which may limit their effectiveness in this group. The study carried out with the Dividat Senso Flex exergame evaluated the usability, acceptance, and safety of the COCARE system among 45 elderly people and 15 health professionals, concluding that the system needs to become more user-friendly and effective in improving cognitive and physical functions. The authors suggest future clinical trials to test its feasibility and effectiveness. Similarly, Nuic et al. (2024) evaluated the efficacy of a personalized home exergaming system for patients with Parkinson's disease (PD) who have gait and balance disorders resistant to aromatherapy, through a randomized controlled clinical trial. The study involved 50 patients with refractory disorders, using the Toap Run exergame. The authors concluded that home training with personalized exercises can be safe and effective in improving these symptoms. They highlight that gait and balance disorders are common in PD and often become resistant to conventional treatments, resulting in episodes of freezing of gait (FOG), falls, worsening quality of life, and increased healthcare costs. In addition, the authors mention that previous trials suggest that the combination of exergaming with home-based physical activity, complemented by remote training, can potentially mitigate motor impairments associated with PD. However, there is still insufficient evidence to definitively recommend the use of home-based exergaming combined with concurrent physical activity to treat gait and balance disorders in advanced stages of PD (NUIC et al., 2024). Hajebrahimi et al. (2022) report that the increase in the number of people living with dementia will result in increasing costs related to the disease worldwide. E-health interventions such as exergaming have the potential to improve the health and quality of life of people with dementia; however, their

cost-effectiveness is still unknown. Furthermore, the authors report that the use of exergaming can improve motor and cognitive functions in patients with Parkinson's disease (PD), especially when combined with traditional therapy. However, studies with larger samples and longer treatments are needed to assess the lasting effects of this approach (HAJEBRAHIMI et al., 2022).

Regarding psychological aspects, major depressive disorder (MDD) is a highly prevalent mental health condition among older adults, resulting in significant impairment in the quality of life of affected individuals. Although several effective treatments are available for the treatment of depression, the actual effectiveness of these treatments has been questioned. According to Tiba et al. (2023), studies indicate that, when research biases are removed, the observed impact of treatments is, in most cases, moderate to small. The same authors concluded, after their study with 110 participants, that exergaming is effective in motor rehabilitation and in reducing depression. Exergaming was well accepted and demonstrated to be feasible, justifying its further investigation in cognitive interventions for individuals with depression (TIBA et al., 2023).

FINAL CONSIDERATIONS

Based on the analysis of the 17 selected articles, it was evident that the use of exergames has significant potential for the stimulation and improvement of various health conditions. In 16 studies reviewed, exergames were predominantly used as stimulation tools, demonstrating their effectiveness in promoting functional and motor improvements in different clinical contexts, such as stroke, dementia, anxiety, depression, and general functional capacity.

However, the application of exergames as an assessment method was limited to only one study. This fact highlights a gap in the literature on the use of exergames for assessment, suggesting the need for further research exploring how these tools can be used to comprehensively and accurately assess the health conditions and progress of older people.

In addition, the studies analyzed indicate that, although exergames are effective for stimulation, there is a lack of evidence on their effectiveness compared to traditional assessment methods.

It is therefore essential that future research focuses not only on evaluating the effectiveness of exergames in different clinical conditions but also on exploring their potential for evaluation to optimize their use and maximize benefits. Combining exergames with other intervention and assessment methods may offer a more comprehensive and

integrated approach to rehabilitation and treatment of various health conditions, especially in older people.

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HIGH-PERFORMANCE MIXTURE FOR DOPING CONSTRUCTION WASTE AGGREGATES

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ABSTRACT

The construction industry is considered the sector of human activities that consumes the most natural resources, generating considerable environmental impacts, including the generation of construction waste. An alternative to this problem is to use this construction waste (RCC) in concrete. Studies show favorable results for this application, but attention must be paid to the limitations of the material, such as heterogeneity in composition, lower mechanical resistance, and greater water absorption. To correct these deficiencies, the doping technique can be applied, which consists of impregnating the aggregate with high-performance grout to alter its structure. Thus, this work addresses the study of the high-performance grout used in the doping of RCC aggregates to produce structural concrete. For this purpose, the recycled aggregate was characterized and the study of the high-performance grout was carried out, varying the proportion of superplasticizer additive and silica fume. After the results, it can be concluded that the doping procedure with high-performance grout proved to be efficient in reducing the porosity of the RCC aggregate, allowing the use of material that currently has no commercial value as an alternative aggregate in the preparation of structural concrete.

Keywords: Waste. High-performance grout. Doping technique. Structural concrete. Environment.

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INTRODUCTION

The construction industry increasingly consumes natural resources, most of which have a limited useful life; and the generation of construction waste accompanies this growth, generating, in turn, direct impacts on the environment. Projects that minimize or solve such problems must be designed in a way that reduces this waste and consequently reduces the environmental impacts of this activity (FERREIRA, 2022).

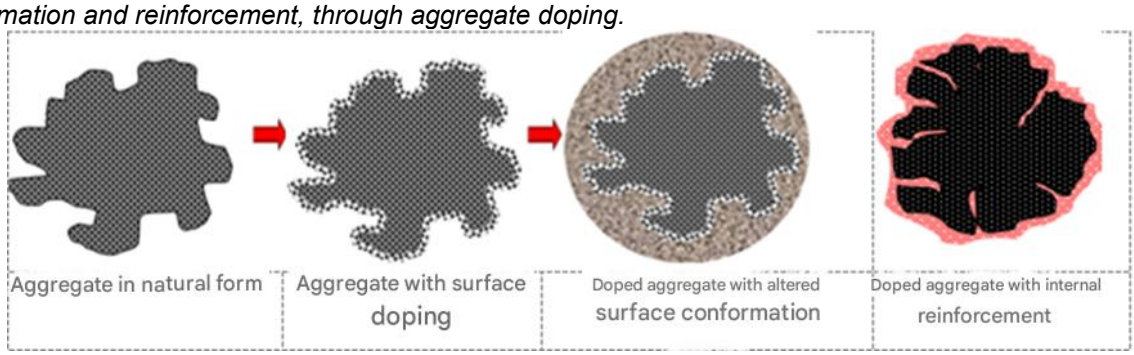
Abritta (2019) states that the scarcity of crushed stone deposits and the great demand for natural aggregates by the construction industry, with the consequent increase in waste generation, lead to the process of reformulating the production chain of this industrial activity, mainly the waste generated. Measures that establish guidelines for the management of construction waste (RCC) emerge, considering its reduction through the use of the material generated.

The use of recycled materials in the composition of new concrete has been investigated to assess the reduction of environmental impacts and the generation of quality products that are economically viable for civil construction, with analyses of concrete strength emerging with the use of alternative aggregates, such as RCC replacing natural aggregate, with behavior and applicability being evaluated (SOUZA, 2020).

Rabello (2015) evaluated the axial compression strength of concrete specimens, varying the percentage of mass replacement of RCC by conventional aggregate at levels of 0, 25, 50, 75, and 100%. The reference sample (0% RCC) reached a strength of 21.49 MPa at 28 days of age. With 25% replacement, the resistance dropped to 8.26 MPa, and with 75% RCC to 8.21 MPa, representing a drop of around 60%, which can be attributed to the excessive porosity of the test specimens made with recycled aggregate.

Thus, in the scenario of reusing RCC and the need to overcome its deficiencies, the aggregate doping technique emerges (Figure 1).

Figure 1 – Modification of the transition zone (TZ) at the paste/aggregate interface, change in surface conformation and reinforcement, through aggregate doping.



Source: Trigo (2012).

According to Trigo (2012), the technique consists of establishing the initial impregnation of the deficient aggregate with materials that react with other binders, modifying the texture of the material, or establishing a connection bridge between it and the binders that may be used, or providing reinforcement of the aggregate itself through its internal doping by filling the existing pores.

By providing the doping of an aggregate, through its “armor” with a high-quality matrix, it becomes possible to use aggregates previously considered unknown to concrete (Trigo, 2012).

Research carried out since 2002 at the Laboratory of Advanced Cement-Based Materials at the São Carlos School of Engineering (University of São Paulo) indicates that there is great potential for applying the material doping technique to increase the performance of concrete properties (Liborio and Fagury (2002); Silva and Liborio (2002); Liborio et al (2003); Silva and Liborio (2005); Trigo, Rebmann, and Liborio (2010); Trigo, Conceição, and Libório (2010); Trigo (2012)). Trigo (2012) states that, in concrete made with the doping technique, it is possible to observe improvements in the characteristics of the matrix-aggregate ZTI, such as a reduction in both the amount of calcium hydroxide (CH) and porosity, CH being a fragile compound formed during cement hydration, in addition to the formation of a large amount of additional hydrated calcium silicate (C-S-H), a more resistant hydrated product.

In his research, Trigo (2012) evaluated the doping technique by applying high-performance grout to lateritic aggregates. The application of the technique reduced the porosity of the laterite grain by more than 35%, demonstrating the efficiency of doping in plugging the surface pores of the aggregate. In terms of mechanical strength, the doping technique resulted in an average gain of 28% in compressive strength for concrete made with laterite. The author states that the increases in strength are a reflection of improvements in the paste/aggregate transition zone, confirmed in microscopic tests, representing the possibility of using many alternative aggregates that have been little or not at all explored until now.

Other materials that can potentially be used to replace the coarse aggregate commonly used in structural concrete, in addition to RCC, stand out, namely: marble waste, waste from oil well drilling, electric furnace slag, rolled gravel, and granite.

Araújo (2018) studied the physical and mechanical properties of concrete made with marble waste as a replacement for the coarse aggregate of granite gravel, in percentages of 5% and 10%, performing simple compression strength and water absorption tests. The results showed that the addition of 5% of marble waste promoted a gain of 4.53% in the

compression strength test at 28 days of age, achieving a strength higher than the characteristic strength (fck) of 20 MPa used in the dosage. When replacing 10% of marble waste with granite aggregate, there was a 7.14% increase in strength, a fact that can be attributed to the packing of aggregate particles in the concrete (Araújo, 2018).

Santos (2018) evaluated the performance of grout manufactured with waste from oil well drilling as a partial replacement for natural aggregates, in terms of properties in the fresh and hardened states. The waste contents evaluated were 10% and 20%, with mass replacement of conventional coarse aggregate (gravel 0). The results showed that the addition of 10% waste did not change the strength, while the mix with 20% replacement showed a higher strength (12.8%) when compared to the reference mix at the age of 28 days, increasing from 41.49 MPa to 46.80 MPa. Thus, for Santos (2018), it is feasible to use 20% of residue as a partial replacement for coarse aggregate, since in addition to meeting workability, it has shown to have superior resistance to the reference mix.

Evangelista (2016) studied the technical and environmental feasibility of using electric furnace slag (EFS), a residue produced in semi-integrated steel mills, as a replacement for coarse aggregate in the production of concrete paving pieces (pavers). Based on the results, Evangelista (2016) states that the use of EFS, in proportions of 25% and 50%, met the regulatory requirements. For higher proportions, mixes that meet the required requirements should be tested.

Silva (2022) evaluated concrete made with rolled gravel and granite gravel in fresh and hardened states. The author observed that, at 28 days of age, the concrete containing rolled gravel exhibited 28.72% higher compressive strength values when compared to that containing granite gravel. The author explains that to maintain the same workability of the concrete, it is necessary to use more water when using granite, justifying the drop in compressive strength. Nest and aspect, the aggregate doping technique can be an alternative to the problem presented, since it provides a change in the conformation of the aggregate.

Martins and Oliveira (2020) studied concretes with granite cutting waste (RCG) from civil construction. The authors concluded that the addition of RCG brings gains in strength with the complete curing period of the concrete, since at 14 days of age the reference mix presented higher strength values than the mixes with addition. The authors explain that the cohesion between cement and granite coarse aggregate is not complete at the beginning of curing, due to the smooth surfaces of the RCG; which can be corrected with the application of the doping technique.

Given the above, it is important to study doping in alternative aggregates, such as RCC, which, despite having a high potential for use due to its availability, presents deficient characteristics, such as high porosity; a factor that often restricts its use in structural concretes.

Thus, this work seeks to study a high-performance grout capable of reinforcing and improving the matrix of alternative aggregates, making them suitable for use in structural concrete.

MATERIALS AND METHODS

Initially, the characterization tests of the aggregates were carried out. The granulometry was done by sieving according to NBR 17054:2022. From the result of this analysis, two important factors for the dosage study were taken, the fineness modulus and the maximum diameter of the coarse aggregate of RCC. To determine the specific mass, water absorption, and unit mass, the standards NBR 16917:2021 and NBR 16972:2021 were followed. The powdery material test followed the recommendations of NBR 16973:2021.

Next, the dosage study of the doping grout of the coarse aggregates was carried out. To obtain a high-performance grout, High Initial Strength Portland Cement (CPV-ARI) and silica fume were used as binders. Silica fume was used at a content of 10%, as suggested by Trigo (2012). To obtain low water-to-grout ratios, a superplasticizer additive was used, with contents of 0.4% to 1.6% of the cement mass being studied, to obtain a consistency suitable for impregnation of the aggregates.

The study of the grout was based on the mini-slump test of the truncated cone (Monte, 2003), which evaluates the additive content and the grout spreading area, making it possible to create a curve and determine the optimum percentage of superplasticizer additive. The homogenization of the mixture and the order of placement of the materials followed the study by Trigo (2012).

Once the high-performance grout had been determined with a consistency suitable for impregnating the coarse aggregates, a test was performed to determine the mixture's setting times by NBR 16607/2018. This test is valuable since inadequate levels can delay the setting, making it difficult to impregnate the material with the grout.

Next, some RCC aggregate grains were selected to proceed with impregnation/reinforcement with the high-performance grout, i.e., application of the doping technique. After applying the technique, images of the aggregates were taken in natural

conditions (without doping) and doped (with high-performance grout) to verify the efficiency of the impregnation.

RESULTS AND DISCUSSION

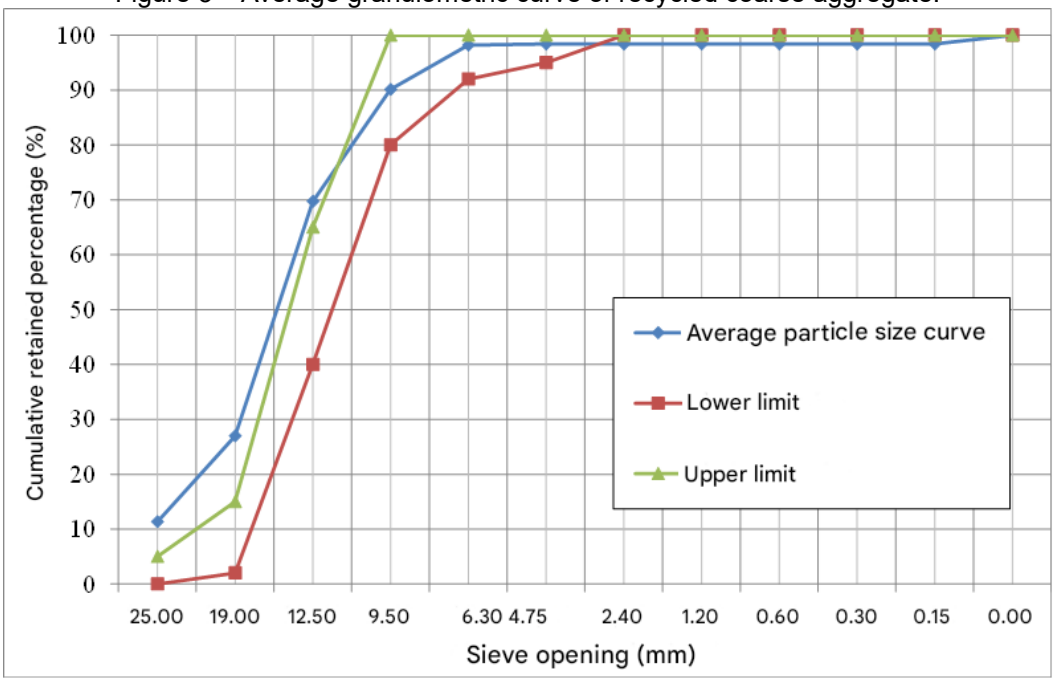
The granulometry test of the recycled coarse aggregate was performed on three different samples to obtain the average between the results and the acceptability of the test. Figure 2 shows the RCC sample used in the work and Figure 3 refers to the average granulometric curve of the aggregate, with the maximum diameter of the RCC being 25 mm and the fineness modulus equal to 7,07.

Figure 2 – Coarse aggregate of RCC studied in the work.



Source Authors.

Figure 3 – Average granulometric curve of recycled coarse aggregate.



Source: Authors, 2025

The average absolute specific mass of the coarse aggregate of RCC was 2.44 g/cm3, approximately 13% lower than the specific mass of a natural stone, which is around

2.80 g/cm3. This difference is mainly due to the presence of mortar adhered to the aggregate, which increases the porosity of the aggregate.

The results of the absolute specific mass of the binders were provided by their respective manufacturers. The cement used was CPV ARI, from the brand CSN Cimentos, with an absolute specific mass of 3.02 g/cm³. Regarding the silica fume, one from the brand Methatec was used, with an absolute specific mass of 2.20 g/cm³.

It was decided to use a 3rd generation superplasticizer additive, from the brand BASF, based on polycarboxylate, whose density is 1.07 g/cm³. The binders and additives are shown in Figure 4.

Figure 4 – Materials used in the research, cement (left), silica fume (center), and additive (right).



Source: Authors, 2025

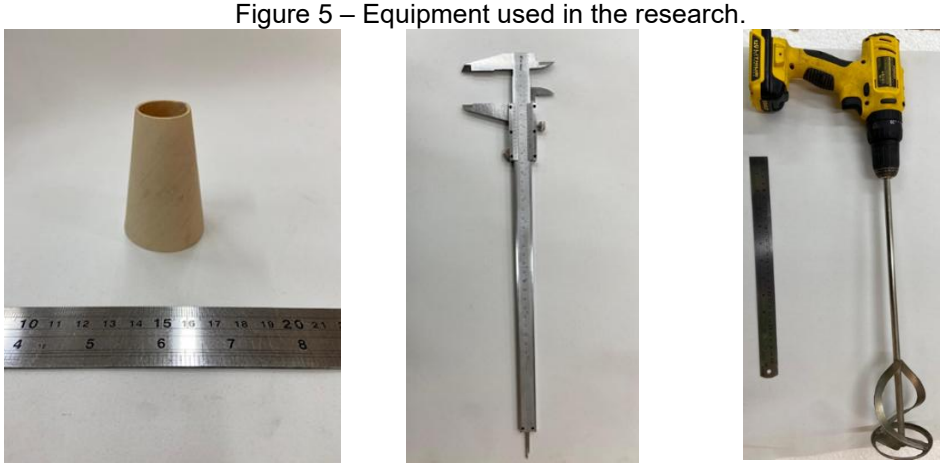
Regarding the loose and compacted unit masses of the recycled coarse aggregate, the average values found were 976.41 kg/m³ and 999.37 kg/m³, respectively.

After determining the composition of the coarse recycled aggregate, by NBR 15116:2021, and obtaining its classification as ARCO (Recycled Concrete Aggregate), the absorption test was performed, recommended by NBR 16917:2021, in which an average value of 18.5% was reached. The result does not meet the 7% limit established by NBR 15116:2021, a factor that can be changed after doping. The increase in absorption can be attributed to the greater porosity of the material when compared to that of the natural coarse aggregate. Once the use of High Initial Strength Portland Cement (HIN-ARI) and silica fume at a content of 10% as binders had been defined, different levels of superplasticizer additive were evaluated to obtain low water to grout ratios and a consistency suitable for impregnating the aggregates. Thus, additive levels of 0.4%, 0.8%, 1.2%, and 1.6% of the cement mass were studied using the Kantro test, or mini-slump of the truncated cone. The mini-slump method was developed by Kantro (1980) and adopted in some national and international studies to determine the consistency of cement pastes with superplasticizer additives. This method consists of a truncated cone mold and a glass plate. After removing the mold, two orthogonal diameters of the paste are measured with a

caliper. The average of the two measured diameters is calculated, and then the spread area of the paste is obtained (MONTE, 2003, p. 23-95).

The equipment used in this work is shown in Figure 5. The helical propeller coupled to the drill was used in the process of mixing the materials of the syrup.

Figure 5 – Equipment used in the research.

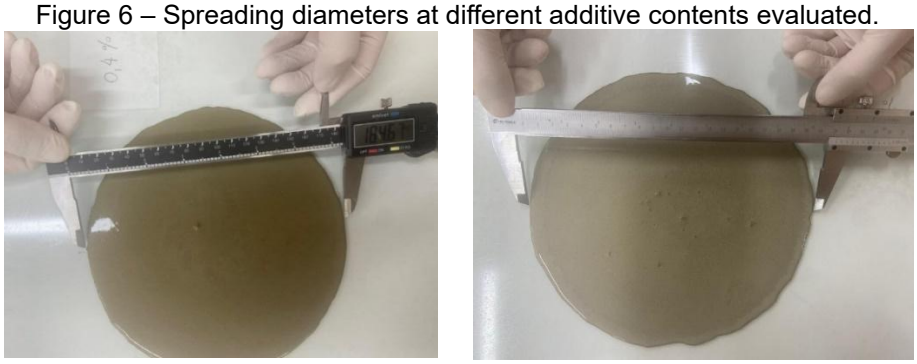


PVC conical trunk mold Analog caliper Drill with helical shank
Source: Authors, 2025

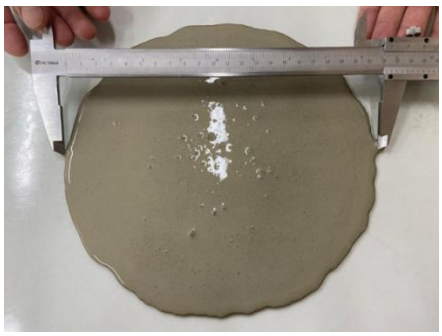
Before starting the Kantro test, the consumption of materials for the high-performance grout was determined, considering the silica fume content of 10% according to Trigo (2012), as well as the water/binder ratio (w/b) set at 0.35, which resulted in 0.9:0.073:0.35.

To define the additive content, the mini-cone slump test was performed on a flat and level bench, at a temperature of 24 degrees, on a glass plate greased with release oil. The mixing order of the materials followed the study by Trigo (2012). Figure 6 shows the different diameters obtained according to the additive content evaluated.

Figure 6 – Spreading diameters at different additive contents evaluated.



Content 0,4% Content 0,8%



Content 1,2%



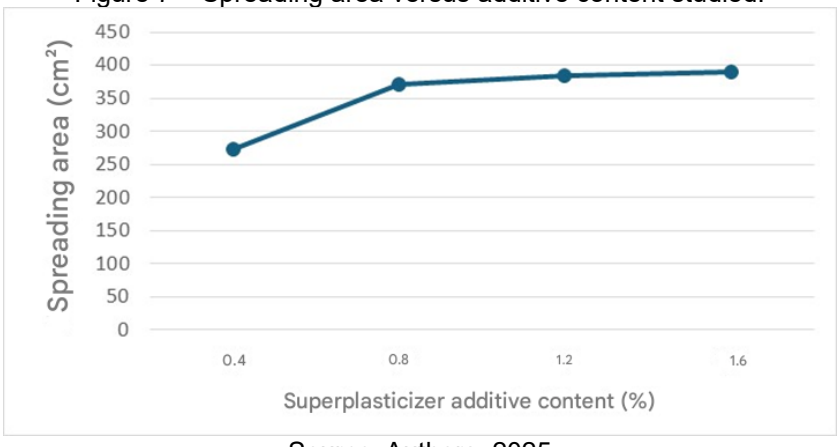
Content 1,6%

Source: Authors, 2025

Thus, with the average diameter values obtained, it was possible to determine the approximate spreading areas of each paste, according to the percentage of additive in the mixture. Figure 7 shows the results of the “spreading area versus superplasticizer content” curve. Analyzing the results, it can be seen that there was a significant increase in the spreading area when increasing the additive content from 0.4% to 0.8%. On the other hand, contents greater than 0.8% contributed practically no gain in spreading, indicating an optimum content of no more than 0.8%.

Therefore, to choose the additive content to be used in the doping mixture, one should base oneself not only on the maximum spreading achieved but also on the lowest loss of spreading over time and the lowest interference in the setting. Therefore, the research continued by performing the setting time test, which followed the provisions of NBR 16607/2018. A Vicat apparatus and a truncated conical mold were used, as seen in Figure 8.

Figure 7 – Spreading area versus additive content studied.



Source: Authors, 2025

Figure 8 – Test to determine the setting times of the doping solution.



Source: Authors, 2025

Table 1 shows the start and end times of the doping grout setting, considering the different superplantifying additive contents evaluated. It can be noted that contents higher than 1.2% resulted in end-of-setting values higher than 8 hours, making them inadequate for the coarse aggregate doping process.

The 0.4% content was the one that resulted in the shortest setting time (the desired condition in this research), however, it did not guarantee perfect dispersion of the particles and adequate doping of the coarse aggregate; a reflection seen in the Kantro test.

The explanation for choosing a shorter setting time is related to the aggregate doping process, more precisely with the concern regarding the permanence of the doping grout in the aggregate after it is mixed with the other constituents of the concrete. It is considered that the closer to the start of the grout setting this mixing is carried out, the less chance there is of the impregnation being removed by the friction of the grains.

Table 1 – Results of setting times of high-performance grouts made with CP V-ARI and different superplasticizer additive contents.

Catching time	Additive content (%)			
(minutes)	0.4	0.8	1.2	1.6
Start	197	366	394	432
End	375	434	536	544

Source Authors

Thus, based on the mini-slump tests of the truncated cone and setting time, it was concluded that the additive at a content of 0.8% relative to the mass of the binder was the most suitable for both dispersing the particles, without causing exudation of the mixture, and for not causing excessive delay in the setting of the cement. Furthermore, this content does not compromise the viability regarding the production time of the doped concrete,

since the mixing of the concrete (previously doped aggregate and other constituent materials) will occur in 366 minutes (6 hours and 6 minutes).

After completing the high-performance grout dosage study, and evaluating the conditions and efficiency of the doping grout, some RCC aggregate grains were selected and impregnated/reinforced with the high-performance grout.

Figure 9 shows the images of the aggregates in natural (without doping) and doped (with high-performance grout) conditions. It can be observed that the most significant change is in the surface conformation of the grain, which tends towards a more spherical shape, and in the reduction of surface pores. The spherical shape and smaller quantity of surface voids can represent an increase in the fluidity of concretes made with doped aggregates.

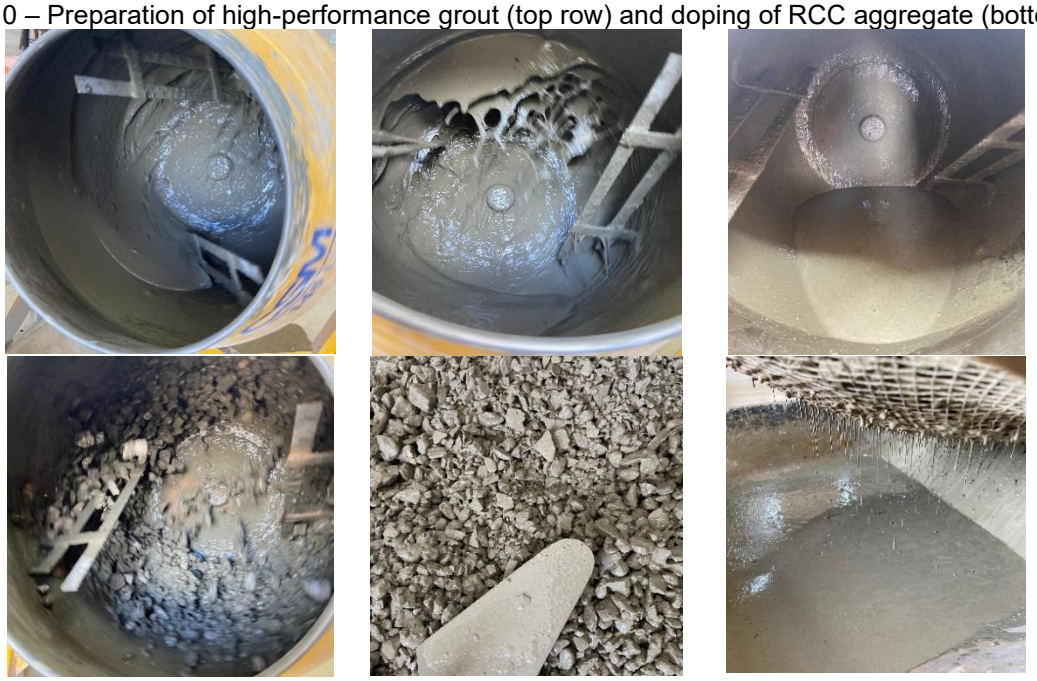
A larger quantity of aggregate was also doped to evaluate the efficiency of the mixture in a concrete mixer and the quantity of grout to be used in the impregnation. The high-performance grout was initially prepared, with the materials being inserted into the concrete mixer following the order of placement prescribed by Trigo (2012). Then, the coarse aggregates of RCC were added, which were mixed to dope them. After this, the material was passed through a sieve to remove the excess grout, thus completing the process of impregnating the aggregate. Figure 10 shows the steps of doping the RCC in a concrete mixer.

Figure 9 - RCC grains before (top row) and after impregnation with syrup (bottom row).



Source: Authors (2025)

Figure 10 – Preparation of high-performance grout (top row) and doping of RCC aggregate (bottom row).



Source: Authors (2025)

CONCLUSIONS

As outlined in the introductory text, the mineral sector faces challenges related to the availability of natural resources, especially those located in or near urban areas. The reduction in the possibilities of exploiting these mineral resources raises concerns about the guarantee of future supply. At the same time, the construction industry is responsible for the significant generation of waste, most of which is not recycled. In this context, it is essential and urgent to develop a technique that improves the performance of low-quality aggregates or aggregates previously considered unsuitable for concrete production.

Therefore, this work presents the development of a high-performance grout through the control and mini-slump tests of the truncated cone, in addition to the setting time test preceded by tests to characterize the aggregate by determining its granulometry, fineness modulus, fines content, and absolute and unit specific mass, where the ideal additive content of 0.8% for the grout was determined. Thus, the efficiency of the technique of doping aggregates with high-performance grout was proven in terms of reducing the porosity of the RCC aggregate through doping with large quantities presented during the work, making it possible to use a discarded material as an alternative material in the preparation of structural concretes.

For future research, it is recommended to mold test specimens using RCC already treated with the doping technique with different substitutions for the conventional coarse aggregate to establish the viability of the technique due to the possibility of reducing the use of natural coarse aggregate in structural concretes and its possible complete replacement.

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ACCESS TO JUSTICE: INNOVATIVE SOLUTIONS FOR PROMOTING PEACE, JUSTICE AND EFFECTIVE INSTITUTIONS

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ABSTRACT

This study aims to analyze how the adoption of Information and Communication Technology (ICT) can act as a mechanism to promote access to justice, transforming it into a more effective right. To this end, the research will show the relationship between the fundamental right to access justice and the technological and innovation tools made available by the National Council of Justice (CNJ). In addition, it seeks to relate these initiatives to public policies and the fulfillment of Sustainable Development Goal (SDG) 16 of the UN 2030 Agenda, to promote peace, justice, and effective institutions. The methodology adopted is a mixed one (qualitative and quantitative), based on a bibliographic review, documentary analysis, and statistical data. This article aims to contribute to the debate on the challenges and benefits associated with computerization in the legal field, highlighting its role in promoting democratization and guaranteeing citizens faster and simpler access to their rights before the Judiciary.

Keywords: Access to justice. Innovation. Technology. UN 2030 Agenda. Public policies.

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INTRODUCTION

Access to justice is a fundamental human right and an essential pillar of the Democratic State of Law, representing an indispensable condition for the consolidation of more just, inclusive, and peaceful societies. In Brazil, a country with a large territorial extension and profound social inequalities, ensuring full access to justice remains a significant challenge. Digital exclusion, aggravated by the lack of access to the internet and technological barriers, emerges as an obstacle, limiting the participation of vulnerable segments of the population in resolving disputes online and, consequently, in the full exercise of their rights. This study is justified by the relevance of the topic for guaranteeing fundamental rights and building a Democratic State of Law. The growing use of ICTs in the Judiciary requires an in-depth analysis of their impacts and challenges, aiming to optimize the use of these tools and ensure more efficient and equitable access to justice."

In this context, the adoption of digital technologies in the justice system emerges as a strategic alternative to democratize access and promote social inclusion. In addition to increasing the efficiency and transparency of processes, the computerization of the legal system has the potential to contribute to regional development by reducing geographic and economic barriers. However, this technological transition is not without its challenges. Issues such as digital exclusion, the need for inclusive public policies, and the training of legal professionals remain at the center of the debate, requiring innovative solutions that are sensitive to the structural inequalities that characterize the country.

This article examines how the implementation of digital technologies can function as a mechanism for expanding access to justice, with a focus on democratizing the legal system and aligning with the goals of Sustainable Development Goal (SDG) 16 of the 2030 Agenda, which advocates the promotion of peace, justice, and effective institutions. The research uses a mixed methodological approach, based on a bibliographic review, documentary analysis, and data reports from bodies such as the National Council of Justice (CNJ) and the United Nations, to identify and evaluate public policies related to access to justice and discuss the challenges and benefits associated with digitalization in the legal field. The article is structured in three main parts. The first section analyzes access to justice as a fundamental right of citizens, its historical evolution, contextualizing the advances and existing obstacles, discussing the prospects for effective accessibility to justice based on the implementation of new technological innovations in the Brazilian judicial system, with emphasis on the changes driven in the midst of and after the Covid-19 pandemic. The second section examines the alignment between the promotion of access to justice and the principles outlined in SDG 16 of the UN 2030 Agenda, addressing the

challenges of ensuring the maintenance of this right in the context of constant technological innovation and sustainable development. Finally, the third section presents statistical data on the structures of the country's courts, the people who work in the judiciary, and digital routines, contributing to transparency and democratic and participatory governance.

In summary, this study reinforces that the modernization of the judicial system, aligned with the goals of SDG 16, should not be seen only as an adaptation to technological changes, but as an ethical and social commitment to promote equity and strengthen democratic institutions. Thus, the construction of a more accessible and inclusive justice system requires coordinated efforts that articulate technology, public policies, and sensitivity to the needs of the population, contributing to the construction of a more just and sustainable society.

ACCESS TO JUSTICE: A FUNDAMENTAL RIGHT

Access to justice is a fundamental right, in this concept, it is up to the State to promote public policies of access and also ways to monitor it.

Access to justice refers to the guarantee that all people can claim and protect their rights through legal and institutional mechanisms, in an equal, effective manner and without discriminatory barriers. More than just the right to appeal to the Judiciary, the concept involves the possibility of understanding, participating, and obtaining fair and equitable results in the legal process. This principle is associated with the promotion of citizenship, human dignity, and social justice, and is recognized as a fundamental right in several national laws and international human rights instruments.

The concept of access to justice has changed over time, in line with changes and demands in society and the development of legal aid systems around the world. Several historical records demonstrate this. Am the existence of normative documents, originating from the Code of Hammurabi (21st to 17th centuries BC), which already provided for the “first guarantees that regulated and prevented the oppression of the weak by the strong, encouraging them to seek judicial authority when they felt oppressed” (CARNEIRO, 1999, p. 4), with the Universal Declaration of Human Rights (UN, 1948), the European Convention for the Protection of Human Rights and Fundamental Freedoms (1950), the International Covenant on Civil and Political Rights (1966), the Pact of San José de Costa Rica (1969), among others. In the 1960s and 1970s, the assessment of the subject gained relevance, given the transformations that had occurred in social relations and the increase in their complexity, especially with the Florence Project on Access to Justice by Mauro Cappelletti

and Bryant Garth, which began in 1971 at an International Conference on the fundamental guarantees of the parties in civil proceedings (CAPPELLETTI; GARTH, 1988).

The Florence Project developed a multidisciplinary approach, from different global contexts and dynamic for a new theoretical perspective of study.

Then, the word “Access to Justice” emerged, which defined the concept of access to justice, the obstacles and practical solutions, the trends in use, the limitations and risks in the approach to access to justice, identifying and describing the problems and solutions of Western countries, which they called “waves of reform”. These are: free legal aid for the poor; representation of diffuse interests and access to representation in court, and a new approach to access to justice.

> [...] We can state that the first access solution – the first “wave” of this new movement – was legal aid; the second concerned reforms aimed at providing legal representation for “diffuse” interests, especially in the areas of environmental and consumer protection; and the third – is what we propose to call simply the “access to justice approach” because it includes the previous positions, but goes far beyond them, thus representing an attempt to attack the barriers to access more articulately and comprehensively. (CAPPELLETTI; GARTH, 1988, p. 5)

In a brief report, to understand this evolution, we describe: the ‘fourth wave’, which refers to the focus on ethics in the legal professions and lawyers’ access to justice. The ‘fifth wave’ is related to the contemporary process of internationalization of the protection of human rights, promoted by International Organizations such as the United Nations (UN).

> The process of generalization of international protection of Human Rights triggered the emergence of a new movement for access to justice, which conforms to the development of a new wave of renewal, dedicated to the effectiveness of the legal protection of the individual in the face of the very State that should protect him. With the internationalization of the protection of Human Rights, a new path opens up in access to justice, making possible the para-state defense of the individual, when the internal system proves incapable of ensuring the effective protection of his legitimate legal claims (ESTEVES; SILVA 2018, p. 109-110).

In turn, the ‘sixth wave’ portrays promising initiatives and new technologies to improve access to justice. And, finally, the ‘seventh wave’ portrays gender and racial inequality in the justice system.

As presented, the ‘sixth wave’ of access to justice, on which we base our study, comes, in the proposal of the Global Access to Justice Project, with timely relevance, providing the incentive of promising provisions, combined with technologies with the scope of improving access to justice, gaining prominence in contemporary society, the information society, in which relationships between individuals are permeated by the use of the internet, new communication and information technologies, implying their complexity in the scope of the resolution of disputes inserted in this context and, consequently, affecting the very right

of access to justice and everything it represents. (GLOBAL ACCESS TO JUSTICE PROJECT)

As described in the introduction of the study, the compulsory social isolation measures during the COVID-19 pandemic have driven judicial systems to invest in the use of technologies to avoid face-to-face contact. However, limited resources and the implementation of improvised solutions have, in many cases, compromised the ability to maintain normal levels of access to justice during the pandemic outbreak in 2019/2020.

In the search for continuous improvements in the specificities of justice and access to the judicial system, new concepts have emerged to be incorporated into the contemporary judicial system. These concepts, which involve innovation and technology, aim to improve the judicial system as a whole.

URQUIZA AND CORREA (2018), emphasize m that in Brazil, such initiatives can be exemplified by the implementation of programs such as “itinerant justice, community justice, alternative means of dispute resolution such as mediation, judicial and extrajudicial conciliation, restorative justice and special courts” (2018, p. 312).

From this perspective, the democratization of access to justice is expressed in section XXXV of article 5 of the 1988 Brazilian Federal Constitution, which guarantees the inalienability of jurisdiction, and states:

> Art. 5 All are equal before the law, without distinction of any nature, guaranteeing Brazilians and foreigners residing in the country the inviolability of the right to life, liberty, equality, security, and property, under the following terms:
> XXXV - the law shall not exclude from the assessment of the Judiciary any injury or threat to rights; (...);

Our Magna Carta ensures that the law may not prevent the Judiciary from examining injuries or threats to rights. Therefore, all citizens have the right to seek judicial protection against any violation or threat to their rights without distinction: “The law shall not exclude from the consideration of the Judiciary any injury or threat to a right” (BRASIL, 1988), which, through dialectical construction, consecrates its provision.

It can be inferred that access to justice is considered fundamental for the exercise of citizenship, a pillar of the Democratic State of Law, and listed as the foundation of the Brazilian State. “It is considered the most essential fundamental guarantee of the citizen” (SCHIAVI, 2017, p. 92).

ACCESS TO JUSTICE: INNOVATION IN THE LEGAL SYSTEM

The concept of “access to justice” goes beyond a mere formal or external approach, involving an aspect of content deeply linked to the understanding of social problems. It is

about identifying the factors that lead to the denial of this fundamental right and understanding the reasons why it is not fully realized. To visualize the difficulties related to access to justice, it is necessary to transcend the perspective of those who provide legal services and adopt the point of view of those who need these services, that is, those who experience conflict and face obstacles in the search for a fair and effective solution.

The Brazilian Judiciary, a public sector, has a negative stigma, as it presents itself with a series of critical problems that affect its performance, such as a large and complex structure, slow and incapable of generating predictable solutions, within a reasonable time frame, and at an affordable cost for everyone.

These problems are caused, in part, by the growth in the number of new cases every year, the high number of appeals provided for by law, delaying formalities in hearings, and hierarchical bureaucracy. This structure induces other problems, such as lack of transparency in the public sector, difficulty in access, institutional disarticulation, slow processing of legal cases, administrative obsolescence, structural complexity, and concentration of litigation, due to the high number of cases that interest the government at both the federal and state levels and large private organizations.

To contribute to the improvement, supervise the administrative and financial activities of the Judiciary, and ensure compliance with constitutional principles, the National Council of Justice (CNJ) stands out as a body of the Brazilian Judiciary, created by Constitutional Amendment No. 45, of December 30, 2004, in the context of the Judiciary Reform. Its main function is to act as a planning and administrative control body of the Judiciary, to improve the efficiency, transparency, and accountability of this power before society.

According to SANTOS (2007), a series of instruments are advocated to promote universal access to justice, such as the creation and expansion of public defenders' offices, popular university legal advisory services, training of community leaders, and popular advocacy. For him, “this profusion of initiatives, alternatives or criticisms share a common denominator with great potential to transform traditional practices of access to justice: the legal empowerment of citizens” (SANTOS, 2007, p. 46). It also brings with it the “valuation of experiences and strategies that foster rapprochement between justice and citizenship” (p. 47).

Currently, new work practices and transformations in the forms of social organization have made society more demanding regarding the quality and efficiency of services provided by the Public Administration. As mentioned, these demands became even more intense during and after the COVID-19 pandemic, which exposed structural weaknesses in several areas and adaptation needs, including the judicial system. The global health crisis

has accelerated the need to adopt innovations and new technologies, forcing public organizations to adapt. Quickly maintain the provision of essential services, reducing costs, eliminating waste, and improving operational efficiency, while ensuring the continuity and accessibility of its services.

The implementation of technological and innovative solutions in the judicial system during and after the COVID-19 pandemic, such as electronic processes (PJe), virtual hearings, and digitization of processes, highlighted the potential of modernization to increase accessibility and promote greater efficiency. These changes, in addition to mitigating the impacts of the crisis, contribute to the construction of a more just, inclusive, and resilient society, aligned with the principles of good governance and the global objectives of sustainable development and implementation of public policies.

Information and communication technologies - ICTs, implemented in the judiciary have been playing a central role in contemporary society, as they connect people, organizations, and governments, transforming the way we communicate, work, and access services. They are widely used in various areas, such as education, health, commerce, public administration, and justice, contributing to efficiency, accessibility, and innovation. After many advances, in 2020, the National Council of Justice (CNJ) established DataJud - the National Database of the Judiciary, by Resolution CNJ No. 331 (BRAZIL, 2020a), which is the primary source of data for the Judiciary Statistics System (SIESPJ). DataJud is responsible for the centralized storage of procedural data and metadata related to all physical or electronic, public or confidential, processes of the courts indicated in items II to VII of art. 92 of the Federal Constitution (BRAZIL, 1988). The database presents several information panels, such as statistics, monitoring of urgent protective measures under the Maria da Penha Law, National Register of Collective Actions (CACOL), civil enforcement, tools to support the DataJud cleanup, monitoring panel and parameterization of panels (Brazil, 2020b). This transformation has resulted in more efficient service provision for society, promoting gains in productivity, transparency, access, savings, and sustainability. However, challenges remain related to integration and effective communication between the different systems used. In this sense, it is related to promising initiatives and new technologies to improve access to justice. Based on the reality experienced in Brazil and the serious social inequality, “it is also necessary to recognize the need to study ways to mitigate the obstacles of the digitally excluded, to avoid an elitism in the issue of access” (MOREIRA, 2022, p. 65).

INFORMATION TECHNOLOGY IN THE JUDICIARY AS A TOOL FOR ACCESS TO JUSTICE

The transition to a digital Judiciary has brought innovations such as the Electronic Judicial Process (PJe), virtual hearings, transparency portals, and procedural consultation systems. However, for these advances to be fully utilized, both legal practitioners (judges, lawyers, and civil servants) and citizens must have adequate digital skills. Without this, judicial inclusion may be compromised, creating new inequalities.

Information Technology (IT) plays an essential role in improving access to justice by modernizing and optimizing judicial processes. In the Judiciary, the adoption of new technologies has been used to reduce barriers, promote transparency and efficiency, and ensure that citizens have faster and more simplified access to their rights.

Some Benefits of IT for Access to Justice:

- Digitization of Processes: The transition from paper to digital media, such as through the Electronic Judicial Process (PJE), has made judicial procedures more agile and accessible. This has eliminated problems related to the logistics of transporting physical documents and reduced delays, allowing parties, lawyers, and judges to monitor proceedings in real-time, facilitating access for people in vulnerable conditions, such as low-income citizens, by offering free or low-cost digital services, such as online legal consultations and alternative dispute resolution platforms (mediation and conciliation), promoting inclusion and proximity to the jurisdiction.

We can exemplify some of the tools currently used by the judiciary:

- Online Platforms: Tools such as transparency portals and online procedural consultation systems allow citizens to monitor the progress of their cases in a practical way, promoting greater inclusion, especially for those living in remote areas.
- Automation and Artificial Intelligence (AI): The use of AI-based systems, such as tools for analyzing case law or screening cases, has accelerated decision-making and facilitated the work of judges. And servers, optimizing resources and reducing procedural delays.
- Virtual Hearings: Virtual hearings via videoconferences have proven to be effective, ensuring the functioning of the justice system even in critical moments, such as during the COVID-19 pandemic and today. These technologies also allow parties and witnesses to participate in judicial proceedings in real-time, without having to travel, promoting savings, efficiency, and speed in the processing of proceedings.

Although innovation and technology have brought significant advances, there are still challenges to be faced, such as:

- Digital inclusion: Ensuring that all citizens have access to the internet and appropriate devices.
- System integration: Standardizing the different systems used in courts to improve communication between them.
- Data security: Protecting sensitive information and ensuring the privacy of the parties involved.

However, in general, the use of Information Technology in the Judiciary not only increases the efficiency of the system but also contributes to making access to justice more democratic, transparent, and aligned with the needs of contemporary society. It is an essential tool to ensure that justice is effective and reaches all people, regardless of their location or social status.

Other initiatives focused on innovation, such as the use of digital technologies, the development of plain language projects, and the implementation of alternative forms of conflict resolution (such as mediation and arbitration), have proven essential to promoting more inclusive and efficient access to justice. These measures not only seek to make the legal system more accessible, especially for those who face economic, social, or cultural barriers but also contribute to the modernization of public policies in the sector.

The use of digital technologies, for example, allows for greater speed and transparency in processes, while plain language projects make it easier for the population to understand rights and duties, reducing the complexity of judicial acts. Alternative forms of conflict resolution, on the other hand, promote a less litigious and more collaborative approach, favoring social pacification and relieving pressure on the judicial system.

These initiatives are in direct dialogue with the sustainable development goals, especially about reducing inequalities (SDG 10) and promoting effective, accountable, and inclusive institutions (SDG 16). For such advances to be effective, the public policies associated with these innovations must be broad, inclusive, and aimed at overcoming the social inequalities that have historically limited access to justice in Brazil.

A genuine democracy is firmly based on the rule of law, but it loses its essence if access to justice is not guaranteed to all. The mere formal recognition of rights by the legal system does not, in itself, ensure their effective application. Thus, people who face barriers to accessing the justice system are vulnerable to negligence or violation of their rights.

The Brazilian Judiciary has made progress in legal data management initiatives, continuously keeping up with technological developments. A notable example is the adoption of digital processes, which has brought greater speed to the activities of institutions operating in the field of justice. This progress has resulted in a more efficient provision of services to society, characterized by significant gains in productivity, access, transparency, economy, and sustainability. However, challenges persist, such as the lack of integration and efficient communication between the different systems used, which still compromises the full use of technological potential.

> In addition to assistive technologies, digital inclusion in the legal system requires specific policies and programs aimed at the digital training of people with disabilities. Digital education is a crucial factor for true inclusion, allowing these people not only to access the systems but also to fully understand and use the available tools. (AMARAL, 2024. p.16)

ACCESS TO JUSTICE: ABILITY TO UNDERSTAND

It is essential to emphasize that technology cannot be an instrument that benefits only some individuals, leaving others on the margins of the digital justice system, especially about certain access points. It is essential to carry out in-depth studies on the efficient functioning of new technologies applied to law, as well as on the possibilities of using them inclusively. The objective should be to promote the overcoming of existing barriers, without creating exclusions, considering that Brazilian society is deeply marked by social inequalities.

Understanding Cybervulnerability is defined as that which, involuntarily or due to instrumental impossibility – does not have access to the computer network – or, due to lack of mastery of the means of use, is left out of the judicial process, being harmed in their constitutional right to access the means capable of resolving disputes.

Digital inclusion is essential to make the right to access justice effective in the scenario of new technologies, especially considering that the system of understanding new technologies and the role they can play in assisting access to justice is extremely relevant.

Digital Literacy and Intelligibility

Digital literacy and intelligibility play central roles in promoting access to justice in the context of technological transformation. Digital literacy refers to the ability of individuals to understand, use, and interact with digital technologies effectively. In the legal sphere, this means enabling citizens to access digital systems, interpret procedural information, and use technological tools autonomously and efficiently.

In turn, intelligibility is related to the clarity and accessibility of the information provided. In law, this involves writing documents, decisions, and guidelines in simple and understandable language, breaking with the excessive technicality that often excludes citizens who are less familiar with legal vocabulary.

Together, these initiatives not only strengthen access to justice but also promote social inclusion and reduce inequalities. Investing in public policies that encourage digital literacy and intelligibility, such as technological training programs and clear language projects, is essential for building a more equitable justice system aligned with the principles of sustainable development. By promoting digital training, it is possible to democratize the use of technological tools, ensure inclusion and strengthen the exercise of citizenship, and promote access to justice, especially given the increasing digitalization of judicial processes and the use of electronic platforms for the provision of judicial services in the form of emails, websites, videoconferences, but also, more recently, in the form of electronic systems for processing and procedural communications via email and WhatsApp.

According to GOMES (2011), to be democratically relevant, “digital initiatives must increase or strengthen the power of citizens about other bodies, encourage transparency in their actions and promote civil participation; consolidate and guarantee political rights for minorities; and promote the diversity of agents, agendas, and agencies in the public sphere”.”

ACCESS TO JUSTICE: INCLUSIVE SOCIETIES – PEACE, JUSTICE AND EFFECTIVE INSTITUTIONS

Access to justice is an essential component for building fair, peaceful, and inclusive societies, in line with the central objectives of Sustainable Development Goal (SDG) 16 of the 2030 Agenda, established by the United Nations (UN). This goal aims to promote the rule of law and ensure that all people, especially the most vulnerable, have access to effective mechanisms for resolving conflicts and protecting their rights. Through an accessible and efficient justice system, the aim is to reduce inequalities, strengthen institutions, and ensure that no one is excluded from legal protection, thus contributing to more equitable and sustainable development.

In New York City, during a historic meeting in 2015, which brought together the 193 member states of the United Nations (UN), the document entitled “Transforming Our World: The 2030 Agenda for Sustainable Development” was prepared, which established objectives to be achieved worldwide over the next 15 years.

This manifesto reaffirmed the importance of the three interdependent dimensions of sustainable development: economic, social, and environmental. Furthermore, it represented a continuation and evolution of the legacy of the Millennium Development Goals (MDGs), consolidating a set of 17 Sustainable Development Goals (SDGs), with 169 targets to be achieved and 231 indicators. The goals and targets are integrated and indivisible, and Brazil is one of the signatories of the Agenda. The 2030 Agenda and its 17 Goals have become a priority milestone, guiding collective efforts to face global challenges in an integrated manner and promote more inclusive, fair, and sustainable societies.

As an object of study, we will highlight Sustainable Development Goal (SDG) 16 of the 2030 Agenda, in its central form. This goal seeks to promote the rule of law and ensure that all people, especially the most vulnerable, have access to effective mechanisms for resolving conflicts and protecting their rights, contributing to the strengthening of sustainable development.

Therefore, SDG 16 emphasizes the importance of strengthening public institutions, such as the justice system, by making them transparent, accountable, and inclusive. In the context of sustainable development, access to justice goes beyond the mere existence of courts or legal mechanisms. It requires that these services be accessible, impartial, and understandable to the entire population. To achieve this goal, it is essential to implement comprehensive public policies that eliminate financial, geographical, and cultural barriers, promote the simplification of legal language, invest in the expansion of free legal aid services, and encourage the use of inclusive technologies. These efforts not only make justice more efficient and agile but also help to foster public trust in institutions.

In addition, these measures not only guarantee fundamental rights but also contribute to ensuring access to justice directly contributes to the achievement of other SDGs, such as the eradication of poverty (SDG 1), gender equality (SDG 5), and the reduction of inequalities (SDG 10). This is because accessible and equitable justice protects fundamental rights, ensures equality before the law, and promotes opportunities for all people.

For the Judiciary, it is essential to monitor social mobility, with an ethical perspective endowed with empathy and sensitivity, to adapt to the continued evolution and consequences of this transformation.

Thus, as a way of seeking social adaptation, the Judiciary created, through Resolution No. 70 of 2009 (National Council of Justice, 2009), national leveling goals, among which Goal 2 stands out, which determined that the courts should identify and judge the oldest legal cases. The main objective of these leveling goals would be to provide

greater procedural agility and efficiency, improve the quality of services, and expand citizens' access to justice, in compliance with the constitutional principles of access to justice and reasonable duration of the process. To this end, several actions were taken to internalize and institutionalize the Sustainable Development Goals (SDGs) established in the 2030 Agenda (LAMPERT, 2021, p. 467/484):

> The challenge of contributing to development, after the adoption of the 2030 Agenda by the United Nations General Assembly in 2015, has been the subject of discussion and breakdown into indicators, especially by the Executive Branch (through the IBGE and Ipea, by adapting global goals to national goals). As the Brazilian State is one, however, such goals certainly constitute a transversal responsibility about the institutions of the signatory countries, especially affecting the Judiciary, especially nte taking into account SDG number 16. As the promotion of Justice, peace and effective institutions becomes one of the SDGs, the need for access and measurement of what is produced by the Judiciary becomes an essential element in verifying Brazil's compliance with the Global Agenda (National Council of Justice, 2019).

In this path, by investing in public policies that expand access to justice, aligned with the principles of SDG 16, an essential step towards building a more just and sustainable society is being taken, where everyone can fully exercise their rights and contribute to global development.

> The Brazilian Judiciary is adopting new practices and breaking with paradigms, thus enabling it to promote its activity, an objective that is constitutionally considered essential. In this way, it can serve the interests of those under its jurisdiction as well as preserve the Democratic Rule of Law itself, by guaranteeing effective access to justice to all those seeking legal protection. (LIMA; SILVA. 2022; p.10862)

The Brazilian Judiciary is evolving by investing in programs and projects that aim at technological and innovation reforms, as they are essential for sustainable development, contributing to the strengthening of peace, justice, and effective institutions: “The Judiciary in Brazil is seeking measures to guarantee effective access to justice, despite the growing demand for lawsuits verified each year, and thus also comply with UN SDG 16.” (LIMA; SILVA, 2022)

The dissemination of information through Information and Communication Technologies (ICTs), public access to data, and the availability of open, reliable, updated, and high-quality information are essential elements to assess public progress and verify, statistically, whether the country is aligned with the objectives of the 2030 Agenda.

The CNJ, concerned with the integration of the Judiciary with the sustainability goals set out in the 2030 Agenda, registered Ordinance no. 133, of 09/28/2018, which established the Interinstitutional Committee to conduct studies and present a proposal for integrating the demands of the Judiciary with the goals and indicators of the Sustainable Development

Goals (SDGs), Agenda 2030, initiating this challenge, and being improved by Ordinances 72/2019 and 55/2020, with the function of preparing biannual data reports.

STATISTICAL DATA

STRUCTURE OF THE COURTS

Corroborating the study, the Justice in Numbers 2024 Report, in its 21st Edition of the CNJ, gathers information from the 91 bodies of the Judiciary. Since 2004, the publication has been an important source of data on judicial activities, covering crucial information such as expenses, revenue collections, data on personnel, as well as a detailed overview of the cases underway in the justice system.

THE PEOPLE WHO DELIVER JUSTICE

Statistics on the staff and infrastructure of the Justice system are based on the MPM System, which collects data on people and structures in the Justice system every month. Based on this system, a "Judiciary Personnel Data" Panel was developed, which allows for continuous and permanent monitoring of the evolution of results in the courts.

- Brazilian courts have 446,534 professionals3, including judges, civil servants, outsourced workers, and interns. This contingent is larger than the population of the capitals of five Brazilian states: Amapá (Macapá), Roraima (Boa Vista), Acre (Rio Branco), Espírito Santo (Vitória), and Tocantins (Palmas).
- In total, there are 15,646 judicial units, of which 12,735 are specialized or have exclusive jurisdiction and 2,098 are single courts. The single courts are located in Brazilian districts with only one court and encompass different jurisdictions.
- Judiciary expenses in 2023 were R$ 132.8 billion, which represents 1.2% of GDP or 2.38% of total expenditure by the Union, states, the Federal District, and municipalities. Public revenue collection through the Judiciary totaled R$ 68.74 billion, an amount corresponding to 52% of the expenses of the entire Judiciary.

DIGITAL ROUTINES FOR THE OPERATION OF THE JUSTICE

By the end of 2023, 90.6% of the cases in progress in the Justice system were electronic. In the year, 99.6% of new cases were filed electronically. In 15 years, 253.3 million new cases were filed in electronic format.

- 79.3% of first-degree judicial units have a 100% Digital Court. There are 49 courts with 100% adherence to this service model created by the CNJ, in which all procedural acts are performed remotely.

- There are 21,751 virtual counterpoints in operation, allowing users of Justice services to access the court secretariats throughout the country remotely.
- 418 points Digital inclusion centers (PID) offer a space equipped with computers and cameras for the practice of procedural acts, such as depositions via videoconferencing. Source: Justice in Numbers 2024, p. 28

As stated in the Statistical Data of the Justice in Numbers Report for 2024, which compared the last fifteen years (covering the period from 2009 to 2023), it was found that up to the year 2023:

Indicator	Value
Electronic cases in 15 years	253.3 million
Percentage of cases in electronic processing (2023)	90.6%
The average duration of electronic cases	3 years and 5 months
The average duration of physical cases	12 years and 4 months
Source	*Relatório Justiça em Números 2024, p. 28*

In 2023, 35.3 million cases were filed and 35 million were dismissed across the Judiciary. There was a 9.4% increase in new cases, with a 6.9% increase in resolved cases. Both the demand for Brazilian justice services and the volume of dismissed cases decreased in 2020 but began to rise again in 2021. This significant volume of cases illustrates the high demand for the Brazilian judicial system and the need for adequate resources to ensure the efficiency of the service provided to society.

The total number of cases filed reached the highest value in the historical series last year. The number of cases closed in 2023 was the second highest in the historical series, with the number of cases resolved slightly lower than that seen in 2019. Source: CNJ - Justice in Numbers, 2024

According to the report, the “Access to Justice” section (p. 144) deals with the population's demand for justice services and the granting of free legal aid by the country's judiciary.

“On average, for every group of a thousand inhabitants, 143 filed a lawsuit in 2023. There was an 8.4% increase in the number of new cases per thousand inhabitants in 2023 when compared to 2022. This indicator only includes the processes of knowledge and execution of extrajudicial executive titles; judicial executions initiated are excluded from the calculation basis.

Using the same data from the court, it was found that the state of Minas Gerais, despite having large courts (TJMG, TRT3, and TRE-MG), is, among those of the same size,

the one with the lowest demand per one hundred thousand inhabitants, except for TRE-MG, which occupies the third position.

In the State Courts, the TJRO is the most sought-after court (15,510) and the TJPA is the least sought-after (5,040). In the Labor Courts, the rates vary from 466 (TRT16 – Maranhão) to 2,510 (TRT2 – São Paulo). In the Federal Courts, the only Court with demand above three thousand cases per one hundred thousand inhabitants is the TRF of the 4th Region, which covers the states of the Southern Region of the country.

The cases filed were granted free legal aid with the number of inhabitants. There was a decrease in the historical series in 2020, with fluctuations until 2023, reaching 2,487 cases filed with free legal aid per one hundred thousand inhabitants".

FINAL CONSIDERATIONS

Given the above, it was found that the concern with guaranteeing effective access to justice is not new. It is a fundamental human right and a central element for the full exercise of citizenship, consolidating itself as one of the pillars of the Democratic State of Law. This desire for access to justice has been neglected for years. However, in the 1960s and 1970s, this issue gained international prominence, especially with the Florence Project, led by Mauro Cappelletti and Bryant Garth.

These authors contributed significantly to the discussion by introducing the waves of renewal of access to justice, which sought to expand and modernize the means of ensuring this fundamental right. Among the proposals presented, is the need to strengthen the link with the legal mechanisms that protect their rights, an essential measure to make the law more accessible to ordinary citizens – the main recipients of the process.

Access to justice, as a fundamental human right, is essential for building fair, peaceful, and inclusive societies, and is one of the pillars of the Democratic Rule of Law and a central objective of SDG 16 of the 2030 Agenda. In Brazil, the quest to expand this access faces significant challenges, especially due to social inequalities and digital exclusion, which hinder the full participation of all citizens in the justice system.

The implementation of digital technologies in the legal field presents an opportunity to democratize access to justice, promoting greater efficiency, transparency, and inclusion. However, the transition to a digitalized system must be accompanied by comprehensive and inclusive public policies that consider the country's structural inequalities. Training legal professionals, digital literacy among the population, and simplifying legal language are essential measures to make judicial services more accessible and understandable.

On the other hand, it is of fundamental importance to recognize that computerization alone is not enough to overcome all barriers. Digital exclusion, aggravated by inequality in access to the internet and technology, requires solutions that combine technological innovation with social sensitivity. Only by eliminating financial, geographic, cultural, and technological barriers will it be possible to ensure that the justice system is truly inclusive, meeting both the demands of the population and the requirements of sustainable development.

The CNJ has been monitoring the rate of access to justice, describing in the year Gary Justice in Numbers, the ability of courts to resolve conflicts within a reasonable time and efficiently.

Statistical data contribute to active transparency and democratic governance, allowing society to participate and monitor the performance of the bodies responsible for justice. By providing these indicators, the Report reinforces the CNJ's commitment to the democratization of information, ensuring that society has access to the knowledge necessary to demand improvements and promote reforms in the judicial system.

It was also found that there is no longer room for the use of paper and rudimentary procedures; the digital age needs to be used.

To this end, there must be empathy on the part of legal professionals. There needs to be a change in the vision of all those involved. Digital tools should be used in the procedural environment as another instrument for access to justice and not an obstacle.

Based on this, it was found through statistics provided by the Justice in Numbers Report in its 21st Edition that there are several movements in favor of technology:

> “From a retrospective point of view, the year 2023 is proving to be a year of high productivity and high jurisdictional demand, with indicators higher than the levels seen before the pandemic caused by COVID-19, which began in 2020. Thus, the years 2020 and 2021 were atypical periods, with the Brazilian and global populations affected by high death rates and restrictions on social interaction imposed. Even with such an adverse situation, the programs established by the CNJ within the scope of the Justice 4.0 Program and the modernization of the judiciary made it possible to continue the provision of jurisdiction and access to justice, including during that period. The “Justice 4.0 Program – Innovation and effectiveness in delivering justice for all” is a milestone in innovation and digital transformation in the Judiciary, which created institutions such as the electronic domicile, the 100% Digital Court, the Virtual Counter, the Judiciary Digital Platform (PDPJ), and allowed the consolidation and qualification of DataJud. These innovations contributed to improving the provision of jurisdiction and increasing productivity. In 49 courts, 100% adherence to the 100% digital court was identified, which already covers 79.3% of all judicial offices. In these jurisdictional units, procedural acts can be performed electronically and remotely, including hearings and trial sessions. There are 314 Justice 4.0 Centers in operation. This is an institution that enables the structuring of justice more efficiently, as specialization in relevant legal matters is now carried out entirely virtually and without new physical structures, generating savings for the public coffers and a more qualified treatment of cases in certain matters covered by these centers. (Source: Justiça em Números, 2024)

Given the innovations adopted by the Judiciary, with a focus on the citizen and on reducing procedural congestion, the right to justice is consolidated as a fundamental right and a duty of the State.

It is essential to highlight the relationship between access to justice and Sustainable Development Goal 16 (SDG 16) of the 2030 Agenda, which aims to promote fair, peaceful, and inclusive societies. Ensuring access to justice contributes to reducing inequalities, strengthening institutions, and promoting the rule of law.

It is suggested that research on the topic continue, focusing on the evolution and real impact of public policies that encourage consensus and conflict resolution. Comparative studies between the country's Courts of Justice are also relevant to identify best practices and challenges. The implementation of effective public policies for access to justice requires a multidisciplinary approach, such as investment in technology, training of civil servants, simplification of procedures, and the promotion of a culture of peace, to build a more just and peaceful society.

The studies and perspectives demonstrate that the use of innovative techniques for access to justice such as the 100% Digital Court and Justice 4.0, which will be the subject of future studies, integrates with existing technological innovations to consolidate the Democratic Rule of Law and improve the user experience. The computerization of the Judiciary in Brazil reveals its transformative potential, not only as a procedural tool but as a catalyst for cultural and institutional changes in Public Administration.

Access to justice is a fundamental right that requires constant action by the State to ensure its effectiveness. Technological innovations and public policies aimed at conflict resolution represent a promising path toward building a more efficient, fair, and accessible justice system for all at all levels.

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ALOPECIA X IN GERMAN SPITZ RESPONSIVE TO ORCHIECTOMY ASSOCIATED WITH THE USE OF MELATONIN: CASE REPORT

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ABSTRACT

Alopecia X is a dermatological disorder that mainly affects Nordic breed dogs. Its cause is not completely clear. Alopecia X is characterized by its non-inflammatory aspect, being similar to endocrine-based dermatopathies. The main lesions are progressive hair loss in the affected areas, being less pronounced on the head and distal extremities of the limbs in more advanced cases. This study aims to report a case of alopecia X in a male, uncastrated German Spitz dog. At the first visit, an initial case of bilateral symmetrical alopecia was observed on the caudal side of the thighs and perineum, without pruritus, macroscopic signs of inflammation and clinical signs of systemic diseases. The patient underwent additional tests (including trichogram, skin scraping, direct ectoparasite screening and blood profile) in which parasitic and systemic diseases were ruled out. Based on clinical aspects, racial predisposition and exclusion of systemic causes, the diagnosis of alopecia X was considered. The treatment of choice was orchiectomy associated with the use of Melatonin, initially for 3 months. After 90 days of treatment, partial regrowth of the alopecic areas was observed, as well as a reduction in the area without hair, with return of primary and secondary hairs in the affected region. It is concluded in this case that the choice of orchiectomy associated with the use of melatonin was effective in improving the dermatological condition, and can be used as an ally.

Keywords: Treatment of alopecia. German Spitz. Melatonin. Dermatology. Dogs.

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INTRODUCTION

Alopecia X is so named because its cause is not fully understood (VENÂNCIO et al., 2016). It is characterized by mainly affecting dogs of Nordic breeds, and clinically by bilateral and symmetrical hair loss, and may be associated with melanoderma, especially affecting the cervical, dorsal and perianal regions and sparing the distal region of the limbs and head. (CARVALHO et al., 2023).

Its etiopathogenesis is not fully understood, and several studies are underway to seek further clarification about its cause. Among them, the theory of adrenal hyperplasia syndrome, the theory of growth hormone deficiency and the theory of hypercortisolemia are cited in the literature. Due to its characteristics that resemble endocrine-based dermatopathies, theories about the causes of alopecia X consider that it may be related to hormonal changes, both systemic and local (BAPTISTA, 2018). The possibility of a genetic cause and factors that act directly on the receptors of hair follicles are the targets of more recent studies (VENÂNCIO et al., 2016).

Several nomenclatures have been used for this alteration, which is currently called alopecia X, among them we can mention pseudo-cushing, congenital adrenal hyperplasia syndrome, growth hormone-responsive alopecia and sterilization-responsive dermatosis (ADAMO, 2018).

The variation in nomenclatures is due to the fact that this pathology presents varied responses to different therapeutic alternatives instituted in animals with it, in search of the possible causes of this condition (PASSATUTTO AND JÚNIOR, 2021).

Clinical signs are limited to local changes in skin areas, characterized by the absence or decrease of hair in a bilateral, symmetrical manner, of non-inflammatory origin and generally without associated pruritus. Affected animals may have dry skin, hair that easily comes off the skin and melanoderma (PASSATUTTO and JÚNIOR, 2021). Alopecia usually affects the caudomedial aspect of the hind limbs, perineum, base of the tail, and may extend to the trunk, sparing the head and distal thirds of the limbs (HORTA et al, 2021), a characteristic that is considered almost pathognomonic of the disease (GODIM and ARAÚJO, 2020).

LITERATURE REVIEW

DIAGNOSIS

Various criteria have been discussed to arrive at the diagnosis of alopecia X, which is made by excluding other diseases that present with a similar condition, and is strongly influenced by the racial predisposition and characteristics of the most affected animals:

breed, age group (young animals between one and five years old), location of the alopecic areas and the absence of systemic diseases, such as endocrinopathies (BAPTISTA, 2018).

Hormonal tests allow the exclusion of endocrine diseases such as hyperadrenocorticism and hypothyroidism for a differential diagnosis, as these diseases mimic skin changes that occur in alopecia X (HORTA et al, 2021). Skin histopathology can be performed as an auxiliary exam, but it is not possible to differentiate alopecia X from other endocrine diseases. Microscopic findings generally show few small bulbs in anagen, epidermal hyperpigmentation and the presence of “flame follicles”. However, these are also commonly observed findings in other endocrinopathies (BAPTISTA, 2018).

TREATMENT

A variety of treatments have been tested and used in cases of alopecia X with varying therapeutic success. Among them, we can mention castration, melatonin, trilostane, deslorelin, microneedling, among others, with castration, melatonin and trilostane currently being the most commonly used (BAPTISTA, 2018). It is also recommended to promote hydration of the skin and remaining coat, due to the intense secondary skin dryness in the affected areas (GONDIM and ARAÚJO, 2020).

Sterilization

In intact dogs, castration is cited as the first-choice treatment, since many dogs have had their hair grow back for years or even permanently after regulating hormone concentrations (VENÂNCIO, 2016).

Studies indicate that castration can result in 75% of hair regrowth due to the reduction in serum concentrations of sex hormones (ADAMO, 2018).

Melatonin

Melatonin comes in second place as the most recommended, with success and hair regrowth rates of around 40%. Studies suggest that some plasma and dermal enzymes act with hyperactivity and degrade melatonin in animals with alopecia X, a fact that is supported by the improvement in these animals after using it in treatment (HORTA, 2021).

CASE REPORT

A male, unneutered, German Spitz dog, aged one year and 11 months, was seen at Pet Me Au in Criciúma/SC, after being observed drying off after bathing that he had areas of

hair thinning on the caudal side of his thighs, bilaterally, on April 24, 2024. The owner was notified and a dermatological consultation was requested.

Clinically, the animal appeared well, alert, with normal color of the mucous membranes, normal hydration, rectal temperature of 38.1ºC, normal pulse, cardiac and pulmonary auscultation without alterations, palpable lymph nodes did not show any enlargement.

Dermatological evaluation revealed primary hair loss and hair thinning on the caudal side of the thighs and bilateral perineal area. The rest of the body was inspected and did not show any other areas of alopecia or other alterations. The skin showed no signs of inflammation, such as redness or crusting, and was normal in color and appearance (figure 1).

Figure 1: Images of the patient presenting bilateral symmetrical hair thinning on the caudal aspect of the thighs and perineum.



Source: personal archive.

After the evaluation, the owner was asked for authorization to perform additional tests: complete blood count, albumin, ALT, creatinine, cholesterol (total and fractions), cortisol (immunofluorescence), triglycerides, TSH (immunofluorescence) and free T4 (chemiluminescence), in addition to skin cytology and trichogram, in order to rule out signs of endocrine diseases that are incriminated in cases of alopecia (table 1).

The skin cytology exam was performed by the veterinarian after a consultation at Pet Me Au, where secondary bacterial infection was ruled out and it was negative for mange and fungi by the direct research method. The trichogram showed that many hairs appeared split in their longitudinal direction, characterizing trichoptilosis.

Table 1: Results of additional laboratory tests.

Exam Result Reference	Exam Result Reference	Exam Result Reference
BLOOD COUNT		

Red blood cells	6,88 /µL	5,5 a 8,5 x 1.000.000
Erythroblasts	0 %	0 a 5
Hematocrit	44 %	37 a 55
Hemoglobin	14,9 g/dL	12,0 a 18,0
V.G.M	63,95 fL	60 a 77
C.H.G.M.	33,86 g/dL	32 a 36
R.D.W.	12,4 %	10 a 15
P.P.T	7,0 g/dL	6,0 a 8,0
PLATELETS	366.000 /µL	200.000 a 500.000
LEUKOGRAM		
Leukocytes	8.220 /µL	6.000 a 17.000
Rods	0 /µL	0 a 300
Segmented	6.247 /µL	3.000 a 11.500
Lymphocytes	1.480 /µL	1.000 a 4.800
Monocytes	0 /µL	150 a 1.350
Eosinophils	493 /µL	100 a 1.250
Basophils	0 /µL	0 a 100
BIOCHEMISTS		
Albumin	2,93 g/dL	2,6 a 3,3
ALT	52,6 U/L	10 a 88
Total cholesterol	179 mg/dL	125 a 270
HDL	162 mg/dL	33 a 120
LDL	12 mg/dL	31 A 71
Cortisol	2,22 mcg/dL	2,0 a 6,0 mcg/dL
Creatinine	1,08 mg/dL	0,5 a 1,5
Triglycerides	27,0 mg/dL	20 a 112
TSH	<0,25 ng/mL	< 0,5 ng/mL
Free T4	0,58 ng/dL	0,32 a 1,69 ng/dL

Given the area of hair thinning and dull fur, local hydration with Hidrapet Skin On spray was prescribed (one spray on each thigh in the affected areas, every 7 days), in order to protect the skin barrier that was exposed without fur, until the results of the blood tests were available for greater diagnostic accuracy and choice of the most appropriate treatment.

After accessing the results of the complementary blood tests that were all within normal limits, in addition to the fact that the skin scraping had been negative for mange and fungi, and taking into account the German Spitz breed and the clinical condition of the animal that showed no signs of systemic diseases, as well as the location of the alopecia, the diagnosis of alopecia X was considered.

When choosing the treatment, the first step was to indicate orchiectomy, which the owner had been considering important for some time, even before the diagnosis. The procedure was performed uneventfully on May 7, 2024. The treatment was combined with the use of melatonin at a dose of 3 mg/animal every 12 hours for at least 3 months, in addition to maintaining the use of hydration after baths every 7 days.

The owner adhered to the treatment, and the animal returned weekly for routine baths, where it was possible to monitor the progress of the treatment. After 90 days, partial

hair regrowth and an increase in primary hair in the alopecic areas were observed (figure 2).

Figure 2: images of the alopecic areas showing partial hair regrowth after 90 days of treatment. Source: personal archive.



Given the partial positive result of therapeutic response, the use of melatonin was extended for another 2 months, together with the Qpelo food supplement to aid in hair growth, until further instructions.

The patient is currently undergoing treatment with the medications mentioned above, and will be reassessed after this period to see if he will need other therapeutic resources such as microneedling. The treatment has been administered without complications, and the patient is in good general condition and showing gradual improvement in his hair.[3]

CONCLUSION

The increased popularity of the German Spitz breed has led to an increase in cases of alopecia X in veterinary clinics, a fact that has sparked several lines of study to further clarify its cause and treatment.

According to the literature, alopecia X is most commonly seen in Pomeranians, especially in young, unneutered males between 1 and 5 years old (MELLO et al, 2022). In the present case, the patient falls within the most affected breed standard, as well as the most affected sex and age group.

Given the fact that this is a breed with high aesthetic expectations, many owners and even professionals end up considering only the aesthetic issue of alopecia. However, the fur of these animals plays a fundamental role in thermoregulation and protection from ultraviolet rays, and when the skin is secondarily exposed to alopecia, it can more easily acquire secondary infections and dryness (PASSATUTTO E JÚNIOR, 2021), and must be treated with the aim of restoring the skin and fur.

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BALANCED SCORECARD: MANAGEMENT TOOL FOR COMMERCIAL AND TOURISM ADMINISTRATION

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ABSTRACT

This research addresses the importance of evaluating and improving the implementation of competitive strategies in organizations, using the Balanced Scorecard as a management tool. In a context of constant economic, social, technological and environmental changes, it seeks to identify deficiencies in strategic execution and propose solutions to strengthen adaptation and anticipation of change. The objective of the study is to analyze the gaps between the calculated indices and the expected levels in different organizational perspectives, in order to propose improvements that optimize overall performance. To meet the proposed objectives, a mixed approach was employed, combining quantitative and qualitative methods. The method of analysis and synthesis was used to define the theoretical references and characterize the problem, and the empirical-analytical method to obtain a direct perception of the object of study and verify the hypothesis raised. The tools included scientific observation to identify problems and characterize the tourist destination, and surveys and interviews to delve deeper into consumer behavior. The study population included experts in strategic management and consumers in the tourism sector. The most relevant scientific results of the study highlighted the effectiveness of the Balanced Scorecard in detecting and addressing gaps in strategy implementation, providing a framework for continuous evaluation and timely adjustment of strategies. This underscores the importance of having clear indicators and well-defined objectives to improve organizational management.

Keywords: Balanced Scorecard. Management. Tourist destination. Administration. Tools.

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INTRODUCTION

Tourism has now emerged as a key player in international trade, becoming one of the main sources of income for many Latin American countries. This growth is also reflected in the diversification of tourism activity and the multiplier effect it generates, creating competition between destinations.

It is crucial to recognize the interrelationship between tourism, culture and the environment, which gives rise to an ancestral, multicultural and multifunctional connection. This relationship contributes to the creation of safer and more sustainable destinations, which drives countries to implement strategies and policies that favor socioeconomic development. Ecuador is no exception and seeks to strengthen tourism through various policies and alternatives.

Tourism activity in Ecuador has shown growth since 2015, when the Gross Domestic Product (GDP) registered an increase of 1.5%. In 2016, due to the earthquake that hit the country, growth decreased by 1.4%. However, in 2017, thanks to the strategies implemented, tourism was reactivated with an increase of 1.74%; in 2018, growth was 1.82%; and in 2019, it reached its highest point with an increase of 1.86%, standing out as the year with the highest tourist influx. In 2020, the COVID-19 pandemic led to a drastic 77% reduction in foreign tourist arrivals and tourism GDP fell to 1.61% due to global lockdown (CFN, 2022).

It is important to note that the National Strategic Plan indicates that the participation of the tourism sector in the services account (export of services) decreased from 68% in 2019 to 39% in 2020. However, by the third quarter of 2021, participation recovered to 47%, despite the difficulties caused by the pandemic (MINTUR, 2019).

Tourism is considered a crucial driver for Ecuador's economy. Internationally, the tourism sector contributes 9.8% of GDP and employs one in 11 people on the planet, which is equivalent to approximately 277 million people. Among the five most visited provinces in the country are Guayas (18.6%), Santa Elena (16.9%), Manabí (15%), Pichincha (12.7%) and Esmeraldas (8.8%). Together, these provinces located in the coastal region represent 59.3% of the total trips made. (Alcívar, 2018)

The province of Manabí, located in the central coastal region of the Pacific, is distinguished by its rich ancestral culture and traditional gastronomy, in addition to its resources and tourist attractions. Its diversity in fauna and flora is also a significant attraction, along with its archaeological heritage that dates back to ancient civilizations, adding a dimension of myths and legends that enrich its tourist offer. Manabí offers splendid

beaches, charming fishing villages, marine and wildlife reserves, wetlands, and the Machalilla National Park, with its abundant vegetation and variety of wildlife species.

From this observatory, a field research was carried out and through group work and with experts, the main deficiencies of tourism in the destination have been defined, which corroborate some insufficiencies reported in the reviewed literature. This is recognized as the research problem and the main aspects of it are detailed below:

- ✓ Deficient control of basic indicators of tourism management (the number of tourists, nationality, average expenditure is not known).
- ✓ Lack of a system of indicators and information flow that facilitates decision-making.
- ✓ Limited coordination of MINTUR and GAD with the unions that manage tourism (hoteliers, restaurants, etc.).
- ✓ Management based on operability and improvisation that facilitates strategies for positioning the tourist destination.
- ✓ Lack of knowledge about instruments that measure the perception of tourists in the destination in order to apply effective and operational strategies.
- ✓ Low levels of efficiency in the destination cause instability in tourism activity. (In 2018 in the country, expenditures represent 41.17% of tourism revenues and in the destination 52.23%, MINTUR 2020)

Framed in this problem, this research is developed within the project: Tourist Observatory for the management of the tourist destination Sucre - San Vicente - Jama - Pedernales that is developed from the Eloy Alfaro Lay University of Manabí and that has allowed the identification of the following scientific problem.

A scientific problem that most relapses in the research work defined by an expert is the deficient management control in the tourist destination Sucre - San Vicente - Jama - Pedernales, which affects the effectiveness, efficiency, competitiveness and decision-making process in said destination. Defining as an objective to develop a model for the management control of the Sucre - San Vicente - Jama - Pedernales destination, which based on the integration of a tourism observatory and a balanced scorecard facilitates the management of effectiveness, efficiency, competitiveness and the decision-making process in the destination. This paper bases its main focus on analyzing the gaps between the calculated indices and the expected levels in different organizational perspectives, in order to propose improvements that optimize overall performance.

The scientific novelty of this study is focused on the proposal of a management control model that evaluates the control process for the management of tourist destinations,

which from the strategic analysis stage assesses the four perspectives of the balanced scorecard for analysis through a decision rule; contributes to achieving changes in processes and allows the construction of indicators, the development of the control system to obtain better competitive and commercial results in the tourist destination; as well as the new procedures for the evaluation of the BSC and the adaptation of marketing techniques and tools.

SCIENTIFIC FOUNDATIONS THAT SUPPORT THE STUDY

TOURIST DESTINATIONS

It is important to start by addressing this issue from authors such as , offer different definitions of the concept of tourist destination. Bull (1994) defines this concept as "Country, region or city to which visitors go, having it as their main objective" and Cooper, Fletcher, Gilbert, Shepherd and Wanhill (1998) define tourist destination as "Concentration of facilities and services designed to meet the needs of tourists".(Bull, 1994)(Cooper y otros, 1998)

On the other hand, Mill and Morrison (1985) They indicate that destinations are not only a fundamental part of the total tourism system, but also that a destination is a system that contains a mix of attractions and services where "each part is dependent on the others for success in attraction, service and tourist satisfaction".

Therefore, Valls (2007) They allege that the destination is the base unit of tourism planning. Improving the value of the experience and adapting the number of tourists to the carrying capacity makes it easier for the territory and heritage not only not to be depleted, but to be constantly revived. From this sustainable perspective, this book deals with the comprehensive management of destinations.

But the World Tourism Organization (UNWTO) states in its blog that a tourist destination is a physical space, with or without an administrative or analytical delimitation, in which a visitor can spend the night. It is a grouping (in the same location) of products and services, and of activities and experiences, in the tourism value chain, and a basic unit of analysis of the sector. A destination incorporates different agents and can extend networks to form larger destinations.(2008)

There are multiple criteria regarding tourist destinations, although criteria indicate that a tourist destination is the conglomerate of tourist products or offers that act within a specific demarcation or geographical area, to which must be added factors such as climate, infrastructure, services, natural and cultural resources, and of course the quality of all this. (EOI, 2011)

So, let's value that a tourist destination is a geographical area in which travelers live new experiences, interesting moments and exciting activities, in this same aspect there are levels in terms of tourist destinations within which we can mention: a center of interest, cities, regions or countries (Barros y otros, 2011).

BALANCED SCORECARD. DEFINITION

Cárdenas in his study argues that the Balanced Scorecard (BSC) is the model developed by (2009)Kaplan and Norton (1997), with the aim of paying greater attention to operational measurements related to customer satisfaction, internal processes, and improvement and innovation activities. There is a well-known phrase that sums up the importance of measurements: "If you can't measure it, you can't control it and if you can't control it, you can't manage it."

Villa (2015) He defines it as "a set of indicators that provide senior management with a comprehensive view of the business and a management tool that translates the company's strategy" although he also claims that it is a new framework that helps organizations to transform strategy into operational objectives. They are the guide for obtaining business results (performance) and strategically aligned behaviors of the company's key people.

Instead Vincent and Viltard (2021) approaches the BSC from a feedback and strategic training approach: Links operational reviews (short-term performance) with strategic reviews (long-term trends) in order to assess the extent to which the outlined strategic framework is working. Because organizational leaders require feedback on strategy, the WCC should provide opportunities to gather information on these types of issues, make reflections, and gather ideas from and for the entire organization.

Santistevan-Nunura et al. (2020) they focus on a Balanced Scorecard from the learning and growth perspective, evidencing in their results that employees have a very high and high degree of knowledge about the company's mission and vision, as well as the level of work performance, motivation, evaluation of the training they receive from the company, growth opportunities and the knowledge they have of how their department contributes to the achievement of organizational objectives; as well as about the comfort of working in the company's facilities.

METHODOLOGY

The research focused on a quantitative and qualitative study that facilitated the fulfillment of the proposed objectives. To carry out the research, different methods were used, such as:

Method of analysis and synthesis: to establish the epistemological characterization and define the theoretical references that serve as support for the research process, in addition to enabling the analysis of all the information for the design of the model and the criteria of experts consulted in the evaluation of the proposal.

Empirical-analytical method: it is used to know the direct perception of the object of research and for the contracting of the hypothesis.

THE TOOLS AND TECHNIQUES USED WERE:

Scientific observation: for the identification of the scientific problem and the characterization of the tourist destination and consumer behavior in the practical object of research.

Surveys and interviews: to deepen and expand information regarding consumer behavior.

Documentary analysis: allowed the analysis of the bibliography related to the object and field of research. In addition, for the review of the information available to the tourist destination and to establish comparisons that allow determining the coherence between these and the requirements of the new proposal.

The computer programs StatisticProgram for Social Sciences for Windows (SPSS version 26), Decision, CurveExpert Pro 2.6.3 and Microsoft Excel for information processing and the preparation of tables and graphs.

RESULTS

METHODOLOGICAL PRINCIPLES FOR THE IMPLEMENTATION OF THE PROPOSED MODEL:

1. Knowledge of the strategic plans of tourism in Ecuador and of tourist destinations.
2. Close correspondence between the different actors involved in tourism management processes.
3. To have effective, efficient and trained personnel for the management control of tourist destinations.
4. Existence of marketing orientations and approaches towards the exhibition of destinations.

5. To have an information system for the development of the analyses.

PRESENTATION OF THE FORM

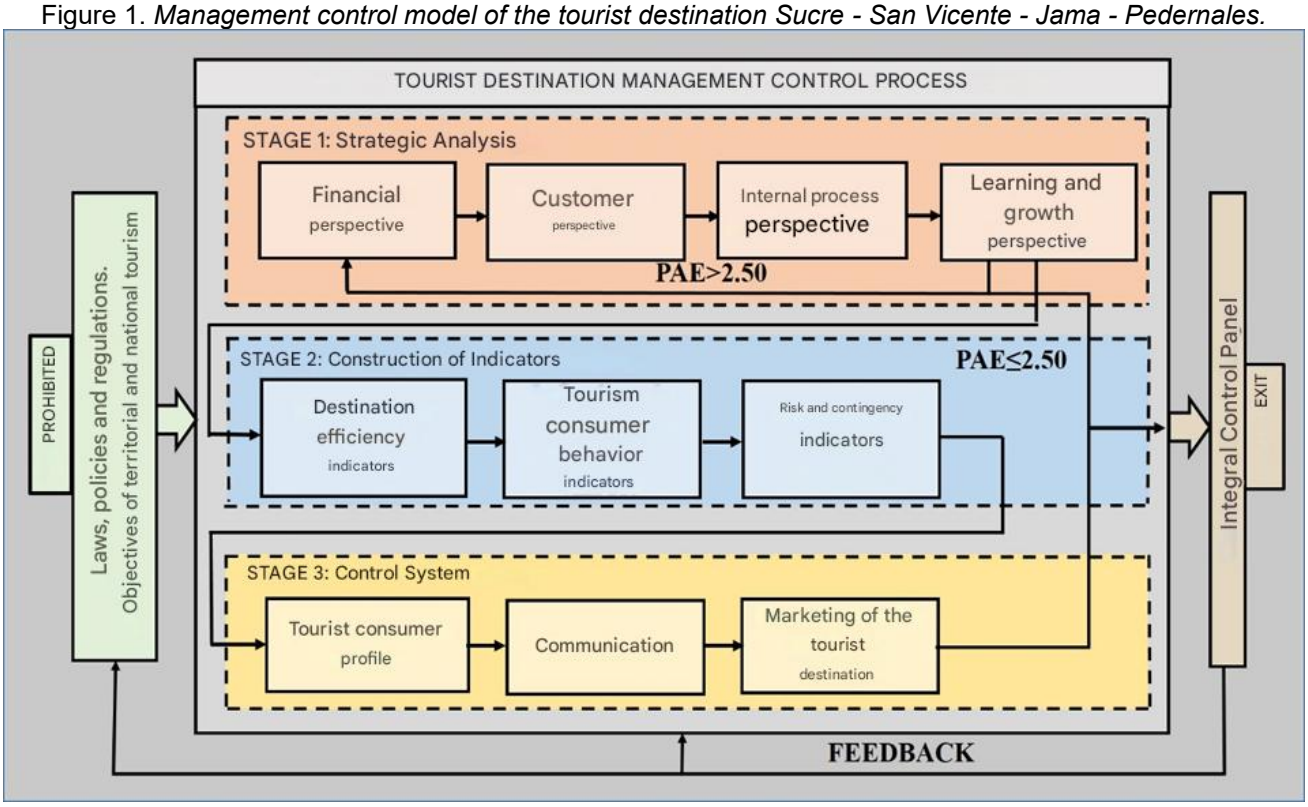
The objective of this model is to control the management of the tourist destination from a general, objective and real vision that supports and evaluates each of the processes developed towards the achievement of the strategic objectives of the tourist destination.

The model's functions:

1. Guide the actors involved in the management control of tourist destinations.
2. To enable the transformation of investment projects towards the sustainability of tourism.
3. Contribute with tools and processes that contribute to decision-making.
4. To provide ease in the evaluation of the social, economic and environmental impacts of tourism investment, minimizing negative aspects.
5. Benefit from increased objectivity in valuations.
6. Increase the attractiveness of destinations to source markets.
7. Link the interests of private national or international investors with those of the local country.

The proposed model has input and output; at the same time, it is composed of three stages that are related to each other, maintaining a continuous sequence and feedback.

Figure 1. *Management control model of the tourist destination Sucre - San Vicente - Jama - Pedernales.*



Source: Prepared by authors

The entry of the model is shaped by the laws, policies and regulations of tourism that Ecuador has; and the objectives of territorial and national tourism. After the analysis of these, the management control process of the tourist destination is continued, comprising three stages.

Stage 1. Strategic analysis is made up of four phases: financial management, the customer perspective, the internal process perspectives, and the learning and growth perspective. These phases are carried out continuously.

In view of the above, the following analysis is proposed as a decision rule: if the strategic analysis procedure (SAP) is greater than 2.5, it is returned to the beginning of the stage to inspect each of the determined phases again. If the results obtained in the new iteration are maintained, we would proceed to the exit of the model. Otherwise, if the strategic analysis procedure (SAP) is less than and equal to 2.5, it goes to the second stage.

Stage 2. The construction of indicators is made up of three phases: Destination efficiency indicators, tourism consumer behavior indicators, and risk and contingency indicators. Opening the third stage.

Stage 3. The control system is made up of three phases: Profile of the tourist consumer, communication and marketing of the tourist destination.

The output of the model is composed of a strategic plan based on the Balanced Scorecard.

MATRIX OF INDICATORS FOR RESULTS (MIR)

The MIR matrix is established to evaluate phases of the first stage, in order to obtain results that allow identifying the management of the tourist destination of the case under study.

STEPS FOR THE DEVELOPMENT OF THE MIR MATRIX

The Lemoine et al. expresses that the matrix(2020) seeks to define where the critical points are located and manage from their results the strategies that position the tourist destination.

The matrix of indicators for results – MIR, consists of the following steps:

1. Establish the general parameters and indicators to be measured for the research topic.
2. Select indicators using the expert method. Given that the score according to the experts' criteria must be from 1 to 5, grading it as follows: 1 is bad, 2 fair, 3 good, 4 very good; and, 5 excellent. The qualification of experts in the subjects does not have to be considered closed numbers, but depends on the participation of specialists and the results obtained by the judgment of all participants.
3. Score the main area. These values must have a proportional value, where the total sum is equal to 1.
4. Weight each of the indicators proportionally, where the sum of each of the parameters established in the main area is equal to 1.
5. Determine the assigned score of each indicator from 1 to 5. Where 1 is the minimum value and 5 is the maximum.
6. Set the calculated score using each main area. Where:

$$P_c = \sum_{i=1} (C_i^3 * A_i)$$

Pc = Calculated Score of the Main Area

∑ = Sumatoria

Ci = Weighted Criterion

AI = Assigned Score

7. Determine the calculated index of the main areas, by:

$$I_c = (P_C - P_i)$$

Where:

Ic = Index calculated by area

PC = Calculated Score of the Main Area

Pi = Main Area Weighting

Calculate the expected level of each area, by:

$$I_e = (5 * P_i)\, n$$

Ie = Expected level per area

Pi = Main Area Weighting

n = Percentage of expected achievement

Phase 1. Financial perspective

Financial management allows you to manage, control and supervise the economic resources that are used in each of the activities aimed at achieving the proposed objectives. Financial management has a series of indicators that allow the processes carried out to be calculated. (Table 1)

Table 1 - Financial perspective indicators.

INDICATORS	MEASUREMENT
Liquidity	- Current Ratio - Acid test - Net working capital
Efficiency	- Inventory turnover - Stock inventories - Collection periods - Portfolio turnover - Asset turnover - Supplier rotation
Efficiency	- Gross profit margin - Return on sales - Return on assets - Return on equity - Earnings per share
Indebtedness	-Indebtedness -Autonomy
Performance	- Market share index - New Product Development Index - Sales growth rate - Customer churn rate
Productivity	- Dupont Index

	- Sales growth rate
Financial diagnosis	- EVA (Economic Value Added) - Marginal contribution - Contribution margin - Break-even point - EBITDA (*Earnings Before Interest, Taxes, Depreciation and Amortization*) - WACC (*Weighted Average Cost of Capita*) - Financial structure - KTNO net operating working capital

Phase 2. Customer Perspective

The customer's perspective responds to the perceptions and behaviors that the customer develops at the time of making their visit and meeting their needs. Table 2 below shows its measurement indicators.

Table 2 - Customer Perspective Indicators.

INDICATORS	MEASUREMENT
Customer volume	- Market share growth (segment) - Proportion of new customer revenue - New customer geographies - New customers for promotional activities
Satisfaction (Retention and loyalty)	- Profitability - Frequency of visits - Purchase intent - Response time -Price -Quality -Brand
Customer profitability	- Income earned during visits

Phase 3. Internal Process Perspective

It allows the analysis of all the processes that have been developed to achieve the objectives, the satisfaction of the market and the orientation of optimal activities that allow the development of quality service at the lowest possible cost. Table 3 details some of the indicators that are part of the internal processes perspective.

Table 3 - Indicators from the perspective of internal processes.

INDICATORS	MEASUREMENT
Internal processes	-Innovation - EVM (*Earned Value Management*) - Time spent carrying out activities - Process downtime (Time that activities are not carried out either due to technical problems, personnel, among others) -Quality
Financial	-Revenue. - Profits (Net, gross, operating). -ROI.
Collaborators	-Feedback - Opinions or suggestions - Employee satisfaction - Teamwork -Productivity
Customer Support	- Customer acquisition cost - Cost in customer retention - Cost in customer loyalty - Lead rate - Market share among competitors - Number of customers - Customer lifetime value

Phase 4. Learning and growth perspective

This phase relates the ability to innovate processes with the ability to learn, improve, and grow in order to align processes, activities, and resources towards global objectives so that processes are carried out effectively. Table 4 shows the indicators of this parameter.

Table 4 - Learning and Growth Perspective Indicators

INDICATORS	MEASUREMENT
Employee capacity	-Satisfaction. -Retention. -Productivity. -Profitability. -Training.
Information systems capacity	- Participation in real-time feedback processes. - Index of access to strategic information. - Customer service collaborators with real-time information for the development of their activities.
Motivation and delegation of power (*empowerment*)	- Number of suggestions per collaborator. - Number of employee suggestions implemented. - Process improvement index. - Projects carried out by the work team.

Based on the definition of the aforementioned indicators, they were evaluated independently and based on studies carried out previously, generating criteria by experts that were transferred to the MIR matrix. The results of the base year, which was 2016, will be presented below and then an assessment or cross-analysis of the historical results of four years (2017, 2018, 2019, 2019) not exposing the results of 2020 because Covid19 generated a destruction of the indicators, although the Tourism Observatory continues to generate statistics on behaviors.

Figure 2. *MIR Matrix 2016*

Área Principal	Ponderación Area Principal	Indicadores o Criterios por Area	Ponderación Criterio	Puntuación asignada	Puntuación calculada Area Indic	Indices Calculados por Area I.	Nivel Esperado por Area I.	Observación
Pespectiva financiera	0,35	Gestió Turitica	0,25	1,52	1,907	0,67	0,88	SEGUIMIENTO REQUERIDO
		Liquidez	0,13	1,9				
		Endeudamiento	0,14	2,05				
		Desempeño	0,18	3				
		Productividad	0,09	2,5				
		Diagnóstico financiero	0,08	2,85				
Perspectivas de procesos internos	0,18	Procesos internos	0,40	2,3	2,18	0,39	0,45	SEGUIMIENTO REQUERIDO
		Financieros	0,20	2,1				
		Colaboradores	0,20	1,7				
		Atención al cliente	0,20	2,5				
Perspectiva de aprendizaje y crecimiento	0,25	Capacidad de los colaboradores	0,52	1,4	1,968	0,49	0,63	SEGUIMIENTO REQUERIDO
		Capacidad de los sistemas de información	0,28	3				
		Motivación y delegación de poder	0,20	2				
Perspectiva del cliente	0,22	Volumen de clientes	0,50	3	2,675	0,59	0,55	APROBADO
		Satisfacción	0,35	2,5				
		Rentabilidad del cliente	0,15	2				
EVALUACION DE LA GESTION DEL DESTINO						2,14	2,50	SEGUIMIENTO REQUERIDO

The evaluation of corporate governance, based on the MIR matrix, reveals satisfactory results in general terms, with an overall index of 2.34 slightly above the expected level of 2.25. In Financial Management, positive results are observed in liquidity (1.52) and indebtedness (2.05), both close to optimal levels. Effectiveness (3.2) exceeds expectations, although efficiency (1.9) could be improved. Overall, the financial management is sound and approved, demonstrating good resource management.

The Internal Process Perspective shows favorable performance, particularly in customer service (3), which is essential for business success. However, employee management performance (1,7) requires attention, as it is below expected standards. Despite this, the internal processes area is approved and meets the evaluated criteria. The Learning and Growth Outlook is the most critical area, with an index of 0.42, which is below the expected level of 0.56. Aspects such as employee capacity (1,4) and motivation and delegation of power (2) need urgent improvements to boost team performance and development. This perspective has been identified as an area of required monitoring.

Financial management has improved in 2019 in terms of liquidity, with a score of 2.7 and a calculated ratio of 0.92, although it remains below the expected level of 1.05. Efficiency also increased with a score of 3.2, while indebtedness stood at 2.5, reflecting more efficient management of financial resources. Despite these advances, the overall performance of financial management still requires monitoring, as it has not reached the expected levels in general terms.

Customer Insight has shown a strong performance in 2019. The volume of clients was evaluated with a score of 4, resulting in a calculated index of 0.70, above the expected level of 0.66, which led to this area being approved. However, customer satisfaction and

profitability still need attention, although they have improved compared to previous years. As for internal processes, the total score is 2.28, with a calculated index of 0.41, which is still below the expected level of 0.54. Performance in this area, especially in employees and financial management, shows that follow-up is needed. Customer support, although improving with a score of 3, still requires strengthening.

Learning and Growth Perspective continues to be one of the weakest. Employee capacity received a low rating of 1.4, which significantly affected the calculated ratio (0.42) compared to the expected level of 0.75. While the capacity of information systems scored a solid 3, the lack of employee development and motivation require urgent intervention.

Overall Assessment indicated that in 2019, the overall assessment of business management improved slightly, reaching a score of 2.45 against the expected score of 3.00. Although there are notable improvements in certain areas, such as customer perspective, other areas, such as internal processes and learning and growth, still require attention and follow-up to reach desired levels of performance.

This analysis shows the importance of continuing monitoring and making strategic adjustments in areas where performance remains insufficient, especially in personnel management and internal processes. The overall assessment of business management results in a score of 2.69 out of an expected level of 3.00, indicating that follow-up is still required in several areas, especially in financial management and internal processes. The improvements in the customer perspective are remarkable, but the overall performance still does not reach the optimal levels expected for the period evaluated. This analysis suggests that while some areas have shown significant progress, others require strategic attention to achieve more balanced performance across the organization.

HISTORICAL STUDIES OF THE GAPS BETWEEN THE CALCULATED AND EXPECTED INDEX

This study facilitated the generation of a critical criterion of the gaps between the dimensions of the BSC in order to observe the indices and to be able to generate increasingly effective strategies or maintenance that affect effective consumer behavior towards the destination under study. The logical historical results of the WCC through the MIR are set out below.

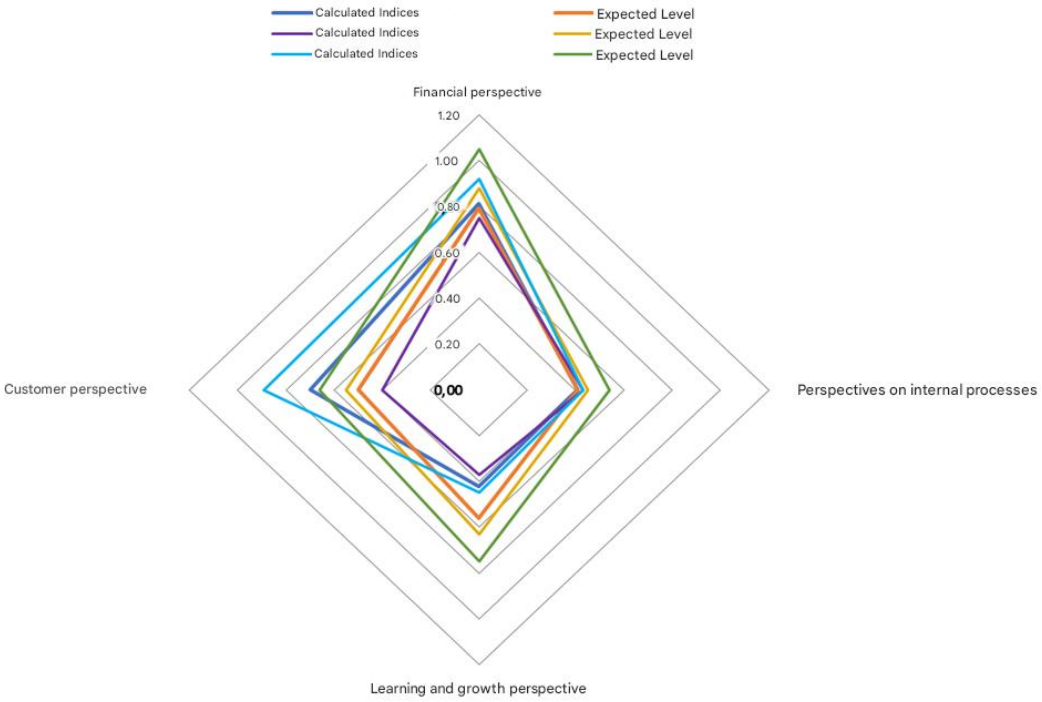
Table 5. *Historical results of the calculated index and expected level*

Perspectives on the Integral Command Board	2016		2017		2018	
	Calculated Indices	Expected Level	Calculated Indices	Expected Level	Calculated Indices	Expected Level
Financial perspective	0.81	0.79	0.75	0.88	0.92	1.05
Customer perspective	0.70	0.50	0.40	0.55	0.89	0.66
Perspectives on internal processes	0.41	0.41	0.43	0.45	0.43	0.54
Learning and growth perspective	0.42	0.56	0.37	0.63	0.45	0.75
MANAGEMENT EVALUATION INDICATOR	2.34	2.26	1.95	2.51	2.69	3.00

A comparative analysis of the calculated indices and expected levels in the balanced scorecard outlook for 2016, 2017 and 2018 reveals variations in the organization's performance. In 2016, the management appraisal indicator was 2.34, slightly above the expected level of 2.26, with the financial outlook showing a return close to target (0.81 vs. 0.79) and the client's outlook far exceeding its target (0.70 vs. 0.50). In 2017, overall performance declined to an index of 1.95 below the expected level of 2.51, which is mainly attributed to the decline in the customer outlook (0.40 vs. 0.55) and in learning and growth (0.37 vs. 0.63), while the financial and internal process outlook remained relatively stable. For 2018, an overall improvement is observed with a management appraisal index of 2.69, still below the expected level of 3.00, but with a significant uptick in the customer outlook (0.89 vs. 0.66) and financial (0.92 vs. 1.05). However, the prospects for internal processes and learning and growth continue to fall short of expected levels, suggesting areas of opportunity in operational efficiency and organizational development.

Below is a radial where it is observed through a history how the calculated index behaves with respect to the desired index, the results of which are shown in Figure 3.

Figure 3 - Historical gaps *between the calculated index and the expected level*



The historical gaps between the calculated index and the expected level, it is necessary to analyze how the differences (or gaps) between the calculated indices and the expected levels vary for each of the perspectives of the balanced scorecard throughout the years 2016, 2017 and 2018. In 2016, the total gap was small with a management evaluation indicator of 2.34 compared to the expected level of 2.26, showing a slight exceedances of the objectives, especially in the client's perspective. In 2017, the gap widened significantly, as the index of 1.95 fell below the expected level of 2.51, reflecting a deterioration in customer outlook and learning and growth. For 2018, although the global gap was reduced with an index of 2.69 compared to the expected 3.00, gaps are still noticeable in the perspective of internal processes and learning and growth. This figure helps to identify the areas with the greatest disparity between actual performance and expectations, pointing out key opportunities for strategic improvements in the management of the organization.

DISCUSSION

Although it is important to highlight the collaborative work between coastal and foreign universities for the development of a model for the management control of the tourist destination Sucre - San Vicente - Jama - Pedernales that responds to the demands of tourism and commercial companies, services and entrepreneurship in general, then it is

important to recognize that the model not only responds to the destination under study but is adaptable due to its scientific novelty for other destinations similar or different.

(Ghiglione, 2021) in his study he argues that the CMI integrates it as a tool that manages business efficiency where he explains that ggestion implies managing and allocating limited resources efficiently, evidencing collaborations carried out in the destination under study according to criteria of when his approach directs it towards the relevance of the CMI and its perspectives as analyzed in this study through the MIR matrix from studies generated by (Pedrini, 2022)(Lemoine et al.,2020, p.96)

However, Lemoine-Quintero et al. (2021) argue that the success or failure of any company, organization or institution, whether public or private, depends to a large extent on the design, scope and level of implementation of its competitive strategies, in this particular case hotel companies which play a fundamental role in the tourism activity of a destination and where consumer behavior has to coincide by Lemoine; Herámdez et al. (2021, p.1344) and behavior style as a preponderant factor for positioning and sustainability. (Lemoine ; Ureta et al., 2023)

Based on criteria of Homero et al. (2020) clarifies that the Balanced Scorecard (BSC) is a strategic administrative tool that allows companies to achieve the level of efficiency and effectiveness in their processes, allowing them to increase their productivity, although according to considerations of the Balanced Scorecard (BSC), it becomes the most used tool in business and(SIMLA, 2021)*eCommerce*to efficiently run a company where these criteria have contributed to integrate it into the tourism context generating actions that contribute to sustainable destinations through the generation of a strategic map and in this way to design the management model that responded to the prevailing tourist needs on the country's coastal coast. (Carvajal et al., 2022, p. 250)

CONCLUSION

That Higher-than-Expected Financial Performance and Customer Satisfaction indicated that the destination has consistently exceeded its goals in the financial and customer outlook. In 2018, the calculated index for the financial perspective was 0.92, exceeding the expected level of 1.05. Similarly, in the client's perspective, the index of 0.89 was above the expected level of 0.66. This reflects effective management in terms of profitability and high customer satisfaction and loyalty, which is essential for sustainable growth at the level of commercial and tourism management of the destination under study.

That Operational Efficiency with Need for Improvement in Internal Processes and Learning at a historical level, the perspectives of internal processes and learning and

growth have shown calculated indices that, although they meet the expected levels in certain periods, reflect areas of opportunity for improvement.

That the Variable Impact of Strategy Implementation: The results show that strategy implementation has had a variable impact on the overall performance of the organization. In 2017, the management evaluation indicator was 1.95, significantly below the expected level of 2.51, suggesting challenges in the effective execution of strategies during that year. However, in 2018, there was a recovery with an index of 2.69, approaching the expected level of 3.00. This pattern highlights the importance of continuous evaluation and timely adjustments in strategies to maintain desired performance.

That the model for the management control of the tourist destination Sucre - San Vicente - Jama - Pedernales meets the management expectations for the commercial and tourism administration of responsible destinations in Ecuador and the coasts.

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TECHNICAL ANALYSIS OF HARTMANN'S RETROSIGMOIDECTOMY IN THE EMERGENCY CONTEXT OF COMPLICATED DIVERTICULITIS HINCHEY III AND IV

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ABSTRACT

Hartmann's retrosigmoidectomy is a widely adopted surgical procedure for managing patients with complicated diverticulitis, particularly in Hinchey III and IV stages. These advanced stages are associated with high morbidity and mortality due to purulent or fecal peritonitis, necessitating emergent surgical interventions. This study presents a systematic technical analysis of Hartmann's procedure in this emergency context, focusing on outcomes such as mortality, morbidity, stoma reversal rates, and long-term complications. A comprehensive search was conducted in PubMed, Embase, Cochrane Library, and Scopus for studies published between 2016 and 2024, using keywords like "Hartmann's Procedure," "Complicated Diverticulitis," "Hinchey III and IV," and "Emergency Surgery." Of 34 initially identified studies, 10 met the inclusion criteria. Findings reveal that while Hartmann's procedure remains a vital option for hemodynamically unstable patients, its limitations, such as low stoma reversal rates (43.9%, Facile et al., 2020) and higher long-term complication rates, underscore the need for patient stratification. Comparatively, primary anastomosis demonstrated superior outcomes in selected stable patients, with higher stoma reversal rates (86.9%, Bridoux et al., 2017) and improved quality of life. Advances in laparoscopic approaches have also shown potential in enhancing outcomes for Hartmann's procedure. Despite its established role, the procedure's high morbidity and low reversal rates prompt the need for further research into individualized patient selection and innovative surgical techniques.

Keywords: Hartmann's Procedure. Complicated Diverticulitis. Hinchey Classification. Emergency Surgery. Primary Anastomosis. Laparoscopic Surgery.

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INTRODUCTION

Hartmann's retrosigmoidectomy is a surgical procedure primarily performed in emergency settings to manage severe cases of complicated diverticulitis, particularly in stages classified as Hinchey III and IV. These advanced stages are characterized by purulent or fecal peritonitis, conditions that pose significant risks to patient survival and require prompt, decisive surgical intervention. While the primary goal of the Hartmann's procedure is to control sepsis by resecting the diseased colonic segment and creating a temporary colostomy, its long-term implications, including morbidity, quality of life, and the feasibility of stoma reversal, remain points of clinical debate (Facile et al., 2020; Bridoux et al., 2017).

Complicated diverticulitis represents the extreme spectrum of diverticular disease, with perforation, abscess formation, and widespread peritoneal contamination being hallmark features in Hinchey III and IV cases. The management of such cases requires not only an understanding of the pathological progression but also a strategic surgical approach tailored to the patient's clinical status. Hartmann's procedure has historically been favored for its reliability in stabilizing critically ill patients. However, evolving surgical techniques and a better understanding of patient selection criteria have led to increased scrutiny of its outcomes compared to alternatives, such as primary anastomosis with or without diverting ileostomy (Halim et al., 2019; Ryan et al., 2020).

The procedure itself, though life-saving in emergent conditions, is not without limitations. The low rate of colostomy reversal, coupled with long-term complications such as hernias and impaired quality of life, has led to the exploration of less invasive techniques and individualized treatment strategies. Moreover, advancements in laparoscopic surgery and perioperative care have opened new avenues for improving outcomes, even in the most severe cases of diverticulitis (Schmidt et al., 2018; Cassini et al., 2019).

This study seeks to provide a comprehensive technical analysis of Hartmann's retrosigmoidectomy in the context of Hinchey III and IV diverticulitis, focusing on its efficacy, risks, and role in contemporary surgical practice. By synthesizing recent evidence, the analysis aims to clarify the procedure's impact on clinical outcomes, including morbidity, mortality, and colostomy reversal rates, while identifying gaps and opportunities for optimizing patient care.

METHODOLOGY

This study adopted a systematic review approach to analyze the technical aspects and outcomes of Hartmann's retrosigmoidectomy in patients with complicated diverticulitis classified as Hinchey III and IV. The objective was to evaluate the efficacy, risks, and clinical outcomes of the procedure, including mortality, morbidity, stoma reversal rates, and long-term complications.

DATA SOURCES AND SEARCH STRATEGY

Data were sourced from PubMed, Embase, Cochrane Library, Web of Science, and Scopus databases using a combination of Medical Subject Headings (MeSH) terms and free-text keywords. The search terms included "Hartmann's Procedure," "Complicated Diverticulitis," "Hinchey Classification," "Emergency Surgery," "Primary Anastomosis," and "Laparoscopic Surgery." Boolean operators "AND" and "OR" were employed to construct a comprehensive search strategy aimed at capturing all relevant studies. The search was restricted to articles published between 2016 and 2024 to ensure the inclusion of recent evidence reflecting contemporary surgical practices.

INCLUSION CRITERIA

The inclusion criteria were defined to identify studies directly relevant to the research objectives:

1. Studies analyzing Hartmann's procedure outcomes in patients with Hinchey III and IV diverticulitis.
2. Articles comparing Hartmann's procedure to alternative approaches, such as primary anastomosis, in emergency settings.
3. Peer-reviewed studies published in English, Portuguese, or Spanish to allow a broader range of high-quality data.
4. Research presenting quantitative data on outcomes such as mortality, morbidity, stoma reversal rates, and long-term complications.
5. Studies evaluating the role of laparoscopic approaches in Hartmann's procedure.

EXCLUSION CRITERIA

Exclusion criteria were applied to omit studies that did not align with the research scope:

1. Studies focusing exclusively on non-emergent or elective surgical interventions.
2. Articles lacking quantitative data on outcomes or clinical comparisons.

3. Research unrelated to Hinchey III and IV diverticulitis or Hartmann's procedure.
4. Studies published in languages other than English, Portuguese, or Spanish.

STUDY SELECTION PROCESS

The initial database search identified 34 articles, which were screened based on titles and abstracts. After applying inclusion and exclusion criteria, 10 studies were included in the final analysis. Selected articles provided comprehensive data on Hartmann's procedure and its comparison to other surgical approaches in managing complicated diverticulitis.

DATA EXTRACTION AND ANALYSIS

Data extraction focused on capturing key variables, including:

1. Patient characteristics (age, comorbidities, and clinical presentation).
2. Surgical techniques (open vs. laparoscopic Hartmann's procedure).
3. Outcome measures (mortality, morbidity, stoma reversal rates, long-term complications).
4. Comparative analysis with alternative surgical approaches, such as primary anastomosis.

The selected studies were critically analyzed to identify patterns, trends, and gaps in the evidence. Emphasis was placed on studies incorporating laparoscopic techniques or reporting on long-term outcomes, given their relevance to advancing surgical practice.

TEMPORAL SCOPE AND RELEVANCE

The timeframe from 2016 to 2024 ensured the inclusion of contemporary evidence and advancements in surgical techniques, perioperative care, and patient management strategies. By synthesizing findings from this period, the study provides a robust evaluation of the technical and clinical aspects of Hartmann's procedure in emergency settings.

This methodology ensures a comprehensive and evidence-based analysis, contributing to a deeper understanding of Hartmann's retrosigmoidectomy's role in the management of complicated diverticulitis and offering insights for optimizing surgical decision-making.

RESULTS

The emergency surgical management of complicated diverticulitis, particularly in cases classified as Hinchey III and IV, presents significant challenges due to its high morbidity and mortality rates. Hartmann's procedure has long been a cornerstone in these scenarios, providing an effective means to control sepsis through resection of the diseased colonic segment and the creation of a temporary colostomy. However, the procedure's associated outcomes, including low stoma reversal rates and long-term complications, have led to an ongoing debate regarding its role compared to alternative approaches such as primary anastomosis.

The reviewed studies demonstrate significant variability in the clinical outcomes and technical approaches to managing complicated diverticulitis. Across the literature, factors such as patient selection, surgical expertise, and advancements in perioperative care have been highlighted as critical determinants of success. All studies reviewed emphasize the importance of individualized treatment planning, the potential benefits of laparoscopic techniques, and the need for comprehensive postoperative follow-up to optimize patient outcomes. These findings reinforce the importance of a systematic and evidence-based approach to guide decision-making in emergent surgical interventions.

The research findings on Hartmann's procedure and alternative approaches for managing Hinchey III and IV diverticulitis are summarized in the table below:

Author, Year	Study Title	Study Summary
Bridoux et al., 2017	Hartmann's Procedure or Primary Anastomosis for Generalized Peritonitis due to Perforated Diverticulitis	Comparison between primary anastomosis with diverting ileostomy and Hartmann's procedure in patients with diverticular peritonitis. Conclusion: primary anastomosis demonstrated a significantly higher stoma reversal rate (96% vs. 65%) without an increase in mortality.
Halim et al., 2019	Primary resection anastomosis versus Hartmann's procedure in Hinchey III and IV diverticulitis	A meta-analysis showed that primary anastomosis was associated with lower mortality and a reduced incidence of complications compared to Hartmann's procedure, particularly in observational studies.
Facile et al., 2020	Short- and long-term outcomes for primary anastomosis versus Hartmann's procedure	Comparison between Hartmann's procedure and primary anastomosis revealed higher morbidity and mortality for Hartmann, with lower stoma reversal rates for patients undergoing the procedure.
Lambrichts et al., 2020	Sigmoid resection with primary anastomosis versus the Hartmann's procedure	A conclusion based on a systematic review indicates that primary anastomosis is preferable to Hartmann's procedure in selected patients, with better stoma reversal rates and lower associated morbidity.

Ryan et al., 2020	Systematic review comparing primary resection and anastomosis versus Hartmann's procedure	A meta-analytical study revealed that primary anastomosis resulted in lower postoperative morbidity and fewer permanent stomas compared to Hartmann's procedure in Hinchey III/IV cases.
Schmidt et al., 2018	Meta-analysis of surgical strategies in perforated left colonic diverticulitis	A review indicated that primary anastomosis had significantly higher rates of colonic restoration compared to Hartmann's procedure for complicated diverticulitis (Hinchey III/IV).
Loire et al., 2021	Long-term outcomes of Hartmann's procedure versus primary anastomosis	Long-term follow-up demonstrated that primary anastomosis resulted in fewer complications and better quality of life compared to Hartmann's procedure.
Cassini et al., 2019	Emergency Hartmann's Procedure and its Reversal	Laparoscopic procedures were associated with lower morbidity rates and successful stoma reversal in 92% of cases.
Elkomos et al., 2023	Is It the End of Hartmann's Procedure?	An updated review compared Hartmann's procedure to primary anastomosis, showing lower mortality associated with primary anastomosis and similar complication rates.
Sarhan et al., 2016	Five years of experience with laparoscopic peritoneal lavage	Laparoscopic peritoneal lavage proved to be safe and effective in patients with purulent diverticulitis (Hinchey III). Reported mortality and morbidity rates were 5% and 15%, respectively.
Bridoux et al., 2017	Hartmann's Procedure or Primary Anastomosis for Generalized Peritonitis due to Perforated Diverticulitis	Comparison between primary anastomosis with diverting ileostomy and Hartmann's procedure in patients with diverticular peritonitis. Conclusion: primary anastomosis demonstrated a significantly higher stoma reversal rate (96% vs. 65%) without an increase in mortality.
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Ryan et al., 2020	Systematic review comparing primary resection and anastomosis versus Hartmann's procedure	A meta-analytical study revealed that primary anastomosis resulted in lower postoperative morbidity and fewer permanent stomas compared to Hartmann's procedure in Hinchey III/IV cases.
Schmidt et al., 2018	Meta-analysis of surgical strategies in perforated left colonic diverticulitis	A review indicated that primary anastomosis had significantly higher rates of colonic restoration compared to Hartmann's procedure for complicated diverticulitis (Hinchey III/IV).

Source: The authors of the study

DISCUSSION

Hartmann's procedure, a well-established surgical approach for managing complicated diverticulitis in Hinchey III and IV stages, has been extensively evaluated in recent years. This procedure, involving the resection of the affected colon segment and creation of a temporary colostomy, is primarily indicated in critically ill patients. However, studies increasingly compare it with primary anastomosis (PA), raising questions about the optimal surgical strategy. The debate centers on morbidity, mortality, stoma reversal rates, and the long-term quality of life of patients undergoing these procedures.

Bridoux et al. (2017) provided compelling evidence favoring PA, demonstrating a 96% stoma reversal rate compared to 65% for Hartmann's procedure, while mortality rates were comparable. This study highlights PA's ability to restore intestinal continuity more effectively, a factor that significantly impacts patient quality of life. The findings suggest that PA could be prioritized in stable patients, challenging the traditional reliance on Hartmann's procedure in all emergency settings.

Halim et al. (2019), through a meta-analysis of 25 studies, reported similar findings, emphasizing PA's lower mortality rate of 8.2% compared to 10.8% for Hartmann's procedure. This slight yet meaningful difference underscores the importance of patient selection. The study advocates for PA in patients with favorable clinical profiles, given its advantages in reducing complications and achieving higher rates of stoma reversal.

Facile et al. (2020) expanded on this discussion, reporting that PA resulted in lower morbidity (9.2% vs. 30.3%) and mortality (0% vs. 10.6%) compared to Hartmann's procedure in a multicenter retrospective analysis. These findings underline the procedural benefits of PA, particularly in minimizing immediate postoperative risks. The high stoma reversal rate of 86.9% in the PA group further highlights its suitability for many patients, provided their condition permits.

Long-term outcomes are also a key focus in this debate. Loire et al. (2021) demonstrated that PA patients experienced fewer complications over time, including lower

rates of incisional hernias (29% vs. 52%) and reoperations. Furthermore, quality-of-life metrics consistently favored PA, suggesting that it may offer superior benefits beyond the acute postoperative phase. These findings emphasize the need to balance immediate surgical risks with long-term patient well-being.

Ryan et al. (2020) reinforced these conclusions, noting that PA was associated with fewer major complications and reduced rates of permanent stomas. However, the authors acknowledged that Hartmann's procedure remains a critical option for patients with severe clinical instability or significant comorbidities. This dual perspective highlights the importance of tailoring surgical decisions to individual patient profiles.

Schmidt et al. (2018), in their meta-analysis, added nuance to the debate by noting no significant difference in overall mortality between PA and Hartmann's procedure. However, they emphasized that PA offers a higher likelihood of restoring intestinal continuity, a critical consideration in improving patients' functional outcomes. This finding supports the growing consensus that PA should be preferred when feasible.

The role of laparoscopic techniques has also emerged as a pivotal consideration. Cassini et al. (2019) demonstrated that laparoscopic Hartmann's procedures yielded improved outcomes, including higher stoma reversal rates and reduced morbidity. These findings suggest that minimally invasive approaches may enhance the efficacy of Hartmann's procedure, particularly in high-risk patients, offering a viable alternative when PA is contraindicated.

Elkomos et al. (2023) extended this discussion by comparing traditional and laparoscopic Hartmann's procedures to PA. Their study highlighted PA's consistently superior outcomes, including lower mortality and higher stoma reversal rates. These results reinforce the importance of adopting evidence-based strategies to optimize surgical outcomes in patients with complicated diverticulitis.

Alternative approaches, such as laparoscopic peritoneal lavage, have also been explored. Sarhan et al. (2016) reported that this technique achieved a 5% mortality rate and 15% morbidity in Hinchey III cases, with reinterventions required in only 6.25% of patients. While not suitable for all cases, laparoscopic lavage may offer a less invasive option for selected patients, particularly those with localized peritonitis.

Despite the advantages of PA, Hartmann's procedure remains indispensable in certain scenarios. Severely ill patients, those with extensive comorbidities, or those presenting with fecal peritonitis often require the stability provided by Hartmann's approach. Its ability to control infection and prevent sepsis in critically ill patients remains unmatched, ensuring its continued relevance in emergency surgical care.

Long-term complications of Hartmann's procedure, such as incisional hernias and the psychological impact of permanent stomas, have been widely discussed. Loire et al. (2021) emphasized the need for ongoing patient support and tailored follow-up care to mitigate these issues. Advances in laparoscopic techniques may further address these challenges, potentially improving outcomes for patients undergoing Hartmann's procedure.

The debate also highlights the significance of surgical expertise and institutional resources. Centers with experienced teams and advanced perioperative care are more likely to achieve favorable outcomes with PA, even in high-risk patients. This underscores the need for continuous training and resource allocation to expand the feasibility of PA in emergency settings.

Ethical considerations also play a role in this discussion. Informed consent and patient preferences are crucial, particularly when deciding between PA and Hartmann's procedure. Understanding the potential risks and benefits of each approach empowers patients to make decisions aligned with their long-term goals and quality of life.

In conclusion, the choice between Hartmann's procedure and PA for managing Hinchey III and IV diverticulitis requires a nuanced approach. While PA offers clear advantages in terms of morbidity, mortality, and stoma reversal rates, Hartmann's procedure remains a critical option for high-risk patients. Continued research, innovation in laparoscopic techniques, and individualized patient care will be essential in refining surgical strategies and optimizing outcomes for this complex patient population.

CONCLUSION

This systematic review highlights the complexity and challenges in the management of complicated diverticulitis classified as Hinchey III and IV, emphasizing the critical role of surgical interventions in improving patient outcomes. The comparative analysis of Hartmann's procedure and primary anastomosis (PA) reveals significant differences in morbidity, mortality, and stoma reversal rates, underscoring the importance of individualized surgical decision-making. While Hartmann's procedure remains a vital option for critically ill patients due to its reliability in controlling sepsis, PA demonstrates superior outcomes in selected stable patients, particularly in terms of long-term quality of life and lower rates of permanent stomas.

The findings emphasize the growing relevance of minimally invasive approaches, such as laparoscopic techniques, which have shown promise in enhancing outcomes for both Hartmann's procedure and PA. The review further underscores the need for advanced perioperative care and multidisciplinary management to optimize patient recovery and

reduce complications. Additionally, the importance of patient stratification and the consideration of comorbidities in surgical planning are critical to achieving favorable outcomes.

Despite its insights, this review has limitations. The included studies exhibit heterogeneity in methodologies, with variations in patient selection criteria, surgical techniques, and outcome measures. Many studies rely on retrospective data or small sample sizes, limiting the generalizability of findings. Furthermore, inconsistencies in the reporting of long-term complications and quality-of-life outcomes highlight the need for standardized research protocols in this field.

Future research should focus on large-scale, multicenter trials to provide robust evidence on the comparative efficacy of Hartmann's procedure and PA in managing Hinchey III and IV diverticulitis. Standardized methodologies and uniform outcome measures will be essential to address existing gaps and improve the reliability of findings. Additionally, the development and evaluation of innovative surgical techniques and technologies, such as robotic-assisted procedures, hold promise for advancing the field.

Finally, further exploration of patient-reported outcomes, including quality of life and functional recovery, is crucial to ensure that surgical strategies align with patient priorities. By addressing these challenges, future studies can significantly enhance the understanding and management of complicated diverticulitis, ultimately improving clinical outcomes and the long-term well-being of patients undergoing these complex surgical interventions.

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INDIGENOUS PEOPLES AND TRADITIONAL COMMUNITIES AND PUBLIC POLICIES IN BRAZIL

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ABSTRACT

The National Policy for the Sustainable Development of Traditional Peoples and Communities (PNPCT), established by Decree No. 6,040/2007, is recognized as a historical and legal milestone in the search for a balance between human relations and the environment. This recognition stems, above all, from valuing culturally differentiated groups and encouraging the sustainable use of biodiversity. However, the invisibility of these groups has resulted in the weakening or loss of knowledge, ancestry, and belonging, in addition to compromising the conservation of biodiversity due to the absence of adequate public policies. Given this scenario, it is essential to foster debates that promote the legitimacy of the PNPCT and the appreciation of the traditional practices and knowledge of Native Peoples and Traditional Communities, which play a fundamental role in the socio-environmental balance. The present work aims to understand the importance of government public policies aimed at Native Peoples and Traditional Communities, highlighting their interrelationship with Good Living as a means to preserve culture, heritage, traditional knowledge and biodiversity. The research, of a bibliographic nature and with an interdisciplinary focus, highlights the indispensability of systematized public policies directed to Native Peoples and Traditional Communities. In this context, the PNPCT must prioritize socio-cultural development, the appreciation of traditional knowledge and knowledge, and respect for the identity of these groups, reaffirming their essential role in building a sustainable and inclusive future.

Keywords: Native Peoples and Traditional Communities. Patrimony. Good Living.

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INTRODUCTION

Brazil is widely recognized for its biodiversity, being a true storehouse of natural resources and a wide variety of plant and animal species. The country is home to different biomes and ecosystems essential for sustaining life on the planet. Its natural and scenic wealth has attracted increasing attention, being the object of concerns of environmental agencies, climate forums and national and international entities focused on the protection of biodiversity.

In this scenario, Indigenous Peoples and Traditional Communities (PCT) play a crucial role, defending human respect, environmental preservation, and care for natural resources. This action is closely linked to cultural heritage and the concept of Good Living, strengthening the debate on the application of the normative purposes of Decree No. 6,040, of February 7, 2007, which instituted the National Policy for the Sustainable Development of Traditional Peoples and Communities (PNPCT). This policy regulates political and social actions that highlight the relevance of these peoples and communities for the cultural and environmental valorization of the territories they occupy.

The objective of this work is to understand the importance of government public policies aimed at Native Peoples and Traditional Communities, highlighting their interrelationship with Buen Vivir as a means to preserve culture, heritage, traditional knowledge and biodiversity.

The relationship between traditional territories, culture and environmental preservation has been widely recognized in recent studies, especially in the areas of Anthropology and Environmental Sciences. These studies show how diverse cultural groups are guardians of ancestry, belonging, knowledge, traditions, innovations, and practices that harmonize with the balanced use of biodiversity in their territories. The philosophy of Good Living reflects this integration, promoting a participatory and harmonious experience between human beings, others and nature, being a principle present in the knowledge and practices of Native Peoples and Traditional Communities.

In view of this, it is the responsibility of society, Brazilian public agencies, social institutions and environmental protection entities to implement, promote and supervise public policies that ensure indispensable conditions for sustainable development. These actions must be guided by the search for a balanced and harmonious relationship between human beings and nature, ensuring the preservation of traditional knowledge and biodiversity.

METHODOLOGY

This research is based on a deductive method with a literature review, with an interdisciplinary focus, in order to discuss the relevance of systematized public policies in favor of Native Peoples and Traditional Communities, to safeguard traditional knowledge, knowledge, belonging, ancestry, practices and innovation in their territories.

RESULTS AND DISCUSSIONS

Native Peoples and Traditional Communities are culturally differentiated groups that have ways of life and social practices guided by respect for nature, differentiating themselves from the predominant economic development models. Through their experiences, these groups resist the hegemonic model of society, preserving ancestral knowledge and knowledge, in addition to maintaining their own identities and social organizations. They occupy territories and use natural resources for cultural, religious, economic and ancestral production purposes.

These groups include indigenous peoples, quilombolas, peoples of African origin, gypsies, rubber tappers, babassu coconut breakers, chestnut trees, pasture communities, faxinalenses, terreiro communities, artisanal fishermen, shellfish gatherers, varzeiros, riverside dwellers, pantaneiros, caiçaras, praieiros, sertanejos, jangadeiros, azoreans, catingueiros, campeiros, varzanteiros, Pomeranians, among others **(Special Secretariat for Policies for the Promotion of Racial Equality -SEPPIR, 2015)** The recognition of these peoples and communities is supported by their socio-cultural relevance, historical resistance and contribution to environmental conservation and cultural diversity in Brazil.

These diverse cultural groups are socio-cultural organizations deeply linked to the idea of a more humane and balanced development. They are recognized for their ways of occupying and using their territories, as well as for their ethnic-cultural contributions, to the preservation of natural resources and animal and plant species, promoting the conservation of biodiversity. The culture and heritage of these groups are fundamental elements of their formation, guiding their practices, ways of acting and harmonious relations with the environment.

Unity among these culturally diverse groups is essential to confront the denial of socio-ethnic-cultural diversity. The strengthening and empowerment of Indigenous Peoples and Traditional Communities are essential to protect their practices, traditions and knowledge, in addition to ensuring the occupation, sustainable use and conservation of traditional territories and natural resources. This dynamic promotes balance, respect for biodiversity and offers valuable learning for all humanity.

National and international normative instruments that demonstrate the relationship of the PCT with culture and the environment due to ways of life and the effective participation in achieving an alternative to development, that is, a more humane and inclusive development, such as the Constitution of the Federative Republic of Brazil of 1988; Decree No. 6,040 of February 7, 2007, which establishes the National Policy for the Sustainable Development of Traditional Peoples and Communities - PNPCT; Convention No. 169 of the International Labor Organization (ILO).

Decree No. 6,040/2007 is the historical-legal framework and brings in its text the conceptualization of Traditional Peoples and Communities, Traditional Territories and Sustainable Development, and is also the instrument that sets the guidelines of the National Policy, such as sustainable production, sociocultural insertion, traditional territories and traditional and natural resources.

Sustainable development is based on three interdependent dimensions: economic, social and environmental, which constitute the pillars of sustainability. There is no hierarchy between these dimensions, as they are all equally essential. However, it is pertinent to highlight the Ecodevelopment approach, which seeks specific solutions considering the environment, culture, individuals and their immediate and long-term needs.

According to Sachs (2007), Ecodevelopment promotes a socially inclusive, economically viable and environmentally sustainable development model, which makes it especially relevant for Indigenous Peoples and Traditional Communities. This perspective recognizes the specificities of these groups and values their cultural practices and ways of life as an integral part of balanced and inclusive development.

Despite the existence of Decree No. 6,040/2007 and the support for Native Peoples and Traditional Communities, however, public policies are scarce for the effective protection, preservation and recognition of PCTs and their importance for the conservation of biodiversity, territory, identity, culture and traditional knowledge.

Several national and international instruments address the importance of heritage and cultural diversity, ensuring the exercise of cultural rights, the dissemination of cultural manifestations, access to the sources of national culture and the appreciation of ethnic and regional diversity. These instruments also promote the defense, preservation, and appreciation of cultural heritage.

Among them, the following stand out: the Constitution of the Federative Republic of Brazil of 1988**, which ensures cultural rights; the National Policy for the Sustainable Development of Traditional Peoples and Communities (PNPCT), aimed at the recognition and protection of Traditional Peoples and Communities; the Convention on the Protection of

the World Cultural and Natural Heritage, adopted at the XVII General Conference of UNESCO; the Convention on Biological Diversity (1998), which recognizes the relationship between biological and cultural diversity; Convention No. 169 of the International Labor Organization (ILO), on the rights of Indigenous and Tribal Peoples; and the Convention on the Protection and Promotion of the Diversity of Cultural Expressions, among others. These legal and political frameworks highlight the relevance of cultural diversity and heritage as essential elements for building a more inclusive and sustainable society.

In 2020, the entire structure of standardization and protection of Native Peoples and Traditional Communities was dismantled, in view of the revocation of the entire organization of the Sustainable Development of Traditional Peoples and Communities by Decree No. 10,473, of August 24, 2020 (Oliveira, *et. al*, 2021, p. 110), receiving much criticism, Behold, the actions were seen as a setback to the rights conquered.

In the years 2019-2022, the period of the Bolsonaro government, although some actions were announced and renewed, it was a period of harsh criticism made by social organizations and indigenous leaders due to measures that weakened the protection of the rights of Indigenous Peoples and Traditional Communities, especially with regard to territorial and environmental protection, such as defending the opening of Indigenous and Traditional Lands for mineral, timber and agricultural exploration (Barreto Filho, 2020).

Since the beginning of 2023, under the presidency of Luiz Inácio Lula da Silva, the Brazilian government has implemented several public policies aimed at Indigenous Peoples and Traditional Communities, aiming at the recognition, protection, and strengthening of their rights.

Among the main initiatives, the following stand out: restructuring of the National Council of Traditional Peoples and Communities (CNPCT), with the objective of monitoring and improving public policies aimed at these groups; creation of the National Secretariat for Traditional Peoples and Communities and Sustainable Rural Development, established within the scope of the Ministry of Environment and Climate Change, being responsible for proposing policies and strategies aimed at the sustainable development of territories occupied by Indigenous Peoples and Traditional Communities, in addition to promoting the conservation of socio-biodiversity and the fight against desertification; the Ministry of Culture created a working group to prepare the National Policy for Traditional and Popular Cultures, in August 2024, aiming at the appreciation and preservation of the cultural manifestations of Traditional Peoples and Communities; and the Institution of the National Policy for Traditional Peoples and Communities of Terreiro and African Matrix, in November 2024, aiming to promote intersectoral measures to guarantee the rights of traditional

peoples and communities of terreiro and African origin, with an emphasis on the recognition, respect and appreciation of their culture and memory, in addition to confronting racism (Brasil, 2024; Brazil 2024; ISA, 2024).

These actions reflect the government's commitment to promoting the inclusion, appreciation and protection of the rights of Indigenous Peoples and Traditional Communities in Brazil, ensuring their active participation in the formulation and implementation of public policies that meet their needs and respect their cultural specificities.

Brazilian cultural heritage is protected by the Federal Constitution of 1988, covering several dimensions that reflect the country's identity and diversity. This protection includes forms of expression; the ways of creating, doing and living; scientific, artistic and technological creations; as well as works, objects, documents and buildings, in addition to all spaces intended for artistic-cultural manifestations. Urban complexes and sites of historical, landscape, artistic, archaeological, paleontological, ecological and scientific value are also protected, highlighting the scope and importance of cultural heritage for the construction and preservation of the nation's collective memory (Brasil, 1988).

Brazil is a country rich in cultural diversity, the result of the plural formation of its people, which is expressed through originality, diversity and pluralism. This cultural wealth is represented in various forms, such as dance, music, theater, poetry, literature, visual arts, beliefs, and countless other artistic manifestations.

Brazilian culture has constitutional protection, according to article 215 of the Federal Constitution, the State has the duty to guarantee everyone the full exercise of cultural rights, access to the sources of national culture and the incentive to the appreciation and dissemination of cultural manifestations (Brasil, 1988). However, for this commitment to be effectively fulfilled, more robust public policies are indispensable, which contemplate planning, promotion and continuous investment in the development and preservation of Brazilian culture.

For Gudynas and Acosta (2011, p. 103) Good Living presents itself "as an opportunity to build another society sustained by the coexistence of human beings in diversity and harmony with nature, based on the recognition of the cultural values existing in each country and in the world", being a movement of alternative to development, of resistance to the valorization of knowledge, of culture and traditional knowledge.

Alcântara and Sampaio (2017, p. 233), it is a "crisis of a systemic and civilizing nature suggests a renewed reflection on the meaning of Good Living, which is related to

quality of life and leads us to issues such as spirituality, nature, ways of life, consumption, politics and ethics". And yet, that the meaning of Buen Vivir also includes

> the valorization of the territorial dimension within the scope of alternative development policies and the recognition of other ways of being in the world - which have always existed, survived and preserved their characteristics with a certain degree of autonomy in the face of the process of modernization and colonization (Sampaio, Alcantara and Vieira, 2022, p. 171)

The multidimensional vision of Buen Vivir integrates human emancipation with a harmonious and respectful coexistence between man and nature. This perspective values participatory management, based on ethical principles, and promotes an inclusive, sustainable, democratic, and economically viable environment, aimed at reducing social, cultural, and economic inequalities.

CONCLUSION

Native Peoples and Traditional Communities are guardians of culture, traditional knowledge and biodiversity, maintaining an intrinsic relationship with natural resources, based on preservation and sustainable use transmitted from generation to generation. This interaction contributes to socio-environmental harmony and balance, making Traditional Peoples and Communities protagonists in essential issues that involve the relationship between society and nature on a sustainable basis.

From an interdisciplinary perspective, themes related to Native Peoples and Traditional Communities, culture, heritage and Buen Vivir play a significant role in the dialogue with society in general. These are themes that enrich the collective understanding of the importance of sociocultural and socio-environmental diversity. However, it is necessary to advance in debates and practices to reduce the distance between public policies and the effective promotion, promotion and access to culture. This approach is crucial to ensure the preservation of traditional knowledge and knowledge, ensuring cultural diversity and promoting the Good Living of Native Peoples and Traditional Communities.

Although Decree No. 6,040/2007 is considered a milestone in the recognition of Traditional Peoples and Communities, as well as other legislation and public policies, its applications have proven to be inefficient and insufficient to ensure the effective recognition of these groups and to promote sociocultural and environmental development.

Given this scenario, it is essential that society and public institutions assume the responsibility of inspecting and demanding the implementation of public policies aimed at preservation and social, cultural, and environmental balance. These actions should contribute to the appreciation of traditional knowledge, respect for identities and the

promotion of the socio-cultural development of Native Peoples and Traditional Communities, ensuring their rights and strengthening their role in the construction of a sustainable, inclusive and fair future.

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THE ROLE OF NURSES IN IUD INSERTION: AN ANALYSIS OF THE EVOLUTION IN CAMPO GRANDE/MS BETWEEN 2019 AND 2023

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ABSTRACT

Family planning is a right guaranteed by law and fundamental for individuals to be able to make informed decisions about their reproduction. In Brazil, the Unified Health System (SUS) plays a crucial role, offering access to contraceptive methods, including Intrauterine Devices (IUDs), which are long-acting reversible methods (LARC) with high efficacy. The copper IUD, for example, is valid for up to 10 years and is 99% effective. The insertion of the IUD can be performed by both doctors and trained nurses, a practice regulated by the Federal Nursing Council (COFEN), expanding access to this method, especially in regions with a shortage of doctors.

In Campo Grande (MS), training programs have trained nurses to insert IUDs, contributing to an increase in insertions, especially with the performance of resident nurses in the TEIAS project. This study aims to analyze the number of IUD insertions performed by physicians and nurses, highlighting the fundamental role of nurses and residency programs in promoting family planning in Primary Health Care.

The research is quantitative, based on secondary data from the Health Information System for Primary Care (SISAB) between the years 2019 and 2023. The results show the positive impact of IUD insertion by nurses in increasing access to contraceptive methods, reflecting the progress in reproductive planning in the SUS.

Keywords: Contraceptive methods. IUD. Training of nurses. Multiprofessional residency. Nursing. Family planning.

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INTRODUCTION

The right to reproduction is guaranteed by law and ensures that every individual can make their reproductive choices in a free and informed manner. For this right to be effective, it is necessary that everyone has access to safe and provided information, as well as to the means and methods available to contraception. In this context, family planning emerges as a fundamental instrument to support these decisions, ensuring that people can achieve their reproductive goals (BRASIL, 1996).

Brazil's Unified Health System (SUS) plays a crucial role in making conscious decisions about reproduction and birth control available to the population and supporting them. Family planning, inserted in the context of primary health care, is an essential service offered by the public network, which seeks to ensure that all citizens can access contraceptive methods in a safe and effective way (BRASIL, 1998).

The main components of family planning include education and information about available methods, free access to different types of contraceptives, personalized counseling to assist with reproductive decisions, and the provision of reproductive health services, such as screening and prenatal care. In addition, primary care acts in the prevention and treatment of infertility and sexually transmitted infections, in addition to providing psychosocial support when necessary (BRASIL, 2018).

Among the contraceptive methods offered by the SUS, the copper Intrauterine Device (IUD TCu 380A) stands out, considered a long-acting reversible method (LARC), with a validity of up to 10 years and an efficacy of 99% (BRASIL, 2018). IUD insertion can be performed by trained doctors or nurses, a practice regulated by specific guidelines in Brazil (COFEN, 2022).

Reproductive planning is a right guaranteed by law to all Brazilians. Among the services offered by the Unified Health System (SUS) is contraceptive care, with access to and choice of contraceptive methods considered an essential activity (BRASIL, 1996). To strengthen this right, the Ministry of Health launched in 1998 the "Technical Manual for Family Planning Assistance", which highlights the importance of family planning and provides guidance on appropriate management. The document also underlines the role of health professionals in knowing all contraceptive options and in adequately informing users, encouraging active participation in the choice of method.

Therefore, family planning, when well implemented, promotes reproductive health, improves the quality of life of individuals and families, and allows everyone to exercise their reproductive rights in an informed and safe manner (BRASIL, 2002).

According to IBGE data from 2019, among women aged 15 to 49 who were still menstruating and sexually active in the previous 12 months, 22.9% used some sterilization method (17.3% tubal ligation and 5.6% vasectomy), 4.4% opted for the IUD, 9.8% used injections, 40.6% preferred the contraceptive pill, 20.4% used male condoms, 0.6% used other modern methods (such as female condoms, ring, adhesive) and 1.2% used traditional methods (such as table or coitus interruptus).

It is observed that the contraceptive method used varies according to the age group. Among women aged 15 to 24 years, 51.0% use the contraceptive pill, 17.2% use injections and 26.5% opt for condoms. Among those aged 25 to 34, sterilization methods begin to appear with 15.2% prevalence and the IUD with 5.4%. In the 35 to 49 age group, 38.7% of women underwent tubal ligation or had partners who underwent vasectomy (IBGE, 2021).

Currently, SUS offers a variety of temporary and reversible contraceptive methods, such as combined pills, mini-pills, monthly and quarterly injectables, female and male condoms, diaphragms, emergency contraceptives, and the copper Intrauterine Device (IUD TCu-380) (Brasil, 2018).

Family planning in Primary Health Care is an essential service offered by the public network, playing a fundamental role in the SUS in Brazil. Through this system, the population receives support and resources to make informed choices about reproduction and birth control. The main components of family planning PHC are: Education and Information; Access to Contraceptives; Personalized Advice; Reproductive Health Services

This comprehensive approach ensures that the population has access to information, services, and support to make safe and informed reproductive choices.

IUD placement can be done by both doctors and trained nurses, and is not an exclusive practice of specialists, nor is it conditional on the performance of complementary exams (BRASIL, 2018).

IUD insertion by trained nurses can be a strategy to expand access to long-acting contraceptive methods, especially in areas where there is a shortage of doctors (BRASIL, 2013).

In Brazil, IUD insertion by nurses is regulated by the Federal Council of Nursing (COFEN), which defines the invasive procedures of technical competence of these professionals. The practice is supported by Law 7,498/86, which regulates the practice of nursing, by Technical Opinion No. 17/2010/CTLN/COFEN, by COFEN Resolution 690/2022 and by Technical Note 31/2023 of the Ministry of Health. This expands access to the contraceptive method for SUS users, since trained nurses can also perform the insertion of the IUD.

To comply with COFEN regulations, nurses must undergo training that includes a 70-hour theoretical-practical course and the insertion of 20 IUDs under the supervision of a trained nurse, during nursing consultations (COFEN, 2022).

In Campo Grande, the capital of Mato Grosso do Sul, the city where data was collected, there are specific programs that train nurses for IUD insertion. Offered by the Municipal Health Department, Regional Nursing Council and Graduate Programs.

In the state capital, 72 Health Units are established, which are UBS (Basic Health Units) and USF (Family Health Units), with doctors and nurses in the care of the population. Among these, 12 units house residents in Family and Community Medicine and the SESAU/Fiocruz Multiprofessional Family Health Program, through the TEIAS project (Integrated Territories of Health Care) which is an initiative that seeks to qualify and expand primary health care (PHC) in the SUS. Developed in partnership between Fiocruz, SESAU and other agencies, it focuses on the reorganization of health services in the territory, promoting integrality, equity and universality in care.

Its implementation aims to strengthen the Family Health Strategy (FHS) in specific areas, such as Manguinhos in Rio de Janeiro, and in other cities, such as Campo Grande/MS. This includes strategies such as expanding FHS coverage to 100% of the target territory, integration with teaching and research, and the inclusion of innovative practices and reducing unnecessary referrals to secondary care. (https://fiocruz.teiascampogrande.com.br/institucional/), this partnership has the annual admission of 72 doctors and 44 nurses linked to this residency program through a selection process.

In this sense, this article aims to analyze the records referring to the insertion of the intrauterine device performed by nurses and physicians in Primary Health Care in Campo Grande, before and after the beginning of the residency in Family Health SESAU/Fiocruz.

OBJECTIVES

The objective of this study is to analyze the number of Intrauterine Device (IUD) insertions performed in the city of Campo Grandes, MS, between 2019 and 2023.

METHODOLOGY

This study with a quantitative, cross-sectional and descriptive approach, conducted based on secondary and public domain data extracted from the Health Information System for Primary Care – SISAB (https://sisab.saude.gov.br/). SISAB is a platform and can be defined as a resource used to identify data related to primary care procedures and services,

with the purpose of transforming them into reliable information necessary to contribute to the decision-making process of health organizations at the federal, state and municipal levels, as well as to health education bodies (BRASIL, 2013).

The Health Information System for Primary Care (SISAB) was established in 2013 by Ordinance GM/MS No. 1,412. It is the current information system to subsidize financing and adherence to the programs and strategies of the National Primary Care Policy (PNAB). SISAB is part of the strategy of the Department of Family Health (DESF/SAPS/MS), called e-SUS Primary Care (e-SUS APS), which aims to improve information management, automate processes, improve infrastructure conditions and optimize workflows in Primary Care. https://sisab.saude.gov.br/

The collection of information was carried out in July 2024 following the following search criteria: access to the SISAB website, Health Production tab; Geographic Unit: Municipality: Campo Grande; Competence: selection of the period from January to December 2019 to 2023, separating into groups of 12 months and at the end adding the result of the total of them; in the Report Row: selected Professional Category; in the column of the selected Report, the Procedure: CIAP/CID; in the filters we selected – Team Type: Eq.de Family Health; Category: Nurse and Doctor, separately. Place of Service: UBS, so in the stage called Type of Production we used the International Classification of Primary Care (ICPC) code, the W12 code was selected, which covers Intrauterine Contraception/Intrauterine Device/IUD. The data were generated by the website itself with on-screen visualization and download in an Excel spreadsheet.

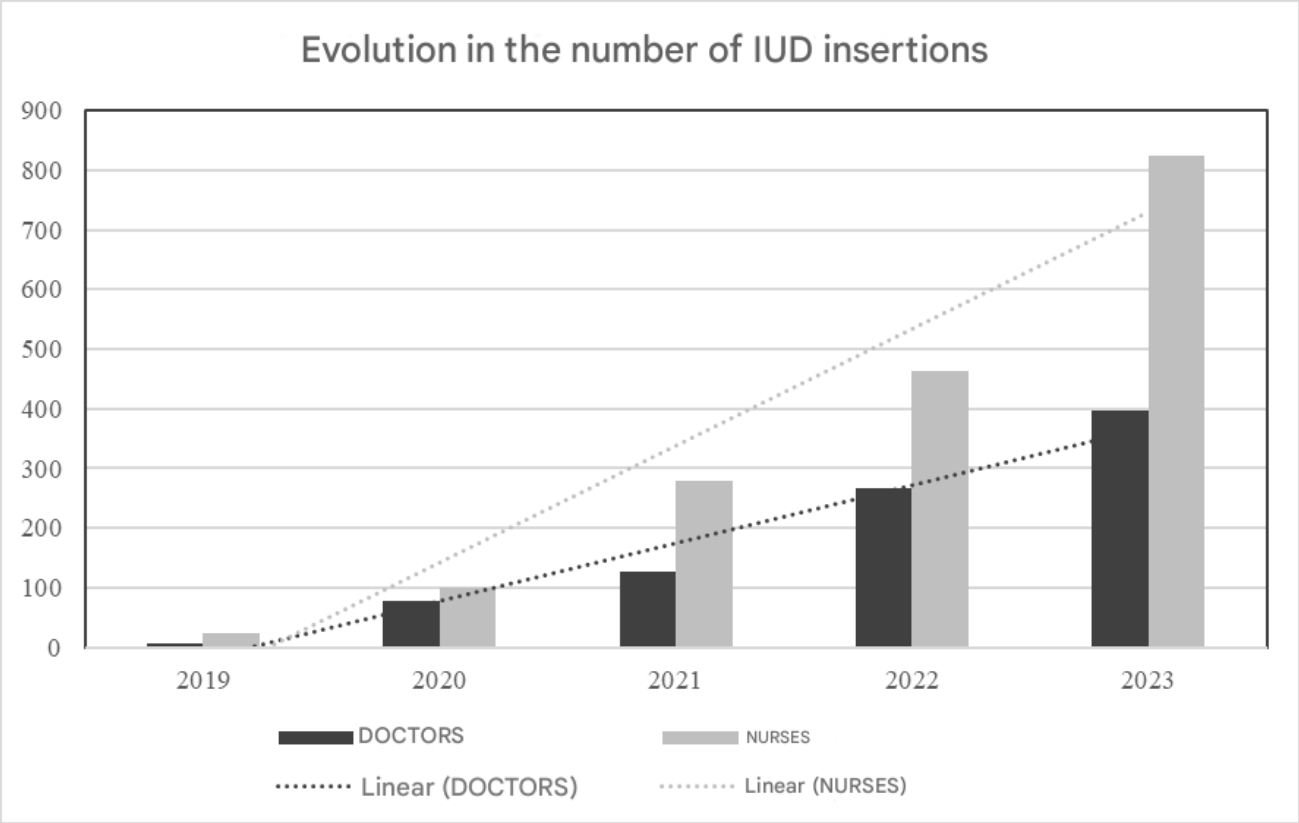
The simple relative frequency analysis technique was used, which makes it possible to explore the data using the quotient between the absolute frequency of the variable and the total number of observations. Tables and graphs generated in Excel were also used to assist in the visualization and analysis of the information produced.

RESULTS AND DISCUSSIONS

The study seeks to demonstrate the significant increase in the insertion of Intrauterine Devices (IUDs) over the last five years, as shown in Chart 1 and Graph 1, which analyzes the factors that contributed to this growth, with special emphasis on the essential role of the nursing professional in this context.

TABLE 1

	2019	2020	2021	2022	2023	TOTAL
DOCTORS	07	77	127	266	396	873
NURSES	24	99	279	464	824	1.690
TOTAL	31	176	406	730	1.220	2.563



The analysis of the growth in IUD insertions by nurses between 2019 and 2023, highlighting the impact of Multiprofessional Residency and subsequent training, reveals notable advances in terms of access to contraceptive methods and family planning in the Unified Health System (SUS). By looking at the data, we can see the following:

In 2019, residency programs had not yet been implemented, the number of IUD insertions was low, with 31 insertions registered. This scenario reflects a context in which access to the IUD was restricted, with a lack of trained professionals in some regions and a greater dependence on doctors to perform the procedure. The shortage of trained nurses limited the expansion of access, especially in areas lacking doctors.

In 2020, the start of the multiprofessional residency coincided with the COVID-19 pandemic, which brought unexpected challenges, including restrictions on face-to-face care. During this period, nurses from the health network began to perform IUD insertions, applying the knowledge acquired in courses and training. However, the pandemic made it difficult to pace face-to-face training and continue training programs, somewhat limiting the expansion of the number of insertions.

In 2021, even with the ongoing pandemic scenario, the first training course for resident nurses for IUD insertion was held. This milestone is important, considering that resident nurses began to be trained in a structured way, gaining technical competence and increasing the capacity to insert IUDs. The number of insertions rose from 279 in 2021,

which represented a significant increase, of approximately 64.69% compared to the previous year, although still below the desired.

In 2022, COFEN Resolution No. 690/2022 also incisively regulated the practice of IUD insertion by nurses, which generated a significant improvement in the quality and safety of the procedure. The number of insertions jumped to 464, which represents an increase of approximately 66.3% compared to 2021. This growth is proof of the effectiveness of training and strengthening the performance of nurses, especially considering that they have become increasingly recognized as essential professionals in the promotion of family planning.

In 2023, with continuous training and the maturation of the residency model, the number of insertions skyrocketed to 1,220. This represents a significant increase of 170% compared to 2021, evidencing not only the positive performance of nurses in the implementation of contraceptive methods, but also the impact of the interprofessional strategies adopted by programs such as the multiprofessional residency, such as the Teias Project. With this expansion, health facilities have been able to reach a much larger number of women, offering long-acting contraceptive options and improving the reproductive autonomy of the population.

The increase in IUD insertions over these five years, with a positive variation of approximately 3,935% from 2019 (31 insertions) to 2023 (1,220 insertions), highlights the strategic importance of training nurses and strengthening multiprofessional residency in the SUS. These data show that, by training nurses, it was possible to expand access to contraceptive methods, especially in areas with a shortage of doctors, and to decentralize the supply of services, promoting equity in access to reproductive health.

In summary, training initiatives and the expansion of the role of nurses in family planning not only increased the coverage of contraceptive methods, but also strengthened women's autonomy in their reproductive choices, directly reflecting on the promotion of sexual and reproductive health in Brazil.

The discussion about IUD insertion by nurses and the impact of programs such as the Multiprofessional Residency (through the Teias Project) on reproductive planning reflects a significant advance in access to long-acting contraceptive methods and in the promotion of reproductive health, in line with the legislation and guidelines of the SUS.

Law No. 9,263/1996, which regulates family planning, ensures the right of Brazilian women to access contraceptive methods, recognizing the importance of reproductive autonomy. This legislation has been fundamental for the expansion of health services aimed at guiding and choosing the most appropriate methods, including temporary methods

such as the pill and the Intrauterine Device itself, but also definitive methods such as tubal ligation. Data from the IBGE reveal that the choice of contraceptive methods varies according to the age group, with younger women preferring temporary methods and older women, definitive methods. The IUD, although it still represents a small portion of the choices, stands out as an effective and long-lasting option, which makes it an excellent choice within the SUS, especially for its 99% effectiveness.

The practice of IUD insertion by nurses was regulated by the Federal Council of Nursing (COFEN), which expanded the performance of these professionals in the field of reproductive health. This not only contributes to increased access to the method, but also relieves the burden on doctors, especially in areas where there is a shortage of these professionals. The required training, with 70 hours of theoretical and practical training and supervision in 20 insertions, ensures that the procedure is performed safely and effectively, benefiting users and offering a reversible and highly effective contraceptive method.

Programs such as the Multiprofessional Residency (Teias Project) have been crucial for interprofessional training and for the improvement of reproductive health care. The Teias Project, focused on the integration between different health professions, has allowed nurses, doctors and other professionals to act collaboratively, strengthening family planning actions in health units. In Campo Grande, the implementation of these programs had a significant impact, with the presence of 44 resident nurses since their inception in 2019, multiplying reproductive health actions and gradually expanding service coverage.

The inclusion of IUDs in health units has been one of the most effective strategies to increase access to long-acting contraceptive methods, especially in the 72 health units of Campo Grande. The training of nurses and the deconcentration of dependence on doctors have been fundamental to ensure that more women have access to the IUD, especially in the regions most in need of medical professionals. The improvement in guidance on family planning also reflects the positive impact of these public policies, which are promoting greater reproductive autonomy and equity in access to services.

CONCLUSION

Training nurses for IUD insertion within the scope of the Teias Project proved to be an effective strategy to increase access to contraceptive methods, improve the efficiency of the health system and maintain an acceptable level of quality in the services provided.

The integration of services and the training of professionals aim to improve the quality of health care. Nurses trained to insert IUDs can provide more complete and accessible care to women, contributing to the autonomy and well-being of patients.

The conclusion on the training of nurses for IUD insertion within the scope of the Multiprofessional Residency Program (Teias Project) shows that this strategy was **fundamental to expand access to long-term contraceptive methods**. By training nurses, it was possible to **decentralize care**, making **family planning** more accessible and efficient for a greater number of women.

This approach has not only **improved the efficiency of the health system**, but has also maintained a **high level of quality in the services** provided, given that trained nurses are able to perform the procedure safely, following protocols that ensure the well-being of patients. In addition, training contributes to strengthening women's **reproductive autonomy**, enabling them **to make more informed decisions** about their family planning.

The **integration of services** and the continuous training of professionals have shown significant results in terms of **the quality of health care**, allowing the SUS to offer a **more complete and accessible service**. This is reflected in the significant increase in IUD insertions in recent years, a direct reflection of the collective effort to improve **sexual and reproductive health** in Brazil.

The analysis of the results shows the success of the strategies implemented:

1. Expanded Coverage: The presence of residents in health facilities has allowed for a significant expansion in IUD insertion and guidance on family planning.
2. Reduction of Medical Dependence: The training of nurses for IUD insertion has been an effective solution for reducing dependence on doctors, especially in areas with a shortage of professionals.
3. Strengthening the SUS: The initiatives have strengthened the SUS, promoting not only access to the IUD, but also equity in care, with a focus on promoting women's reproductive health.

These actions represent an advance in the Brazilian public health system, in line with SUS guidelines and the health needs of the population. The interprofessional training model, with emphasis on the continuing education of nurses, has been shown to be essential to ensure the quality and safety of procedures, in addition to ensuring access to contraceptive methods for a growing number of women across the country.

The continuity and expansion of these projects is key to achieving more inclusive and efficient reproductive health, especially in regions where the shortage of doctors represents a constant challenge.

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VICE OF INITIATIVE AND LEGISLATIVE POWER IN THE FEDERAL DISTRICT: POLITICS IN THE APPROPRIATION OF LEGISLATIVE AGENDAS

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ABSTRACT

The phenomenon of appropriation of the agenda can have great consequences for the effectiveness of citizens' rights, by affecting the effectiveness and credibility of legislative action. In this vein, the articulation between the Legislative and Executive branches seems to show signs of validation of propositions with a flagrant defect of unconstitutionality, whether at the stage of the processing of the proposal or at the time of the veto of the Executive branch. This article, prepared with the aim of analyzing theoretical and practical issues of the Legislative power of the Federal District, will address the verification of this phenomenon, analyzing its causes, effects and consequences, as a way to broaden the debate.

Keywords: Appropriation of the agenda. Citizens' rights. Legislative action. Articulation between the powers. District Legislative House.

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INTRODUCTION

The Legislative Process was developed around specific conceptions and rules that highlight the functions of each branch of the republic and, consequently, the limits of creativity with regard to the matter to be analyzed by the respective Legislative House. The conception of typical and atypical functions of each branch is envisioned, with the function of legislating being proper to the Legislative Branch.

Another typical function of the Legislative Branch is to represent the people, the nation. The Legislature's performance goes beyond the powers of legislating and supervising the application of public resources. It is up to him, for example, to debate important issues, which often do not necessarily result in the insertion of a new norm in the Legal System or in an inspection of a certain entity or public agent, which denotes an inherent performance in the exercise of parliamentary activity (SANTOS; GRANDSON; CARNEIRO, 2021). In the exercise of the typical function of the Legislative Branch, in the eagerness to defend the flags, ideas and ideals of parliament, "deliberate unconstitutionalities" arise, with a flagrant defect of form.

For the purposes of this article, "deliberate unconstitutionalities" are the initiatives of parliamentarians tainted with a flagrant defect of form, to the point of being able to presume that the political agent knew of the unconstitutionality and, even so, proposed the project.

In the same line of ideas, could the parliamentarian present Unconstitutional proposals due to a defect of form to gauge political gain with his electorate? If the law must obey material and formal aspects, how can the parliamentarian start the legislative process with a latent formal defect? While the material defect deals with the content of the rule, the formal defect concerns the rules of the legislative process. The approach to this theme is pertinent in the field of separation of competences between powers. This approach to the control of norms is particularly pertinent to the field of separation of powers.

It is unequivocal that Unconstitutionality has consequences for the credibility and effectiveness of the Legislative Branch's performance.

This is because, according to Hans Kelsen's theoretical elaboration, the Constitution is situated as the supreme law of the State, when it was linked to normativist positivism and reached its culmination (KELSEN, 1979). A scaling of norms is asserted by means of a formal structure, the basis of validity at the top of the legal order.

> "The Legal Order is not a system of legal norms ordered on the same plane, situated next to each other, but is a staggered construction of different layers or levels of legal norms. Its unity is the product of the connection of dependence that results from the fact that the validity of one norm, which has been produced in accordance with another, rests on this other norm, whose production, in turn, is determined by another; and so on, until finally abiding by the fundamental norm –

> presupposed. The fundamental norm – hypothetical, in these terms – is, therefore, the **ultimate foundation of validity** that constitutes the unity of this creative interconnection". (KELSEN, 1979. p. 310.)

In this sense, Paulo Bonavides expresses that the matter contained in the Constitution enjoys the guarantee and the superior value that the Constitutional text confers on it, which certainly would not happen if it had been deferred to the Ordinary Legislation. "Grafted onto its normative body, the Constitutional matter refers to the basic or institutional elements of political organization" (BONAVIDES, 2019. p. 81).

According to the teachings of Celso Ribeiro Bastos, in turn, the formal meaning of the Constitution refers to the set of Legislative Norms, which, because they are produced within a more solemn and difficult Legislative Process, are distinguished from non-constitutional norms. Unlike the material meaning, the formal Constitution is not limited to understanding the behavioral reality of society; it aims only at the existence of a text approved in accordance with state sovereignty, which gives it its structure and determines fundamental rights (BASTOS, 1999, p. 46).

The protagonism of the Executive Branch in relation to parliament brings the idea that the relations of the State *versus* society need to be configured according to some agendas of priorities, particularly as a result of the primary functions of each branch as well as democratic constitutionalism. The Constitution has a configuration of centrality in the legal system, a fact that transmits to Parliament its duty to legislate according to the Magna Carta and in the light of the current order.

In these terms, the work of the district parliamentarian to link his exercise of representation to the electorate becomes an intrinsic challenge, requiring him to carry out multiple strategies. In this sense, some practices have been observed that even contradict the legal dictates.

In general terms, in the eagerness to legislate, parliamentarians go beyond formal aspects and present purposeful unconstitutionalities, in the aspect of the intelligent intention of the deputy to see the interference of the district executive power provoked to remedy the formal defect of the rule. This data is reflected in national jurisprudence, which is often limited to examining merely formal aspects, which repeatedly lead laws to unconstitutionality.

It so happens that, in this way, behind a deliberate unconstitutionality, the strategy of bargaining and appropriation of the matter by the Executive Branch is born. This is because the democratic arrangements capable of understanding the relationship between the powers and the new expectations regarding the activity of the parliamentarian in relation to society, make him, on several occasions, dare to deliberate something in disagreement with

the constitutional text, with regard to competence, to, in the future, negotiate the participation of the Executive Branch to remedy the defect of the initiative. This is where the phenomenon of the appropriation of the agenda is born, which is essential to clarify some peculiarities of the political system of the Federal District, in order to follow the banners that the Congressman defends and the evolution of society.

In this context, the article in question aims to assess whether the possible existence of the phenomenon of appropriation of the legislative agenda within the scope of the Legislative Branch of the Federal District would run in favor of the practice of approving propositions with flagrant formal defects. We found in the work the scientific freedom capable of harboring the phenomenon of appropriation in the fruit of the legislative work of the Legislative Chamber of the Federal District. Scientific thinking marks this work in a peculiar way, since it is observed that there is a scarcity of approaches on the subject within the scope of the Legislative Branch of the Federal District.

The phenomenon of appropriation of the agenda will permeate a critical view, with a view to demonstrating that deliberate unconstitutionalities seek to remedy the vice by the competent power, respecting discretion and typical competence. We assume that, in such situations, there is a proposal to be bargained and debated by the parties, with the objective of meeting the wishes of the parliamentarian and society.

This article deals with the phenomenon of agenda appropriation in the federative entity of the Federal District, which has its peculiarities and specific characteristics, as it cumulates both state and municipal legislative functions. Within the scope of the Legislative Power of the Federal District, pursuant to article 63, item I and § 1, of the internal regulations of the Legislative Chamber of the Federal District[2], it is incumbent upon the Constitution and Justice Commission to examine the admissibility of propositions in general as to constitutionality, legality, legality, regimentality, legislative technique and wording, allowing the analysis of the propositions according to the legal norms in force and in accordance with the interpretations of the national courts.

In other words, in the District Legislative Branch the thesis of Constitutional supremacy prevails, since all Infra-constitutional rules derive their basis of validity from the text of the constitution. The objective of constitutional supremacy is to harmonize the system and bring unity, with the constitutional charter being the supreme norm of the legal system. Although it is endowed with the supremacy of the Constitution, there is no lack of choices with deliberate defects that are not exempted, *a posteriori,* from veto by the

[2] https://biblioteca.cl.df.gov.br/dspace/bitstream/123456789/1933/1/Texto%20atualiz.%20at%C3%A9%2021-8-2017

Executive Branch or reexamination by the Judiciary. For this reason, in the course of the research, in addition to the pertinent Constitutional considerations, analogical and disparate aspects on the subject are presented.

It is intended, in this way, not only to bring the view under the constitutional aspect of the legislative process of the Federal District, but also to demonstrate that, without losing the autonomy and independence of each power, a systemic study is required to assess the existence of the phenomenon of appropriation. In addition, the present work does not aim to analyze what is culpable or doubtful Unconstitutionality. The core of the study is to analyze the existence of the appropriation of the agenda in what is unconstitutional to the point of being able to presume that the political agent knew about the Unconstitutionality and even so proposed the project. For this, the filter of the cases analyzed are the projects of initiative of a parliamentarian with a flagrant defect of competence and with a veto by the Executive branch.

We have chosen as a plan of investigation and analysis the Constitution of the Federative Republic of Brazil in force, the Organic Law of the Federal District and the Internal Regulations of the Legislative Chamber. This methodological approach is capable of observing the subject in a systemic way, considering that the core of the study is the Legislative Branch of the Federal District, which has its own peculiarities and characteristics.

The general objective is the study of the phenomenon within the scope of the Legislative Branch of the Federal District. By investigating this phenomenon never before studied in the Legislative Branch of the Federal District, the work contributes to identifying the reasons for proposals with purposeful Unconstitutionalities with initiative defect.

In this sense, the specific objectives of this article concern: collating cases of deliberate Unconstitutionality; expose cases of incidence of the phenomenon of Appropriation of the Agenda in the Legislative Branch of the Federal District; understand the phenomenon in the Legislative Branch of the Federal District; identify the possible causes of propositions with initiative bias.

In this vein, as a presupposition, we critically affirm that the appropriation of the legislative agenda by the executive branch does not find an obstacle in the 1988 constitution and does not break with the typical functions of each branch, in order to guarantee the priorities of each government with regard to the importance of legislative demands.

As a research question, we asked whether the Appropriation of the Agenda would be a phenomenon used to remedy the deliberate unconstitutionalities, and, consequently, to politically value the parliamentary performance of the CLDF?

To answer the research question, we tracked cases of appropriation of the agenda in the CLDF system and, based on them, we identified the deliberate use of the defect of initiative, in an effort to see an appropriation of the proposal by the executive branch.

In this line of ideas, the approach to the theme is justified by the fact that there are no studies on the subject within the scope of the Legislative Branch of the Federal District. As a logical consequence, we will weave studies on real cases in a way that admits the importance of the phenomenon for society.

As for the methodology adopted, the study starts from the collection of real cases of the Legislative Power of the Federal District, analyzing the occurrences in a qualitative way, that is, from these propositions were critically analyzed, argumentative lines developed on the phenomenon of appropriation, in the light of the constitutional order.

In the conclusion, the essence of the argumentation presented in the course of the work is summarized, indicating the main results of the investigation.

THE PHENOMENON OF APPROPRIATION OF THE AGENDA

In Brazil, the Executive Branch has the peculiarity of preparing its own legislative proposals. On the other hand, it is observed that initiatives by parliamentarians attract the attention of the Government, which intervenes in this specific agenda, presenting a proposal that meets their preferences, combined with the articulation of the text in progress in the legislative house.

Let's see the opinion of Silveira e Silva e Araujo:

> In Brazil, "the Executive Branch has a wide range of power resources, de jure and de facto, making it unequivocal predominance in the initiative of legislative proposals for state management and the conduct of public policies. This effect seems to be linked to the period of authoritarian government of the military (1964-1985), as well as to the apparent passivity of the Legislature, which needs to maintain cordial relations with an Executive, which holds several resources of power." (ARAÚJO and SILVA, 2012; SILVA and ARAÚJO, 2013).

In this relationship between the powers, it is important to highlight the direct or indirect participation of parliamentarians for the approval of legislative initiatives. It will be interesting to note that, in its atypical function, the Executive Branch also drafts laws, taking for itself, on several occasions, proposals from the Legislative Branch. This is where the phenomenon of Appropriation of the Agenda arises.

This phenomenon brings to the Executive Branch the possibility of articulating and bargaining for proposals initiated by parliamentarians. In view of this fact, in an attempt to benefit from the phenomenon of appropriation, parliamentarians propose "Purposeful Unconstitutionalities" due to a defect of initiative, either in the search for promising agendas or in order to draw attention to a certain demand that should be initiated by the Executive Branch.

Let us see Silveira e Silva's understanding:

> Appropriation occurs when the Executive relies on bills in progress in Congress, as well as on the content of the debates and other by-products of the ongoing legislative process, to prepare and present its own propositions, incorporating additional elements to the legislative agenda, and in some cases preventing the development of the agenda under debate in Parliament (ARAÚJO, SILVA, 2012; SILVA, ARAÚJO, 2013).

The appropriation can be carried out by proposals similar to those of the parliamentarians, or even identical. When analyzing the theme, one asks: what would be the governor's interest in appropriating projects in progress in the Legislative Branch of the Federal District? This question is not easy to answer in the face of the existence of internal and external factors that contribute to the existence of the phenomenon of Appropriation.

Among these factors, one is of important importance. It is when appropriation appears as a measure that pleases the authoring parliamentarian and the Executive Branch. In these cases, we may be facing a negotiation between the powers, bargaining, payment of a political favor, etc.

J.J. Canotilho (2003) states that the political function:

> [...] It may take the form of legislative or regulatory acts, guidelines or instructions in global or sectoral plans, acts of military command, information and proposals for the appointment of officials or chairpersons of bodies.

In the hypothesis of the phenomenon of appropriation, the Executive chooses to present a bill of its authorship. With this, the Governor also becomes the protagonist of a certain proposal. It can be seen that appropriation is a coalition strategy between the powers, in the form of the hypothesis of articulating and bargaining demands with both the government base and the opposition.

The legislative agenda may be promising, with positive repercussions for the Executive Branch, or the agenda may threaten political interests, a perception that is called the risk control agenda. The first portrays political gain for the Executive Branch, the second, demands a hypothesis of control.

Within the scope of the Legislative Branch of the Federal District, the Governor is the most interested in the agenda and its consequences, whether positive or negative. The control of the agenda defines the priorities of each government. Let us see Silveira e Silva's opinion on the phenomenon within the scope of the Federal Legislative Branch:

> The priorities depend on the interactive game between the Executive and the Legislative Branches and the level of influence of the internal government in decisions, whether of the Presidency, of the cabinet position that proposed the Agenda, or even of other parties in the coalition. Different priorities also determine different treatments between the government agendas that transit concomitantly in Congress (ARAÚJO, SILVA, 2012; SILVA, ARAÚJO, 2013).

Therefore, appropriation is a strategy with the intention of articulating with the Legislative Branch and persuading it, without taking into account whether the parliamentarian is from the opposition or from the government base. By appropriating projects from the base, the Executive strengthens the government in the Legislative House. On the other hand, by appropriating opposition projects, the Executive avoids criticism and attacks from the opposition, as the proposal becomes a Government initiative.

In the understanding of Silveira e Silva e Araujo,

> "The Executive strategically exploits the tools at its disposal to control and approve its legislative agenda, and this is derived from the way the Executive-Legislative relationship is approached, that is, by the empirically verifiable connections between the formation of a coalition government and the pattern of performance of the agenda setters in the Legislature. Even observing that the performance of the Legislative occurs under strong restrictions, it is far from being negligible, also presenting its forms of restriction on the action of the Executive". (ARAÚJO and SILVA, 2012; SILVA and ARAÚJO, 2013).[3]

We will study this phenomenon in the sphere of the Legislative Branch of the Federal District, in order to understand the reason for its existence, what are its advantages for political agents and how is the behavior of the Executive Branch when faced with a parliamentary initiative that is within its competence.

The object of study, even if relevant and important to the society of the Federal District, is still unexplored in the academic field. This fact demonstrates the importance of scrutinizing the proposed theme.

It is interesting to note that, with a strong Executive Branch, it is important to observe the necessary measures for political gain before parliamentarians, who plead for "appropriate" Bills to do politics in favor of their defenses, flags and interests.

Even so, the study of appropriation clarifies the interposition of "deliberate unconstitutionalities" while these are justified, either by the possibility of appropriation by

[3] Ditto

the Executive Branch, or to force a legislative action within the competence of the Government.

Reiterating what was stated in the introduction and, for the purposes of this work, "deliberate unconstitutionalities" are the initiatives of parliamentarians tainted with a flagrant defect of form, to the point of being able to presume that the political agent knew about the Unconstitutionality and still proposed the project.

Nevertheless, the appropriation of the proposal can take place at the time of the veto, for which there is an interest of the governor to remedy the defect of initiative and forward a new proposal to parliament. This form of negotiation between the powers can demonstrate a combination with the Legislative House, a factor that gives rise to a new discussion on a certain agenda, with its consequent resumption of the political game.

Let us look at Silveira e Silva's understanding: "My argument is that the veto as a vehicle for carrying out appropriation can be understood by the nature and characteristics of the agenda in question, which leads to the strategic action of the Executive and the reaction of the Legislative"[4].

The gains with the appropriation can occur in the field of the ruling and opposition parliamentarians, as well as in the scope of the Executive Branch, which needs to negotiate support with the deputies to see its agendas approved.

Despite the existence of appropriation and the aforementioned purposeful Unconstitutionalities, the final fruit, the Law, is not unambiguous. The Law, as *Clèmerson Merlin Clève teaches,*

> [...] can be used with several different meanings. The term is used to designate any legal norm, no matter through which instrument it is conveyed; sometimes it is used to designate only legal norms clothed with some attributes, such as justice or generality; sometimes it is used to designate only the legal norms voted by parliament; sometimes it is used in the sense of a legal order[5].

In Clèmerson's definition Merlin Clève*,* "Law, therefore, in the contemporary State, is defined by its (extended) origin and by its form. No longer because of its content or the characteristic of generality".[6]

Despite the distribution of competences among the powers, as demonstrated, it cannot be disregarded that the objective of the Legislative Process is the Law, over which the attributions that the Constitution grants them will be undertaken and consummated.

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[4] Silveira e Silva the appropriation of the legislative agenda as a third way to the presidential veto power, 2018.
[5] Legislative activity of the Executive Branch in the contemporary State and in the 1988 Constitution. São Paulo: Revista dos Tribunais, 2000, p. 61-62.
[6] CLÈVE, Clèmerson Merlin. Legislative activity of the Executive Branch in the contemporary State and in the 1988 Constitution, São Paulo: Revista dos Tribunais, 2000, p. 67

After defining the phenomenon of appropriation of the agenda, it is worth noting that we will now study the modality of appropriation by veto, the field that concentrates the field research of this article.

APPROPRIATION BY VETO

The Law is born with the sanction that is a prerequisite for its existence, unless it is vetoed and the veto rejected[7]..."

"The word veto comes from the Latin *vetare*, whose meaning is to prohibit, veto, oppose" (MOTTA, 2017, p. 639).

The veto, in the current conception, originated in the thought of Montesquieu – pointed out in his famous work The Spirit of Laws – who inscribed it as a prerogative attributed to the Executive Branch as a participant in the Legislative elaboration (SILVA, 2017, p.222).

José Afonso da Silva discusses the interest of the Executive Branch in vetoing a bill:

> Basically, the veto is an instrument of control of legislation not only from the point of view of constitutionality but also of interests, content of the bill.
> [...] There is, here, the possibility of harmonizing the exercise of the veto power with the exercise of the power of governmental legislative initiative. This, as we have seen, constitutes an instrument for the action of a political program, a government program. It happens that, through the initiative of the parliamentarian and the power to amend, bills are adopted in parliament, inadequate or incompatible with the government program, which, converted into law, imply a deviation or disturbing element of the government plan. The veto, in this case, acts as a corrective factor according to the government's ideology, in an attempt to prevent such laws from dismantling its programming. (SILVA, 2017, p. p.223-224).

In the conception of Dyrley da Cunha Junior, veto is the formal, express and motivated disagreement of the Executive with the Bill approved in the Legislature, as it understands it to be unconstitutional or contrary to the public interest. In the system of *checks and balances*, or checks and balances, the veto stems from the Power of the Chief Executive to prevent unconstitutional proposals or proposals contrary to the public interest, approved by the Legislature, from becoming laws. "It is a Constitutional measure to contain and bar any abuses and excesses of the Legislative Branch" (JUNIOR, 2019, p. 967).

The veto "is always expressed, and there is no tacit veto because, after the 15 working days without manifestation, it is presumed that the project has been tacitly sanctioned[8]".

[7] SILVA, José Afonso da. Course on positive constitutional law. 23 ed.. São Paulo: Malheiros, 2004, p. 525.)
[8] CARVALHO, Kildare Gonçalves. Legislative technique. Belo Horizonte: Del Rey, 1993, p. 92

The veto can be total, when it falls on the entirety of the project, and partial, when it affects the full text of an article, paragraph, item or subparagraph. Once a certain bill is vetoed by the governor, it is up to the CLDF to consider the veto and deliberate on the overturn.

"The veto is relative. That is, it does not absolutely block the progress of the project[9]."

If there is a partial veto, the vetoed part will go through the stages set out above, since the partial veto – and this is a particularity of Brazilian Law – only requires the reexamination of the vetoed part, while the rest of the bill, which is sanctioned, must be enacted and enters into force after publication, even before the reconsideration of the vetoed part (art. 66, § 5, of the FC).[10]

The author Sylvio Motta defines veto as "the way that the Executive has to reject a project already approved by the Legislative Branch, which is justified due to the interconnected relationship between the powers of the State, allowing for reciprocal control between them" (MOTTA, 2018, p. 639).

Within the scope of the Legislative Branch, the veto can be used as a way to restart the Legislative game, when the Governor himself prevents the approval of the proposal initiated in the Legislative Branch and presents his proposition on the matter.

Marcelo Novelino defines "as a veto the disagreement of the Head of the Executive Branch with the terms of the Bill" (NOVELINO, 2021, p. 711).

It is important to note that, sometimes, in the event that a certain proposition is vetoed, the Executive Branch sends a similar proposal to the Legislative House. This and other cases of veto fit into the phenomenon recently called appropriation, recently studied in the Brazilian literature[11].

To better understand the incidence of the Phenomenon of appropriation within the scope of the Legislative Branch of the Federal District, we illustrate the views on the institute of veto in figure 1 and, soon after, we bring the scenario of veto in the CLDF:

Figure 1: Views on the institute of veto

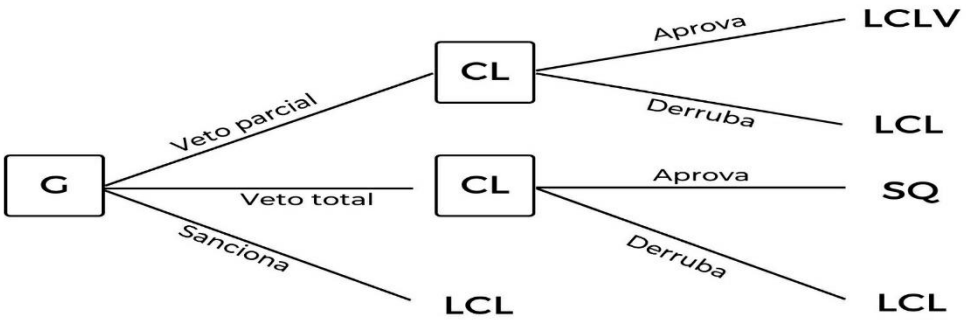
	Veto bargaining (Cameron)	Conditional Agenda Power (Tsebelis and German)	Veto with appropriation in Brazil
Formal Instruments	Veto	*Veto amendment* (merger of veto and new constitutionally provided proposition)	Veto + Presentation of a new proposition ("circumstantial fusion")

[9] SILVA, José Afonso da. Course on positive constitutional law. 23 ed.. São Paulo: Malheiros, 2004, p. 526.)
[10] FERREIRA FILHO, Manoel Gonçalves. Legislative process. 3 current ed. São Paulo: Saraiva, 1995, p. 219.
[11] SCOTT; SILVA. The appropriation of the legislative agenda as a third way to the presidential veto power, 2018.

Negotiation	Negotiation prior to the veto (the resumption of the legislative game occurs at the initiative of Congress)	Negotiation continues (it only ends when the Legislature votes on amendments presented by the Executive)	Negotiation after the veto (resumption of the legislative game at the initiative of the Executive)

Source: Silveira e Silva the appropriation of the legislative agenda as a third way to the presidential veto power, 2018 – based on Cameron (2000, 2019) and Tsebelis and Alemán (2005).

Figure 2: Scenario of the veto in the CLDF



Where:

G: Governor

CL: Legislative Chamber

SQ: Maintaining the Status quo

Lcl: CLDF initiative law sanctioned

Lclv: CLDF initiative law partially vetoed

Based on the aforementioned figure – that is, based on the veto procedure of the Legislative Branch of the Federal District, we seek to observe moments in which the Governor can use the veto to outline strategies in his favor.

The act of vetoing a certain proposition is the prerogative of the Executive Branch, which has the atypical function of legislating on certain matters. Nevertheless, the possibility of appropriation through veto makes it possible to assess its own characteristics, whether it is of interest on the part of the Executive Branch in the authorship of the proposal, or in the face of negotiations with the Legislative Branch.

In the Legislative House of the Federal District, there are initiatives by parliamentarians with the aim of attracting the Executive to the debate of proposals in a negative sense, in order to demonstrate to the people that the Executive Branch is omitting to legislate in that specific demand, a factor directly linked to the large number of vetoes on the agenda.

The adhesion of the head of the Executive Branch to the Bill approved by the Legislative Branch[12]" is of great relevance to the Legislative Process and transcribes the existence of the Law.

Within this veto dynamic, to which we must focus, in 2020, Deputy Reginaldo Sardinha proposed bill 1262 of 2020, which "Provides for the creation of the Octagonal Urban Park in the Administrative Region of the Southwest/Octagonal and provides other provisions".

At the time of the above Bill, the Government of the Federal District communicated to the Presidency of the Legislative Chamber of the Federal District the reasons for the total veto opposed to Bill No. 1,262, of 2020, which provides for the creation of the Octagonal Urban Park and provides for other provisions.

In his explanatory statement, the governor asserted that the proposition incurs in a formal defect of unconstitutionality, as it disrespects article 71, § 1, VI and VII, of the LODF,[13] according to which it is incumbent on the governor to initiate laws that provide for the use and occupation of land or alteration of district real estate.

He also added that the Court of Justice of the Federal District and Territories, on repeated occasions, has already decided for the formal unconstitutionality of laws authored by a parliamentarian that dealt with the creation of District Urban Parks on public properties.

Table 1: Bill for the creation of urban parks.

Exclusive competence of the Governor	Legislation Correspondence	Creation of parks: initiative of parliamentarian	
Initiative of laws that provide for the use and occupation of land or alteration of district real estate	District Arts. 71, § 1º, VI and VII from LODF Arts. 3, XI, 52 and 100, VI and 321 from LODF.	Bill No. 1,262, of 2020. (Deputy Reginaldo Sardinha). Veto of the Executive Branch (Defect of initiative).	Overturning the CLDF veto Law 6997 of 2021 (Law in force).

It can be seen that, even in the face of the arguments of the Executive's veto, the parliamentarians decided to overturn the veto, a fact that resulted in the entry into force of law 6997 of 2021[14], which creates the Octagonal Urban Park and provides other provisions. In this case, there is no incidence of appropriation, since the CLDF and the Governor did not have an understanding and agreement on the vetoed proposal. On the other hand, the

[12] SILVA, José Afonso da. Course on positive constitutional law. 23 ed.. São Paulo: Malheiros, 2004, p. 525.
[13] https://conteudojuridico.com.br/consulta/leis%20a%20comentar/8195/lodf-art-71-das-leis
[14] https://www.sinj.df.gov.br/sinj/Norma/73e2b465219d4e5e83a8d22d2c63b496/Lei_6997_2021.html

Legislative Chamber chose to revoke the Governor's veto, even though the existence of the initiative defect persists.

However, despite the governor's veto, there is no impediment to a future appropriation of this agenda by the Executive Branch, because, as stated in the veto, it is up to the governor to initiate laws that provide for the use and occupation of land or alteration of district real estate.

It is true that this was not the only case of creation of a park by parliamentary initiative with a veto by the local Executive Branch due to a defect in the initiative. In the same dynamic as the veto, Deputy João Cardoso proposed Bill No. 983 of 2020, which creates the Mangueiral Ecological Park in the Administrative Region of the Botanical Garden – RA XXVI. It is essential to say, for the topics that we will deal with below, that the proposal was vetoed for the same reason as the case mentioned in table 1, that is, defect of initiative.

Table 2: Bill for the creation of urban parks.

Exclusive competence of the Governor	Legislation Correspondence	Creation of parks: initiative of parliamentarian	
Initiative of laws that provide for the use and occupation of land or alteration of district real estate	District Arts. 71, § 1º, VI and VII from LODF Arts. 3, XI, 52 and 100, VI and 321 from LODF.	Bill No. 983, of 2020. (Deputy João Cardoso). Veto of the Executive Branch (Defect of initiative).	Overturning the CLDF veto Law 6995 of 2021 (Law in force).

In this case, the parliamentarians also chose to overturn the veto of the Executive Branch, a fact that led to the entry into force of law 6995 of 2021[15], which creates the Mangueiral Ecological Park in the Administrava Jardim Botânico Region – RA XXVI.

From our approach, the incidence of deliberate unconstitutionality sometimes generates action by the Executive Branch to remedy the defect and a restart of the legislative game, a fact that results in appropriation by veto. As a rule, the veto signals the completion of a legislative process. On the other hand, in the case of the appropriation of the agenda, the veto means a new beginning, a preparatory act to restart the discussion of a certain vetoed matter.

This is a differentiated strategy of the Brazilian Chief Executive, which can be inserted, by alternative means, to what Tsebelis and Alemán call *conditional* agenda-setting *power* (ALEMÁN; TSEBELIS, 2005).

[15] https://www.sinj.df.gov.br/sinj/Norma/42cde85a375141c18eeec4c5d25a1e46/Lei_6995_09_12_2021.html

APPROPRIATION OF THE AGENDA AS AN INSTRUMENT OF CONSTITUTIONAL SANITATION

The mechanisms used by the State to ensure that its Laws are complied with (*enforcement of law*) is a recurring theme over time. Several authors have focused on the matter. In less recent history, the contributions of Montesquieu (1996), Beccaria (1999) and Bentham (1996) can be cited. In the near past, there is the manuscript by Gary Becker (1968), which has influenced several authors since then.

Polinsky and Shavell point out that there are "four public choices normally made regarding the repression of transgressors of the Laws". The first choice concerns the type of assumption adopted by the State to attribute responsibility to a certain citizen for non-compliance with a rule of law, whether the assumption of strict liability or the basis of subjective liability. The second point to be considered is "whether the sanction will be monetary or non-monetary, or whether there will be a mixture of the two types of sanction". The third choice to be made, according to the authors, concerns the *quantum* of the penalty. And the fourth and no less important public choice concerns the "probability of detecting and effectively punishing transgressors". This last variable is directly related to the amount of resources that the State is willing to employ to find and effectively punish those who break the law.

All four public choices mentioned by Polinsky and Shavell directly influence the expected return of the transgressor, that is, the profit that the agent takes from non-compliance with the law.

Although the four variables mentioned above are equally important, in the field of the Legislative Process, the benefit of the legislative initiative that is unconstitutional due to a defect of initiative is to the benefit of the parliamentarian himself, who stands out as the author of the idea, this time, in joint processing with the competent power, the Executive Branch.

However, it is important to note that there is no point in the Unconstitutional initiative due to a defect in form if there is no probability of appropriation of the idea by the Executive Branch, precisely because it is the competent subject to initiate certain propositions.

Thus, the capacity of a given state system to guarantee a higher or lower rate of initiative defect will depend, in principle, on the correlation between the Executive and the Legislative Branches.

In 2022, the amendment of Complementary Law No. 840, of December 23, 2011[16], which provides for the legal regime of civil servants in the Federal District, municipalities and district public foundations, is being debated in Parliament. Complementary Bill 113 of 2022, authored by the Executive Branch, is embodied in 3 (three) articles, which are:

Article 1 establishes that:

> Article 1 The following items are added to article 152 of Complementary Law No. 840, of December 23, 2011:
> VI – position in commission or function of trust of an organ of the Judiciary located in the Federal District;
> VII - executive position of professional class bodies, when elected by peers for a mandate of the federal or regional agency representing the professional class."

Article 2 establishes that:

> Article 2 The following item is added to Article 157 of Complementary Law No. 840, of December 23, 2011:
> VI – requisition from the Governor's Office.

Afterwards, article 3 follows, which provides for the clause of validity and publication of the rule. The big point is that, in the justification of the proposition, the Executive Branch argues that the aforementioned changes were declared unconstitutional by the local Court, since they originate from Amendments by Parliamentarians and not by the exclusive initiative of the Executive Branch. The following are excerpts from the project's justification:

> It should be noted that the changes proposed in article 152 of Complementary Law No. 840/2011 were the subject of Complementary Law No. 964/2020, which was declared unconstitutional by the Court of Justice of the Federal District and Territories, in the Direct Action of Unconstitutionality 0744824- 36.2020.8.07.0000, due to a defect in the initiative, since they originated from parliamentary amendments to a Complementary Bill initiated by the Executive Branch.

In other words, having verified the importance of the idea of the parliamentarians and the consequent declaration of Unconstitutionality due to a defect of form, the Governor forwarded Complementary Bill 113 of 2022 to the Legislative House, so that the legislation comes into force in the legal system with the remediation of the defect once detected by the Judiciary.

In the case under analysis, after a deliberate unconstitutionality due to a defect of initiative and the granting of the declaration of unconstitutionality by the TJDFT, the governor appropriated the rule to see the legislation generate effects in the legal system of the Federal District.

[16]http://www.fazenda.df.gov.br/aplicacoes/legislacao/legislacao/TelaSaidaDocumento.cfm?txtNumero=840&txtAno=2011&txtTipo=4&txtParte

In the field of budgeting, a well-debated tool in the Legislative Branch of the Federal District is the financial administrative decentralization programs. In several years, the CLDF has come across this type of proposal initiated by a sitting parliamentarian. The case Bill No. 260 of 2015, authored by Deputy Cristiano Araújo, deserves to be highlighted for being the first of budgetary matters initiated and appropriated by the Executive Branch – the so-called PDAF.

This proposition was initiated in 2015 by parliamentarian Cristiano Araújo, a proposal that aims to strengthen democratic management through financial autonomy in the school units of the public school network of the Federal District and its regional schools.

Entering into the content of the proposition, the Parliamentarian clarifies that financial decentralization aims to support and promote more autonomy to decentralized units – the executive bodies – to provide greater efficiency and effectiveness in their internal procedures, reducing bureaucracy and strengthening managerial public administration in the school units of the public education network of the Federal District.

In this sense, the proposition is commendable, as it institutes not only the decentralization of resources, but also the mechanisms to control the use of resources, such as the obligation of accountability.

It so happens that, by establishing that the PDAF will have a transfer of resources to the executing unit (art. 2), and defining rules regarding the amount that must be transferred (art. 5 and 6), the above-mentioned Bill restricts the freedom of the head of the Executive Branch to prepare the Budget Law. It is explained.

Under the terms of the Federal Constitution, article 165, belonging to Title VI – Taxation and Budget, Chapter II – Public Finances, Section II – Budgets, it is incumbent upon the Executive Branch to initiate budget items[17]:

The Organic Law of the Federal District – LODF, in turn, in arts. 71, § 1, V, 100, XVI, and 149, applying the principle of constitutional symmetry, **confers the same prerogatives on the Governor of the Federal District**[18]:

Thus, the proposition under examination, of parliamentary initiative**,** when deliberating on budgetary matters and respective rules on the amount to be allocated, violates the governor's private initiative established in the aforementioned provisions, since, if approved, it would oblige the Executive Branch to include budgetary appropriations for the program in question.

[17] https://www.camara.leg.br/internet/comissao/index/mista/orca/Legisla_CMO/const_fed.html
[18]http://www.fazenda.df.gov.br/aplicacoes/legislacao/legislacao/TelaSaidaDocumento.cfm?txtNumero=0&txtAno=0&txtTipo=290&txtParte=.

Table 5: Administrative and financial decentralisation programmes

Exclusive competence of the Governor	Legislation Correspondence	Attributions of initiative of the Executive Branch	
Multi-year plan, annual budget and budget guidelines	District arts. 71, § 1, V, 100, XVI and 149 of the LODF National Article 165, belonging to Title VI – Taxation and the Budget of the Federal Constitution	To send to the Legislative Chamber bills related to the multi-year plan, budget guidelines, annual budget, public debt and credit operations;	Art. 100, LODF in XVI

It should be noted that the obligation to allocate resources to the PDAF, as proposed by Bill 260 of 2015, hinders the Public Budget, which, as found in the National Treasury Fiscal Report, already has a low level of freedom:

> Since the Federal Constitution of 1988, the Brazilian public budget has been undergoing an intense process of plastering, resulting from the spread of mandatory expenditures and constitutional and legal transfers, rules for indexation of expenditures, mandatory minimum application of resources in some sectors and the creation of revenues linked to certain expenditures, which limits the State's ability to carry out public policies and reallocate resources to meet goals Tax.

Thus, by guaranteeing budgetary resources, the Bill under analysis imposes new budget rules, invades the exclusive competence of the head of the Executive Branch and restricts district budget planning, thus conflicting with the constitutional norms regarding budget pieces.

There is case law of the Federal Supreme Court (STF) in this regard, as can be seen in Direct Action of Unconstitutionality No. 1,144 (ADI No. 1,144/RS):[19]

> SUMMARY: DIRECT ACTION OF UNCONSTITUTIONALITY. LAW NO. 10.238/94 OF THE STATE OF RIO GRANDE DO SUL. INSTITUTION OF THE STATE PUBLIC LIGHTING PROGRAM, AIMED AT MUNICIPALITIES. CREATION OF A BOARD TO ADMINISTER THE PROGRAM. LAW OF PARLIAMENTARY INITIATIVE. VIOLATION OF ARTICLE 61, § 1, ITEM II, PARAGRAPH "E", OF THE CONSTITUTION OF BRAZIL.
> 1. Defect of initiative, since the bill was presented by a parliamentarian, although it deals with a typical matter of Administration.
> 2. The normative text created a new body in the state Public Administration, the Board of Directors, composed, among others, of two Secretaries of State, in addition to entailing a burden for the Member State. Affront to the provisions of article 61, § 1, item II, paragraph "e" of the Constitution of Brazil.
> 3. The normative text, by restricting the initiative for the preparation of the budget law, collides with the provisions of article 165, item III, of the 1988 Constitution.

[19] https://redir.stf.jus.br/paginadorpub/paginador.jsp?docTP=TP&docID=7100290

> 4. The declaration of unconstitutionality of articles 2 and 3 of the attacked law implies their emptying. The declaration of unconstitutionality of its other precepts is made by dragging.
> 5. Request upheld to declare the unconstitutionality of Law No. 10,238/94 of the State of Rio Grande do Sul. (Emphasis added)

In the judgment of the aforementioned ADI, the reporting judge, Justice Eros Grau, adduces in his vote that the institution of a State Public Lighting Program consisting of its own budget appropriations, by the Law of parliamentary initiative, in a manner similar to what is stated in the Bill under analysis, collides with the provisions of article 165, item III, of the Federal Constitution, which assigns to the Executive Branch the initiative of the Annual Budget Bill.

In other words, if the proposal were processed only on the initiative of the authoring parliamentarian, it would be inadmissible both by the COEF, article 64, II and § 2, of the RICLDF, as well as by the CCJ, under the terms of article 63, I of the RICLDF[20].

However, to remedy the defect of initiative, in 2017, the Executive Branch presented to the CLDF Bill 1674 of 2017, which establishes the Administrative and Financial Decentralization Program (PDAF) and provides for its application and execution in school units and in the regional schools of the public school network of the Federal District. It can be seen that the new Bill deals with the same matter that was initiated by parliamentarian Cristiano Araújo, in this case, Bill No. 260 of 2015.

After a new proposal was initiated by the Executive Branch, the CLDF granted joint processing of the projects, providing remediation of the initiative defect, a fact that resulted in Law No. 6,023, of December 18, 2017[21], authored by Deputy Cristiano Araújo and the Executive Branch, which instituted the Administrative and Financial Decentralization Program (PDAF) in the public school system of the Federal District.

The Law had repercussions in the Schools of the Federal District, as the principles of administrative, financial and pedagogical decentralization of the schools unite the actors of the school community to align the demands of the school community, with the objective of identifying local problems and proposing their perspectives for solutions.

The repercussion of the PDAF Legislation generated positive effects in the local news, let's see some publications on the subject:

> The resources of the Administrative and Financial Decentralization Program (Pdaf) are being used by the Department of Education in the renovation of six schools in Taguatinga. Secretary Leandro Cruz was at the works this week.
> One of the works visited is the construction of the Integrated Teaching Center 10 (CEI 10), which has already received R$ 500 thousand in resources. "We are facing

[20] https://www.cl.df.gov.br/documents/10162/3945302/Comiss%C3%A3o+de+Economia.pdf
[21]https://www.sinj.df.gov.br/sinj/DetalhesDeNorma.aspx?id_norma=b1020cf205f648a8b7a625c238a7d1eb

> historical problems in the Taguatinga region and the entire Federal District, changing the game in education and strengthening public, free and quality education," said Leandro Cruz.
> The regional coordinator of Education of Taguatinga, Murilo Marconi Rodrigues, reinforced: "The importance of the works in the area of education in Taguatinga is to better serve the school community as a whole, to expand the offer to several students[22]".

According to the website of the Department of Education, in 2020, an amount of R$ 210 million was reserved for the allocation of PDAF resources:

> More than R$ 210 million transformed, for the better, the structures of public schools in the Federal District in 2020. The amount is the sum of the funds from parliamentary amendments and the cash of the Department of Education destined to the Administrative and Financial Decentralization Program (Pdaf).
> For the first time, the regular installments were paid on time and, to make it better, all the districts helped to pay for the repairs. The year ended with 100% execution of the amounts committed[23].

The above case was a typical case of Appropriation of Agenda in which the Executive Branch remedies the defect of the parliamentarian's initiative, which we also call "purposeful unconstitutionality", to give technical, legal and political feasibility to the rule.

From now on, after specific clarifications on the phenomenon of appropriation, appropriation by veto and appropriation as an instrument of constitutional reorganization, we will proceed to make final considerations about the result of the study with regard to the phenomenon of appropriation.

RESULT OF THE STUDY ON THE PHENOMENON OF APPROPRIATION

Regarding the result of the study, it is reached the conception of the uncontroversial existence of the phenomenon of appropriation of the Legislative Agenda in the Legislative Power of the District. The incidence of the phenomenon consisted of the analysis of the cases indicated in the content of the study.

The tripartition of Powers aims at social harmony and Legal Security. Throughout the study, it is clear that an Unconstitutional initiative due to initiative defect does not always have the objective of legislating in the sphere of another power. This is because the Legislative Branch reflects social desires, as it represents society. The Legislative Chamber must reproduce the aspirations of the people, in various ways, even with the protocol of projects with a flagrant defect of initiative.

The article addressed a topic still unexplored in the field of the relationship between the powers of the Federal District. In the course of the research, we noticed the contribution

[22]https://jornaldebrasilia.com.br/brasilia/recursos-do-pdaf-melhoram-escolas-de-taguatinga/.
[23] https://www.educacao.df.gov.br/pdaf-39-superior-em-2020-e-o-maior-da-historia/

of parliamentarians and the interest of the Executive Branch in the approval of certain propositions. In the course of the research, it is noticeable that the Legislative Chamber must reproduce the aspirations of the people, respecting the tripartition of Powers and the competence of initiative.

Facing the study of the phenomenon brought us as triggering factors of Unconstitutionality of Laws, this time not due to the lack of knowledge of the Constitution by the Legislator, but as a form of political strategy. Unconstitutionality can be generated from several elements, even when the political agent intends to legislate for electoral purposes, whether in defense of a category of civil servants or an administrative region, a factor that can generate crises of governability or legal uncertainty.

Rogério Bastos Arantes explains that in crises of governability or legal uncertainty, the STF acts in the normative role of annulling norms of dubious constitutionality, because there is "tension between respect for the Constitution and the imperatives of government[24].

In view of this situation, it should be noted that the study of Appropriation provided an opportunity for a more cautious look at the work developed by the District Deputies, who sometimes file projects with a defect of competence to bring to light the interest of the voter in projects initiated by the government in a given legislative proposal. This factor elevates and values the activity of parliamentarians as a source of possible legislative innovation in the sphere of competence of the Executive Branch. Appropriation also presents itself as an interlocutor of the voice of society in the parliament of the Federal District, to the extent that the proposals are debated and reported in the press.

In this line of ideas, would the appropriation of the agenda be a phenomenon used to remedy deliberate unconstitutionalities, and, consequently, to politically value parliamentary action in the CLDF?

The answer to the question is of considerable relevance for the research, as it was a real verification of the deliberate unconstitutionalities, the parliamentary political action and the verification of the phenomenon of appropriation of the agenda. In this way, the verification of the phenomenon in the cases of appropriation investigated was improved, taking into account the initiatives of parliamentarians with deliberate unconstitutionalities.

In this way, the study addresses an unprecedented topic in the Legislative Branch of the Federal District and contributes to the discussion related to the phenomenon of Appropriation of the Agenda. The study indicates the relevance of the parliamentarian's activity in cases of Appropriation of the Legislative Agenda.

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THE IMPACT OF BARIATRIC SURGERY ON ORAL HEALTH

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ABSTRACT

This study explores the impact of bariatric surgery on oral health, highlighting the importance of the dental surgeon in the multidisciplinary team for the pre- and postoperative follow-up of these patients. Through a literature review, studies were analyzed that relate bariatric surgery to dental complications, such as reflux, vomiting, vitamin deficiency, xerostomia and dental erosion. The results show the vulnerability of bariatric patients to these conditions, reinforcing the need for constant dental follow-up. It is concluded that the integration of the dental surgeon in the team is essential to prevent and treat these complications, promoting a better quality of life for patients.

Keywords: Dentistry. Oral Health. Bariatric Surgery. Obesity.

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INTRODUCTION

Obesity is one of the great challenges of contemporary public health, impacting millions of people around the world. In addition to the associated risk factors, such as hypertension and diabetes, studies point to a correlation between obesity and oral health problems, including cavities and periodontal diseases[1].

These conditions are aggravated by the high consumption of foods rich in sugars and fats, common in the diet of obese individuals, as well as by the frequent use of medications to control comorbidities[2].

In this context, bariatric surgery emerges as an effective alternative for the treatment of obesity, resulting in significant weight loss and an overall improvement in the quality of life of patients[3].

This procedure, however, is not without consequences, especially with regard to oral health. The reduction in the absorption of essential nutrients can trigger conditions such as xerostomia and dental erosion, due to the higher incidence of gastroesophageal reflux, which alters the pH of saliva and favors the demineralization of tooth enamel[4].

In addition, nutritional deficiencies seen after bariatric surgery, including a lack of vitamins and minerals such as calcium and vitamin D, have direct implications for bone and dental health. Santos et al.[1] point out that the absence of these nutrients can lead to loss of bone mass, increasing the susceptibility of patients to bone fractures and carious injuries, especially in a context of low salivation.

The presence of xerostomia, or dry mouth, after surgery also contributes to an environment conducive to bacterial growth, compromising the oral microbiota and increasing the risk of cavities and other oral infections[4]. This effect is exacerbated by restricted dieting and changes in the digestive system, which often lead patients to prefer easily digestible foods such as simple carbohydrates, further increasing oral health risks[5].

Considering the complexity of oral impacts associated with bariatric surgery, the need for specialized and continuous dental follow-up becomes evident.

The integration of dentists in the multidisciplinary team that cares for bariatric patients allows for early and effective intervention to minimize dental complications[6].

The literature suggests that preventive practices, such as fluoride application and dietary counseling, are essential to preserve the oral health of these individuals[7]. Therefore, this integrative literature review seeks to investigate the repercussions of bariatric surgery on oral health and to propose strategies that promote comprehensive and preventive care.

MATERIALS AND METHODS

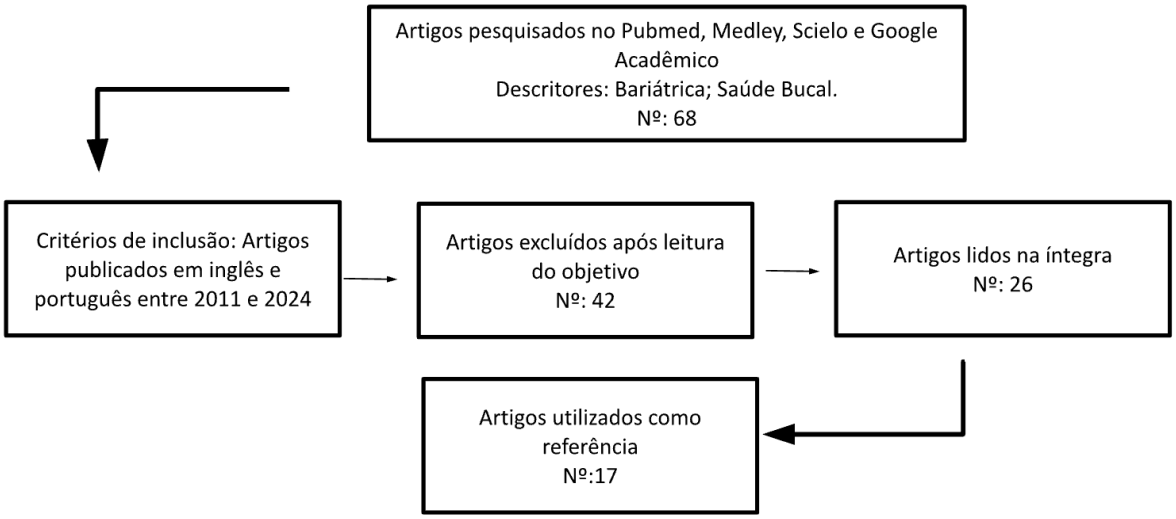
The present study aims to analyze the impact of bariatric surgery on oral health, highlighting the main dental changes and complications associated with this procedure. Specific objectives are intended to:

a) Map the main concepts related to oral health in patients undergoing bariatric surgery;
b) Identify the most common dental challenges and complications faced by these patients;
c) Explore opportunities for the implementation of new practices and protocols in pre- and postoperative dental care.

To this end, this study used a bibliographic approach to investigate the impact of bariatric surgery on oral health. The search was conducted in the PubMed, Mendeley, Scielo, and Google Scholar databases, covering the period from 2004 to 2024, with selected articles in Portuguese and English. Specific combinations of keywords such as "bariatric surgery teeth" and "bariatric effects" were used to identify studies that explored the relationships between bariatric surgery and its effects on oral health.

The selection of articles prioritized national and international journals that investigated oral complications related to bariatric surgery, including reflux, vomiting, vitamin deficiency, xerostomia, caries, and dental erosion. Chart 1 presents the flowchart of the selected articles, while Chart 2 summarizes the main findings of the reviewed studies.

Chart 01 - Flowchart for article searches



Source: The authors (2024)

Chart 02 - Summary of related articles

Authors	Objective	Conclusion
MOURA et al., 2012.	Identify the consequences of this procedure and its repercussions on oral health.	Maintaining adequate oral health in patients undergoing bariatric surgery contributes to success after the operation, safeguarding the benefits and minimizing side effects.
SANTOS et al., 2019.	Discuss the relationship of changes in the oral cavity as a result of bariatric surgery.	The review on the importance of the dentist in the pre and post was concluded.
GRECLL et al., 2011.	To evaluate oral alterations, such as dental caries, periodontal disease, tooth wear and salivary flow in bariatric patients.	Lifestyle changes after bariatric surgery and these changes can increase the severity of pre-existing dental problems. However, these changes in oral health did not influence quality of life.
BARBOSA et al., 2010.	Summary of dental manifestations in bariatric patients.	Current data indicate that recommended post-surgical meal patterns and gastric reflux may increase the risk of dental injury.
KARLSSON et al., 2018.	To survey the perceived oral health among individuals who have undergone bariatric surgery and compare the measurements with two cohorts consisting of healthy individuals with respectively equal to or below versus above a body mass index score of 30.	Perceived oral health problems appear to be more frequent among individuals who have undergone bariatric surgery compared to healthy obese and non-obese individuals.
ALDOWAH, 2022.	This cross-sectional study aims to evaluate the awareness and attitude of surgeons in relation to dental erosion in patients undergoing bariatric surgery.	General surgeons had inadequate awareness and attitude towards dental erosion in bariatric surgery patients.
YANG et al., 2021.	It evaluates the presence of dental erosion in obese patients before and after bariatric surgery using the BEWE (Basic Erosive Wear Examination) scoring system.	With sufficient education before surgery and consistent intake of vitamin and mineral supplements, significant erosive tooth wear after bariatric surgery can be prevented.
ASUNÇÃO et al., 2023.	To identify the various oral alterations in patients undergoing bariatric surgery, emphasizing the importance of integrating the dental surgeon into the multidisciplinary team.	A multidisciplinary approach for patients undergoing bariatric surgery is crucial to address all of these oral health implications, as collaboration between bariatric surgeons and dentists is essential to monitor and mitigate adverse effects on the oral cavity.
YOLAK et al., 2021.	To determine if periodontal health deteriorates after bariatric surgery.	BS can have a transient negative effect on periodontal health.
TAGHA et al., 2019.	To examine how individuals treated for obesity with gastric bypass surgery (GBP) perceived their oral health and oral health-related quality of life.	A large proportion of individuals undergoing GBP surgery reported problems with their oral health and impacts on their oral health-related quality of life, indicating the need for medical and dental staff, surgeons and general practitioners, as well as other health professionals to offer oral health promotion and prevention measures.
MACEDO et al., 2021.	The aim of this study was to observe the impact of bariatric surgery on oral health and to highlight the role of the dental surgeon in the multidisciplinary team.	The presence of the dental surgeon in the multidisciplinary team is essential in the pre and postoperative period of bariatric surgery; as well as in the prevention and treatment of oral lesions and, consequently, to improve the patient's quality of life.
MARSK et al., 2022.	The study aimed to investigate its impact on the risk of dental interventions.	Surgical intervention can have a substantial negative impact on oral health. These results imply an important role for metabolic surgery counseling for patients on preventive oral health measures.

CASTILHO et al., 2019.	To analyze the impact of bariatric surgery on gastroesophageal reflux and tooth wear.	Patients undergoing bariatric surgery show a higher prevalence of gastroesophageal reflux and tooth wear.
AZNAR et al., 2019.	To evaluate and compare the occurrence of tooth wear and tooth loss in eutrophic, morbidly obese patients undergoing Roux-en-Y gastric bypass.	Individuals who underwent Roux-en-Y gastric bypass, regardless of the period of the operation, had more tooth wear on the incisal/occlusal surfaces, and the anterior teeth were the most affected. Tooth wear was associated with age and the number of teeth lost.
SAPORITI et al., 2015.	To observe the existence of a possible relationship between obesity and the following oral diseases: caries, periodontal diseases and dental trauma.	The results are controversial among the different studies, highlighting the still existing lack of evidence supporting this association.
PATARO et al., 2016.	To compare the frequency of oral periodontopathogens and H. pylori in the mouth and stomach of obese individuals.	Obese individuals had high frequencies of periodontopathogens and H. pylori in their mouths and stomachs. Bariatric surgery has shown an inverse microbial effect in the oral and stomach environments by revealing higher oral and lower stomach bacterial frequencies.
FANDIÑO et al., 2004.	Present an update on surgical techniques, as well as clinical and psychiatric aspects involved with this procedure.	A careful clinical and psychiatric evaluation is extremely important, aiming at reducing possible postoperative complications.

Source: The authors (2024)

The data analysis was qualitative, seeking to integrate the findings on oral impacts and highlight the importance of dental follow-up in the pre- and postoperative care of bariatric patients. With this, the research followed a descriptive methodology, divided into three stages:

i. Definition of the theme and objectives;
ii. Exploratory research and comprehensive literature review;
iii. Development of work focusing on the dental effects of bariatric surgery.

RESULTS

Fandiño et al.[8] describe that the WHO (World Health Organization) classifies obesity into three grades, categorizing patients according to their BMI (Body Mass Index):

- Grade I: BMI between 30 and 34.9 kg/m²
- Grade II: BMI between 35 and 39.9 kg/m²
- Grade III: BMI above 40 kg/m²

According to Santos et al.[1], obesity is a public health issue that, in addition to being associated with several comorbidities, negatively impacts oral health. This is because there is a proven relationship between obesity and conditions such as hypertension and diabetes.

In these cases, the use of medications to control these diseases can result in side effects, such as xerostomia and caries. Santos et al.[1] also observe that the diet of obese

people is often rich in saturated fats, sugars and carbohydrates. When this diet is combined with inadequate oral hygiene, there is a greater risk of dental erosion, often associated with gastroesophageal reflux and eating disorders.

In this context, Fandiño et al.[8] indicate that patients with a BMI above 35 kg/m², who have comorbidities such as hypertension, type 2 diabetes, and sleep apnea, and who have tried other weight loss techniques without success for at least five years, are candidates for bariatric surgery. Bariatric surgery, when performed in conjunction with lifestyle changes, a balanced diet and multidisciplinary follow-up, can positively modify the picture of preexisting diseases.

Fandiño et al.[8] also state that, after bariatric surgery, patients who previously had cardiorespiratory diseases, such as dyspnea, sleep apnea, hypertension, diabetes, and lipid disorders, showed improvement in quality of life and in physical and mental health.

In a study that demonstrates the negative impact of obesity on oral health, Santos et al.[1] point out that this condition compromises the integrity of the tooth structure, affecting bone health due to the lack of vitamins and the demineralization caused by erosion, resulting from the change in the pH of saliva. In addition, nutrient deficiency and gastroesophageal reflux increase susceptibility to caries, aggravated by frequent intake of foods high in sugar.

According to WHO data presented by Aldowah[9], more than 10% of the world's population is obese. To address this global public health problem, medicine offers bariatric surgery as a resource that can provide a significant improvement in the quality of life of patients with obesity. Over the years, the demand for bariatric surgeries has gradually increased, since this procedure is currently considered one of the most effective methods in combating obesity.

Bariatric surgery can be performed by different techniques, the choice of which depends on the medical evaluation. Jesus et al.[10] describe four main types of bariatric surgery:

Sleeve Gastrectomy (VG): also known as "sleeve", it involves the removal of up to 80% of the stomach longitudinally, without deviation of the intestine, and is performed laparoscopically. This approach significantly reduces gastric capacity and promotes weight loss.

Bileopancreatic Bypass (DBP): In this method, up to 85% of the stomach is removed, combined with the diversion of part of the small intestine, resulting in less absorption of nutrients. This technique is more complex and can negatively impact the patient's nutritional status.

Adjustable Gastric Band: consists of placing a silicone ring around the stomach to limit food intake. The band can be adjusted by means of a valve that allows the addition or removal of saline, controlling the degree of restriction. It is a reversible and less invasive technique.

Roux-en-Y Gastroplasty (GYR) or Gastric Bypass: is the most widely used method, in which about 80% of the stomach is stapled, diverting food from the duodenum to the proximal jejunum. This technique reduces the capacity of the stomach and promotes early satiety, helping with calorie restriction.

In this context, it is understood that bariatric surgery is a procedure that provides significant weight loss and improvement in health conditions associated with obesity, although it can also have adverse effects on oral health. According to Aldowah[9], after surgery, many patients prefer easily digestible foods, such as simple carbohydrates, which can cause episodes of epigastric pain, hypoglycemia and flushing, known as "dumping" symptoms. This phenomenon occurs when the stomach quickly absorbs food, causing discomfort. Additionally, due to changes in the digestive system after surgery, fluid consumption may be poorly tolerated, which can reduce salivary flow and increase the risk of xerostomia and other oral complications.

Bariatric surgery can lead to significant nutritional deficiencies, such as malabsorption of iron, calcium, vitamin B12, and vitamin D, resulting in systemic effects that compromise the patient's overall and oral health[4]. These deficiencies occur due to anatomical and physiological changes in the gastrointestinal tract, which limit the body's ability to obtain essential nutrients from food.

Moura et al.[11] point out that, after surgery, vitamin supplementation becomes indispensable, as the diet alone cannot meet nutritional needs. Deficiency of vitamin B12, iron, calcium, and vitamin D3 can lead to conditions such as anemia, osteoporosis, and metabolic bone disease.

In particular, vitamin D deficiency negatively affects calcium metabolism, which is essential for maintaining bone and dental health, increasing the risk of secondary hyperparathyroidism, which elevates the production of parathyroid hormone, resulting in calcium loss in the bones and, consequently, osteoporosis. This process causes a decrease in bone density, compromising the trabecular bone and thinning the cortical bone, which increases vulnerability to fractures and dental problems[4], [11].

In addition to deficiencies in essential vitamins and minerals, bariatric surgery can trigger major oral complications, such as bone loss. The drastic reduction in body weight after the procedure causes metabolic changes and releases a greater amount of pro-

inflammatory proteins, increasing the predisposition to gum problems, such as gingivitis. This condition, characterized by inflammation, edema, redness, and bleeding gums, can progress to periodontitis if not treated properly, causing irreversible damage to the supporting tissue of the teeth, formation of periodontal pockets, and tooth mobility[4].

Malabsorption of nutrients, especially calcium — common after bariatric surgery — further aggravates the risk of bone resorption. Deficiency of this essential mineral compromises bone density, making patients more susceptible to bone fractures and tooth loss. Without periodic dental follow-up and adequate supplementation, this condition can progress to clinical conditions that require more drastic interventions, such as tooth extractions[4].

Gastric alterations, such as reflux and vomiting, carry hydrochloric acid from the stomach to the oral cavity, causing changes in the pH of saliva and promoting an acidic environment that favors tooth demineralization and erosion[4]. This environment, due to the low pH of hydrochloric acid, is harmful to the teeth, and xerostomia — or dry mouth sensation — common after surgery, aggravates the condition by compromising speech, swallowing and creating ideal conditions for bacterial proliferation that alters the oral microbiota.

Barbosa et al.[5] point out that gastroesophageal reflux induced by bariatric surgery exposes the teeth to an acid pH of approximately 1.2, which is far below the critical pH of 5.5 for the dissolution of hydroxyapatite, and results in enamel demineralization and greater vulnerability to carious lesions. In addition, malabsorption of nutrients after surgery contributes to poor oral health, presenting symptoms such as dentin hypersensitivity due to exposure of the dentin tubules.

Santos et al.[1] describe that caries is a multifactorial disease caused by the imbalance between the tooth surface and the bacterial biofilm, resulting in loss of minerals and can vary from an initial opacity to deep cavities that reach the dental pulp. Bariatric patients, who are usually recommended to eat small portions every three hours, often fail to clean their mouths between meals. This, associated with reduced salivary pH, increases oral acidity and increases enamel demineralization.

In addition, Jesus et al.[10] point out that, with guidance for a restricted diet and frequent meals — sometimes every 30 minutes — the oral health of bariatric patients can be compromised. Therefore, it is essential that they adopt low-sugar practices, perform periodic dental check-ups, and use fluoride to minimize adverse effects on oral health.

Dental erosion, characterized by the progressive loss of tooth structure, commonly affects the lingual, palatal, occlusal, and buccal surfaces of the teeth, especially the anterior

ones. An initial clinical manifestation is the opaque appearance of the enamel, which loses its shine and is accompanied by an increase in tooth sensitivity. This condition results from chemical processes caused by exposure to acids, which can have an extrinsic origin (such as acidic foods and drinks) or an intrinsic origin (such as gastroesophageal reflux). The latter often occurs in patients undergoing bariatric surgery, who may present with eating disorders and recurrent vomiting[1].

According to Macedo et al.[6], chronic regurgitation is common in patients undergoing Roux-en-Y gastric bypass, especially when a silicone ring is used to reduce the stomach, facilitating vomiting episodes. These episodes expose the oral cavity to stomach acid, increasing the risk of tooth erosion. Many patients, without adequate knowledge of the necessary care, brush their teeth immediately after vomiting, which intensifies the erosive action by spreading acidity over the tooth surface and further aggravates the demineralization of the enamel.

Studies by Jesus et al.[10] indicate that the risk of tooth wear increases two to four times in bariatric patients, due to the higher frequency of vomiting and reflux. Frequent contact of gastric acid with the teeth reduces the critical pH of the enamel, favoring the dissolution of hydroxyapatite crystals and promoting dental erosion. This repeated exposure to acid alters the mineral balance of the tooth surface and accelerates wear.

Barbosa et al.[5] observed that post-bariatric gastroesophageal reflux increases acidity in the oral cavity, altering the pH of saliva and resulting in demineralization of dental tissues. This chemical process, in which acids act as chelating agents, dissolves the minerals in the teeth and causes erosion, being aggravated by the frequency and intensity of reflux episodes.

Castilho et al.[12] highlight that bariatric patients have a higher risk of tooth wear compared to the general population, with the frequency of regurgitation and gastroesophageal reflux being determinant factors for greater susceptibility to dental erosion in these individuals. It points to a significant negative impact on the oral health of these patients, reinforcing the importance of rigorous dental monitoring and preventive interventions to minimize adverse effects on the oral cavity.

Dental follow-up plays an essential role in the care of obese patients, both pre- and postoperatively after bariatric surgery. As pointed out by Macedo et al.[6], this monitoring is essential to assess systemic conditions and eating habits that directly impact oral health. Obese patients often have risk factors that increase their vulnerability to periodontal diseases, tooth wear and problems resulting from gastroesophageal reflux, complications

that can intensify after bariatric surgery due to the metabolic and dietary changes inherent to the procedure.

DISCUSSION

This study addresses the implications of bariatric surgery on oral health, with emphasis on the physiological changes and oral risks that accompany the procedure, including xerostomia, dental erosion, bone loss, and caries. Several studies corroborate the need for regular dental follow-up to mitigate these effects, while others suggest that preventive dental intervention could minimize postoperative complications.

Xerostomia, often seen after bariatric surgery, has been associated with reduced salivary flow, which increases susceptibility to caries and erosions. According to Santos et al.[1] and Assunção et al.[4], gastroesophageal reflux and recurrent vomiting favor the maintenance of an acidic environment in the oral cavity, demineralizing the enamel and aggravating dental erosion. In contrast, Yang et al.[7] suggest that erosion can be prevented with a balanced diet and regular intake of vitamin supplements, indicating that post-surgical dietary control is a relevant measure for the preservation of oral health.

Nutrient deficiency, especially vitamins such as B12 and D, compromises the structural integrity of bones and teeth, which can lead to bone resorption and increased vulnerability to dental fractures[4],[5],[11]. Studies such as the one by Karlsson et al.[13] suggest that the impact on bone density is more pronounced in bariatric patients compared to obese non-operated patients, reinforcing the need for supplementation. Yang et al.[7] state that adequate calcium and vitamin D supplementation is essential to avoid the worsening of bone complications, but may be insufficient without specific dental follow-up.

In addition, patients who have undergone bariatric surgery often report increased caries and dentin hypersensitivity, aggravated by the post-surgical diet rich in simple carbohydrates, as pointed out by Santos et al.[1] and Castilho et al.[12]. This dietary pattern, combined with the need for frequent meals, increases the risk of cavities and periodontal diseases, since oral acidity increases and makes it difficult to maintain oral hygiene. Macedo et al.[6], on the other hand, observed that adequate dietary guidance in the postoperative period could reduce these risks.

Gastroesophageal reflux is another complication observed in the postoperative period, often exacerbated by gastric bypass techniques[10]. Castilho et al.[12] and Barbosa et al.[5] report that constant contact with gastric acid causes a progressive demineralization of the enamel, resulting in greater tooth wear. On the other hand, Marsk et al. [14] highlight that

preventive measures, such as avoiding brushing teeth immediately after reflux episodes, can minimize damage, suggesting that dental guidance is essential in this context.

Dental erosion has been widely discussed in studies, and authors such as Yolak et al.[15] state that bariatric surgery can amplify the severity of this problem compared to patients who have not undergone the procedure. However, Barbosa et al.[5] argue that erosion is controllable with strict preventive care and adequate dental follow-up. This difference in approach reinforces the importance of an individualized preventive protocol for each patient.

The integration of the dental surgeon in the multidisciplinary team has been pointed out as essential for the success of dental treatment in the context of bariatric surgery. Macedo et al.[6] and Assunção et al.[4] suggest that without this continuous follow-up, patients face a substantial risk of oral complications that can compromise overall health. This consensus highlights the need for collaborative practices between the fields of dentistry and medicine to ensure the integral well-being of the patient.

CONCLUSION

It is concluded that bariatric surgery, although an effective solution for obesity, brings significant challenges to oral health, highlighting the importance of preventive and continuous dental follow-up. The integration of the dental surgeon in the multidisciplinary team is essential to identify and mitigate complications such as xerostomia, bone loss, and dental erosion, promoting a better quality of life for patients.

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TO AGGRESSIONS, WE (RE)EXIST WITH THE ENVIRONMENTAL CULTURE OF *OUR AMERICA*

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ABSTRACT

This text presents the results of the research entitled: "Environmental culture in rural education: landscape, history and traditional knowledge of the countryside territory", carried out between 2016 and 2019, where it was possible to research the environmental culture of the northwest of São Paulo – SP, from the point of view of its sustainable development. The general objectives of the research were to investigate the landscape, history and traditional knowledge of the countryside territory and as specific objectives, the education of young people and adults (EJA). As for the theoretical-methodological framework, work projects were used. The results were the articulation of knowledge with the different areas of knowledge, enabling the experience of new values, the triggering of collective actions, as well as the increase in schooling associated with social and professional qualification, enabling new learning.

Keywords: Environmental Culture. Rural Education. Traditional Knowledge. Countryside Territory.

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INTRODUCTION

We warned that the impact of environmental problems on human health and the maintenance of life on planet Earth would reach an "Overload" (Cf. Earth Overshoot, 2020). Authors, from different perspectives, have denounced the dynamics of the contemporary system in the following way: "terricide" (Marcuse, 1973), "you will not see any country" (Brandão, 1981), "the great poor Mother Earth" (Boff, 2019 and 1993), "destructive progress" (Löwy, 2005), "socio-ecological metabolism" (Clark and Foster, 2006), "environmental culture" (Villela, 2016a), "health in the soil" (Pinheiro, 2018), etc. These authors pointed to the unlimited tendency of production for production's sake and the contradiction between the limited character of the Earth's resources and the willingness to take capitalist relations to the four corners of the planet.

The pandemic of the new Coronavirus or COVID-19 (Cf. Werneck and Carvalho, 2020), with its impacts on the various countries, is a new alert for the radical change that needs to be made in the "sociometabolic model of capital" (Mészáros, 2002). The experimentation with the "absolute limits of capital" has a gigantic impact on the environment, increasing, in the social sphere, inequality between classes, extreme poverty, lack of access to health and education services and, in the environmental sphere, pollution of air, water and land, acid rain, global warming and climate change. among other environmental problems (Cf. Mészáros, 2002).

Faced with the problem of human survival on a planetary scale, the challenge is set to rethink new relations of production, discuss issues related to ecology, agroecology, agricultural cooperation, etc., as a form of resistance and construction of a new societal reality. (Cf. Foster, 2005). In this sense, we present some results of the research entitled: "Environmental culture in rural education: landscape, history and traditional knowledge of the countryside territory", carried out between 2016 and 2019 (Cf. Villela, 2016a). The general objectives of the research were to investigate the landscape, history and traditional knowledge of the countryside territory and as specific objectives, the education of young people and adults (hereinafter, EJA). The results were the articulation of knowledge with the different areas of knowledge, enabling the experience of new values, the triggering of collective actions, as well as the increase in schooling associated with social and professional qualification, enabling new learning.

THE ENVIRONMENTAL CULTURE OF *NUESTRA* AMÉRICA

From a theoretical-methodological point of view, this project is based on 4 main axes, which are: (1) Environmental Culture; (2) Work Projects; (3) Youth and Adult

Education (EJA) and (4) New Technologies Applied to Education. One of the motivations of this research is the need to understand the "environmental culture" of individuals and community groups in the northwest of São Paulo – SP, with the possibility of sustainable development. The relations between man-society-nature condition and are conditioned by the "environmental culture", from which one must start in order to understand the consciousness of individuals and community groups. Changes in attitudes can only be achieved with a careful investigation of the "environmental culture" of communities, based on an environmentalist training strategy.

The concept of "environmental culture" is taken up again from Irizarri (2010), among other authors. For the author, "environmental culture" is a "system of knowledge, experiences, motivations, values, attitudes related to the environment". In the concept of "environmental culture" are implicit beliefs and ideas that become a regular form of thought and practical action in social activity. In this concept, the forms of social consciousness are intrinsically linked: political, ethical, religious, aesthetic, legal, philosophical, and scientific. According to Irizarri (2010), in order to develop "environmental culture", one must start from the formation of a deep awareness in individuals and community groups and reach "environmental awareness".

One of the first intellectuals to develop the concept of "environmental culture" was Fernando Salinas (1930-1992). The ideas of this pedagogue were researched in our postdoctoral work (Cf. Villela, 2009-2010). The author defines "environmental culture" as the "maximum physical representation of the social and economic advances of a developing country", where popular traditions, participation and professional knowledge are related. According to the author,

> *The environment is the unit of society, the individual and the environment. Life is developed in an environmental system that encompasses the past, the present and the future through the background, reality and imagination. The environmental culture is a synthesis of the conditions of the natural environment and the disdesigned landscape, the urban complexes and spaces for public use, streets, squares and parks; buildings of different uses; furniture, equipment, clothing, body culture in all its aspects; gastronomy, objects of use and contemplation -utilitarian or decorative-, sound works, painting, sculpture, graphic design, industrial or artisanal design, the chromatic set, photography and typography, which are found in the spaces of daily life and their visual or audiovisual images are distributed by television, cinema, el video o las publicaciones; in all its relations between themselves and with whom the experiment was in a moment of history and in a specific social, economic, political, ecological and cultural environment* [...]*element.* (SALINAS, 1988, apud PÉREZ-RUBIO, 1994, p. 237-238).

From the end of the twentieth century to the threshold of the twenty-first, the concept of "environmental culture" has been developed by several researchers, among them: Salinas (1988 and 1992), Cárdenas (2002), Pérez-Rubio (1994 and 2003), Cruz (2002),

Quesada (2002), Cruz, Romero and Hernández (2007) and Bery (2009), among others. Of the conceptions analyzed, I highlight the definition of Quesada (2002), where environmental culture encompasses the totality of the way of life of the members of a society and expresses the complex network of relationships that are established between society and its environment. Quesada (2002) defines "environmental culture" as follows:

> *Dialectical process that reflects the quality of life of communities, the degree and expression of the domain of the communitarians of their conditions of existence that is manifested through the symbols, the meanings inherited, experienced and created by the subjects in the iteration and relationship with other communarians in their natural and social environment.* (QUESADA, 2002, p. 24).

As Bery (2009) demonstrates, the "environmental culture" is part of the general integral culture of the population, its objective is to achieve harmony in the relations between man, society, nature and to contribute to the full development of man's potential and his enrichment as a social being, consequently to the elevation of his quality of life. The concept of "environmental culture" is of enormous importance since it contributes to the formation of a conception of the world in which the individual analyzes in a deep, real and integral way, the complex processes, events and phenomena that take place in the infinite material world and the interaction between them. Consequently, human beings are able to assess the scope and consequences of their transformative activity on the environment, not only for the present generation, but also for future generations.

Also according to Bery (2009), the idea of "environmental culture" reflects the ethical model of the relations between man and the rest of the components of the environment of which he is an indissoluble part, between the community and its surroundings, through culture. The "culture of the environment" allows the establishment of positive relationships of social coexistence with the natural landscape, indispensable for the success of ecological sustainability and which ensures the permanence and development of life on our planet.

In summary, for the authors cited, the mission of culture in the environmental area is associated with human development and aims to build a new and definitive social and individual responsibility for human sustainability. Culture must enhance an ethic of sustainability "from", "with" and "for" the community, where the relationship with the rest of the components of the environment is essential. The following is a watercolor made by Fernando Salinas, in the fifties of the last century, which illustrates the idea of "Environmental Culture" of *Nuestra* América (Cf. Velázquez, 2018).

Figure 1 - *Architecture is an impulse*. Source: Velázquez (2018).



From a methodological point of view, the possibilities of working with projects were chosen, due to the wealth of material accumulated on rural communities (Cf. MST, 2019). Among the various options for working with projects, the following stand out: "teaching projects", "work projects", "learning projects", "generating themes", "methodology of the thematic complex", among others (Cf. Hernández 1998). In this way, the methodologies of working with the project allow greater flexibility of strategies to the teacher and greater freedom to the student, enabling learning that actually corresponds to the real needs of the community.

According to Silva (1991, p. 30-32), the term "project", as we use it today, has its indisputable origin in the following Latin words: *jactare* (verb, meaning: to throw, to throw); *pro* (preposition, meaning: in front of, in favor of, instead of, etc.); *projectio*, *projectionis* (noun, meaning: action of throwing forward, stretching); *projectus* (adjective, meaning: thrown forward, prominent, prominent); *projicere* (verb, meaning: to throw forward). For the author, it is easy to verify that this is the common origin of the terms equivalent to project in practically all Western languages: "projeto" corresponds to *proyecto* in Spanish, *progettoem* in Italian, *projet* in French, *project* in English, *projekt* in German, etc.

Still for the author, like countless other words in philosophical and scientific terminology, the word "project" assumes practically the same form and meaning in a very broad scope. It is known, however, that in the past, the Portuguese language preferentially used other denominations, such as "risco", "moth", etc., with semantic richness close to that of the Italian *risico* or *rischio* , which, in turn, derives from the classical Arabic *rizq* ("That which is faced with providence"). The term refers to the proximity of a possible danger,

damage or threat, but also of opportunity. (Cf. SILVA, 1991). Next, we will distinguish the concept of work projects, from the point of view of schooling.

At the end of the 90s, when questioning the pedagogical practices that have been guiding teaching, in the field of debate of dialectical conceptions of education, with strong affinities with historical-cultural psychology, Gasparin (2002) proposed to the educator a way of teaching and learning, interconnecting the student's social practice with theory, in order to enable teacher training and that, To the extent possible, respond to the needs of the students. The pedagogue defends a practice of research and action based on the theoretical-methodological assumptions of Saviani's Historical-Critical Pedagogy, seeking to point out the contributions of the dialectical method in the elaboration and execution of work projects. The didactic process, proposed by Gasparin (2002), was elaborated from Saviani (2012). For a practical example of this proposal, we suggest reading Villela (2018).

Allied to this methodology, the EJA experience developed within the scope of the "Unesp Project for Youth and Adult Education" (hereinafter, Peja - Unesp) was used. Peja - Unesp was created at Unesp in 2000, at the time, linked to the Unesp Program for Community Social Integration, of the Dean of University Extension - PROEX, with the objective of establishing a public policy for the education of young people and adults, seeking local community partnerships and aiming at the contribution of resources for the formation of critical and participatory citizens/readers, as well as that of teachers with the vision of "popular educators". Currently, PEJA is developed in eight Unesp campuses (Araçatuba, Araraquara, Assis, Bauru, Marília, Presidente Prudente, Rio Claro and São José do Rio Preto) with human and material resources from the Dean of University Extension – PROEX for the development of its work (Cf. Villela, 2016b and Villela et al., 2007).

In addition to these two methodological experiences (Work Projects and EJA), the one developed in Villela (2014) was used, specifically the project: Virtual Center for Studies and Cultures of the Rural World. This tool was developed as a didactic resource and tool in the teaching of sociology for students of the pedagogy course at Unesp in São José do Rio Preto (SP), hereinafter Rio Preto, and later extended to schools that expressed interest in developing topics in the area of Human Sciences and their Technologies. The project uses the blog methodology, a frequently updated website, through which the contents appear in reverse chronological order. They can contain texts, images, audios, videos and animations. This methodology enables the dissemination of the knowledge produced by the university on the internet for free. The community relates through content, enabling the

transmission of information, making the web a space for reading, writing, participation and reflection.

The class blog, for example, was used as a tool of Peja - Rio Preto in one of the works developed at the Center for the Coexistence of the Elderly, hereinafter CCI. At the CCI's Peja – Rio Preto, the central focus was the development of literacy/writing practices in the context of digital technology (Cf. Komesu; Tenani, 2010). In this sense, young people, adults and the elderly were able to acquire basic computer knowledge (*word*, *internet*, *facebook*, *blogs*, etc.).[2] In addition to the development of literacy/writing practices in the context of digital technology, the objectives of Peja - Unesp are: to prepare students to: read and write in the Mother Tongue (ML); to employ, with discernment, the decimal numeral system and the fundamental operations in the resolution of day-to-day problems; to know the rights, duties and laws that govern the world of work; to develop notions of physical health, psychological and mental; discuss issues related to the preservation of the environment. The work of Peja – Rio Preto at the CCI is configured as a partnership between Unesp and the Municipal Secretariat of Social Assistance of Rio Preto[3] and has as general objectives to insert the elderly population in the[4] process of digital inclusion, considering the needs imposed by a technological society. We move on to the results and the discussion.

RESULTS AND DISCUSSION

Several extension courses were organized between 2016 and 2019 where the processes described above were experienced. The courses served Ibilce/Unesp students and the community in general, who wished to acquire specific training in the area of rural education, especially to develop work and/or research with the agroecology, agroforestry and soil health interface. Some topics of the course were: 1. Environmental Culture (Cf. Villela, 2016a); 2. Soil Health (Blanco, 2020, 2017 and 2013); Agroforestry (Costa et al., 2014) and 3. Sustainable Agriculture (Nagai and Kishimoto, 2008). A first elaboration of the results of this discussion can be recovered in Villela (2018). Figure 1 follows with some elements of the praxis of extension courses: phosphite, picumã, mineral mixtures, glass water, biofertilizers and Pfeiffer's chromatography (Cf. Blanco, 2017).

[2] For the development of themes related to internetese, the project had the collaboration of professors Drs. Fabiana Komesu and Luciani Tenani, both from the Department of Linguistic and Literary Studies.
[3] This partnership was signed through an "addendum" to the agreement in force between Unesp and the Municipality of Rio Preto, developed through the Peja – Rio Preto team, starting in 2013.
[4] The population is registered at the Social Assistance Reference Center (CRASS) to be selected to attend the CCI – Rio Preto, located at Av. Philadelpho Manoel Gouveia Neto, 785, Vila Novaes, north of the city.

Figure 2 – Folder with images of the praxis of extension courses



Source: Blanco (2017).

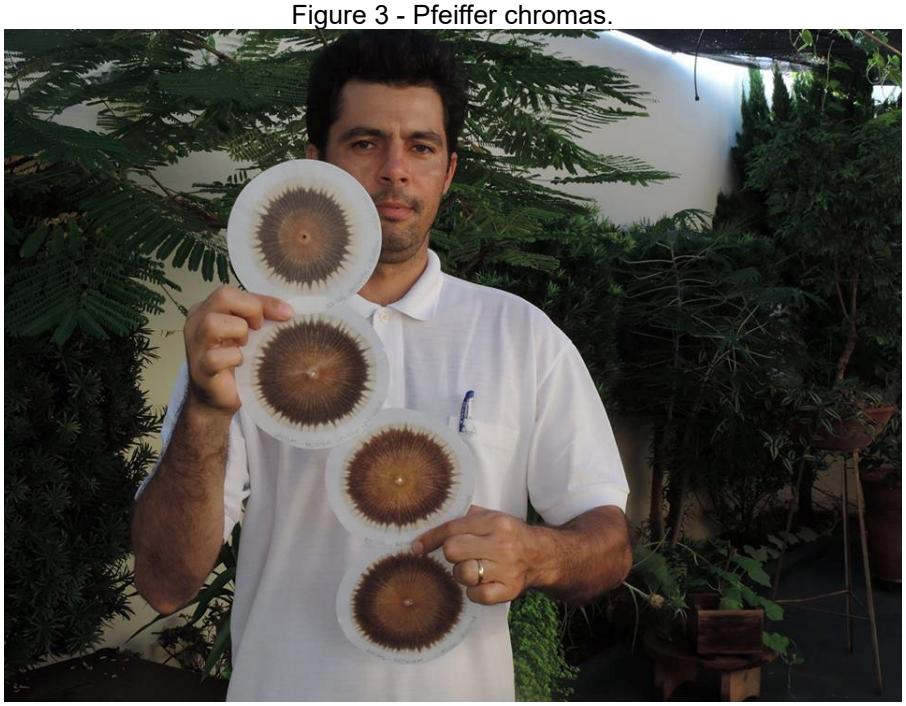
Among the various "praxis" of this educational process, we highlight the elaboration of the "Pfeiffer Chromatography" used to diagnose the state of soil health (Cf. Blanco, 2017). Chromatography, from the Greek *chroma*, means "color" and *graphein*, "to write". It is the collective term for a set of laboratory techniques for the separation of mixtures. Chromatography was invented by the Italian biologist, son of Russian immigrants, Tswett in 1910 and has become a sophisticated segment of soil science (BLANCO, 2017). The author shows us how to elaborate chromatography:

> What is a chroma? It is much more than a biochemical analysis of the soil. It is a hologram (each part contains the information of the whole) of the effects of the Sun on the biogeochemical cycles metabolized in living soil. Its circular harmony (halo) indicates the amount of carbon in the soil and the glory (optical phenomenon) of integration with biodiversity and soil life as in a kaleidoscope. The greater the harmony, the greater and constant is the transformation and fluidity of energy, without losses in this analyzed soil. In the microcosm of the chromatogram we see the struggle between fusion and gravity, where life (fusion) is the animation of minerals, a force against gravity, according to Vernadsky. The simpler and lifeless, the substances remain closer to the gravitational center of the chromatogram (as in the case of metals/minerals). The more complex and vital the substances, the closer to the surface or melting edge of the chromatogram (BLANCO, 2017).

According to Blanco (2017), the chromatogram is an integral soil analysis, which allows the diagnosis and accompanies its treatment in a self-interpretative way, made by the farmer himself/herself. The most accurate and safe analysis in living beings is genomics

(DNA). Pfeiffer's chromatography is more sophisticated, because in addition to identifying DNA, it incorporates proteomics, expression of gene proteins, according to the environment. Quickly, easily and cheaply, it allows the farmer himself to read the situation of his soil, through time-space in the same way that a father follows the growth, development, physical and mental health status of the child, with the ability to intervene, when necessary (BLANCO, 2017).

Figure 3 - Pfeiffer chromas.



Source: Blanco, 2020.

What is looked for in a chromatogram? For Branco (2017), the reading of life, of the quality of life of the soil, at a given moment is sought. This is easily visualized in a chromatogram, through the harmony of colors and design between all the different mineral, organic, energetic, and electromagnetic components of the soil. Thus, it is possible to know if a certain mineral is in harmony with organic matter, pH, biodiversity of microorganisms or degree of oxidation/reduction of enzymes, vitamins and proteins and how the situation found to achieve this goal can be positively changed (BLANCO, 2017).

It is worth remembering, according to the author, that the analysis will depend on the empirical learning of the nature of those who are carrying it out, the farmer himself and his family. The chromatogram is a tomography of the soil and plant that allows us to know: (1) what is the management of the soil water content and (2) what is the management of minerals, adventitious plants and others. In other words, it allows the perfect diagnosis of soil health and the evaluation of the quality of the food produced in it (BLANCO, 2017).

Next, in Chart 2, we present a comparison between criollo and transgenic corn chromas. Clockwise, (1) ears of Creole and transgenic corn; (2) Creole corn, with minimal soil preparation with liming, rock flour and biofertilizers applied during its development, in addition to the use of the Milpa system (intercropping of corn, cowpeas and pumpkin); (3) the same seed as the previous Creole corn, cultivated by producer Aguinaldo (São Pedro/SP). The production system used was the conventional one.

According to Naves (2020), the producer suspects that the corn was contaminated with transgenic corn pollen. The "Chroma" reveals this possibility; (4) counter-proof, from the same previous Chroma; (5) transgenic corn, identified as 2B63PW; (6) Conventional fresh corn from Market. In these cereal chromatograms the difference between a Creole corn and a transgenic corn is evident: the DNA connections: cytosine, guanine, adenosine, seem to be "failed"; proving that the industry has changed the corn protein, according to Naves (2020). On the health hazards of transgenic corn, see Villela (2014).

Figure 4 - Creole and Transgenic Corn Chromates





Source: Blanco (2020).

The extension courses held between 2016 and 2019 were moments in the development of work projects, based on the didactics of historical-critical pedagogy, proposed by Gasparin (2002). According to this theoretical-methodological perspective, the starting point concerns the level of real development of the student, the initial social practice; the second moment constitutes the link between social practice and instrumentalization, that is, problematization; the third is related to didactic-pedagogical actions for learning, called instrumentalization; the fourth, the elaborated expression of the new way of understanding social practice, catharsis; and the fifth and last, to the current level of development of the student, that is, the final social practice.

The writing of course participants from 2016 to 2019, which is presented in Chart 3, expresses the passage from a chaotic view of reality to the scientific knowledge provided by the project, where reality is inferred through new ways of thinking (Other posts can be found at: Villela, 2014). It is the manifestation of the intellectual improvement of the participants, who, in a continuous way, dialectically challenge themselves to transform the contradiction between the old (initial social practice) and the new (final social practice), according to Gasparin (2002). The writing present in the posts represents one of the points of arrival of the project's pedagogical process, proving that the process of counter-hegemony opens spaces of struggle and displacements and enables the reversal of forms of material and immaterial domination (Cf. Moraes, 2002). The following are the posts of the course participants (transcribed exactly as in the original).

Chart 1 - Posts of the participants of the extension courses (2016-2019)

Participant F. 17/07/03 13:22 The Caipira Territory course promoted by Unesp is an invaluable wealth for knowledge. In module 1, the importance and practice of making fermented products was highlighted: kobashi, biofertilizer, microorganism silo, MS.

These practices showed how easy it is for agroecological producers to be independent of chemical inputs, not to mention the complete health they will make available to their soil, for planting and also for their animals. Wonderful lectures and explanations of the fundamentals of agroecology, given by mentor Oliver, support the practices developed in a divine way. Not to mention the very rich explanation given by Prof. Fábio, about the socio/historical/cultural wealth of rural women. In short, everything beautiful and wonderful, of resounding value for our agroecological consciousness, making us plant our foot with all our strength in this attitude of preserving the health of the soil.
Participant F. 17/07/03 18:18 In module 2 of the Soil Health course we learned a lot of wonderful things: hot and cold syrups, phosphite, biochar. As always, these are very simple and inexpensive recipes that can lead to efficient and healthy agroecological production. The practice of chromatography certainly raised the level of the course even more, showing, with simplicity and art, how to design the health of the soil and also of food. Courses like this should be a constant in our region and around the world, as it clarifies well the duty of awareness we have towards the soil, father and mother of all living beings. "HEALTHY SOIL, HEALTHY PEOPLE. SICK SOIL, SICK PEOPLE"
Participant L. 17/07/12 13:58 In this second part of the Caipira Territory Course – Soil Health, we explore in a practical way the Pfeiffer Chromatography (or circular chromatography) that allows the farmer to have autonomy with an integral view of the soil of the property, also analyzing the evolution of the agroecological management that is being done, following the successive stages with measurement of results and progress. Prepared Mineral Syrups have a double function. They act to nourish and also, in emergency cases, can act on the symptoms/vectors of diseases. They allow self-sufficiency in relation to the industry since most of the inputs are easily accessible and others can come from the property or the region. The joint use of the techniques learned can give the farmer a great empowerment since the revitalized and remineralized soil will certainly reciprocate with healthy, geobiodiverse, nutritious and abundant food.
Participant M. 17/07/04 14:06 In this second module of practices, we had a lot of exchange of information and knowledge about what living soil and energy are. We enter into the flow of signals and the reading of these signals, to intervene in a way that respects the transformation processes and biological cycles. Using the recipes of syrups and mineral compounds, we cook and feed the land, for the control, rebalancing and health of crops and soil. The handling, collection, observation of matter in transformation or stagnant, was fixed, documented in the time/space of the paper cut in a circle. Chromatography, starting point and reading for future actions and evaluations of the practices employed. The door was opened for the formation of a network for the exchange of knowledge and experiences. Gratitude.
Participant J. 12/16/19 9:10 AM Another inspiring meeting, where we learned much more than techniques focused on corn cultivation, but rather studies and experiences of Oliver Blanco and researchers on management in organic agriculture. Despite being a producer and professional in the area, I was surprised by several "novelties" such as: chromatography applied to soils, plants and composts; principles 3 M and 4M; siderophores, biochar, alternative pelleting for unconventional seeds, phosphite formulation, among others. Oliver's experience and humility made me dive into the historical past of corn, going through discoveries of techniques, importance of an organic food for an organism, impacts of transgenics, theory of trophobiosis and so many other fantastic things on our subject. We need, as we are sure, more time with Oliver to try to "suck" in every good way, more of his experiences and bring closer to our region so "needy" essential information for the maintenance and expansion of our family and organic agriculture.

Source: Villela (2014).

As we can observe in the writing of the participants above, the theoretical-methodological option from the perspective of historical-critical pedagogy contributes to the valorization of scientific-cultural knowledge, the basis for the transformation of reality. As Saviani (2012) points out, the appropriation of knowledge historically produced by humanity derives from the process of mediation, as a result of people's relationships with each other and with culture. The participants' writing indicates the overcoming of common sense towards philosophical consciousness. The writing makes it clear that the student recognizes elements of his situation, pointing out the need to intervene in reality, transforming it in the sense of expanding freedom, communication and collaboration among men.

The merit of the reorganization of the initial social practices of the course participants lies in the didactic process of historical-critical pedagogy, whose method of investigation and elaboration of scientific knowledge is based on the unveiling of Marx's labor theory of value. This theoretical-methodological contribution contributes to new teaching and learning relationships and helps both in the training of students and teachers. A work project in this theoretical-methodological perspective is an excellent didactic instrument, in view of the dialectical process present in its teaching and learning methodology.

FINAL CONSIDERATIONS

We can highlight as the main achievements of this work: (1) survey of research material through hypertexts produced, in the environment of the class blog, by the participants of the project, in order to provide qualitative data for research interested in the description and understanding of the centrality of the value of labor; (2) the development of possibilities of actions, as demonstrated by the participants' writing, for productive inclusion in the countryside territory, according to a work project from the perspective of historical-critical pedagogy; (3) the consolidation of socioeconomic networks of family farming within rural territories, especially in the northwest region of São Paulo, considering the practices of solidarity economy; (4) the strengthening of economic organizations, contributing to the productive inclusion and sustainable and solidary development of the country territory; (5) practical development of the idea of "environmental culture", proposed by Salinas (1988), among others, enabling new environmental designs for *Nuestra* América, according to Pérez-Rubio (2003).

Finally, it is worth highlighting (6) the contribution to the production and systematization of innovative EJA methodologies in rural education; (7) the improvement of pedagogical theories and educational experiences, with regard to Information and Communication Technologies (ICTs) and other technological tools in rural education. The

project was developed in an EJA space, according to Brasil (2000), where this environment encompasses the entire learning process, formal or informal, in which people considered adults by society develop their skills, enrich their knowledge and improve their technical and professional qualifications, directing them to the satisfaction of their needs and those of their society. In the EJA environment, the real situations should constitute the core of the organization of the pedagogical proposal to be developed. To this end, the challenge of EJA is to integrate work and the improvement of schooling into its curricular organization. Based on these ideas, the "occupational arc" worked on was family rural production and social and professional qualification. The result of this work is the articulation of the knowledge of the students with the different areas of knowledge, enabling the experience of new values, the triggering of collective actions, as well as the increase of schooling associated with social and professional qualification, enabling new learning for the students in the country territory.

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PRESENTATION, ANALYSIS AND VALIDATION OF A RESEARCH INSTRUMENT TO SURVEY THE HABITS OF USE OF DERMOCOSMETICS

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ABSTRACT

The objective of the present study was to present a reliable instrument for conducting survey-type research on the knowledge, use and habits of the interviewees in relation to dermocosmetics, consultations with dermatologists and the interviewees' concepts about the necessary skin care. To this end, a questionnaire was prepared, approved by the research ethics committee and applied to 199 people, so that the necessary statistical reliability tests could be carried out with the results. The results obtained showed that the questionnaire elaborated can be considered reliable and thus the present study presents this new research tool, as no questionnaire for this purpose was found ready and validated in the recent literature that was researched. It should be noted that it is very important to know people's behaviors, attitudes, opinions and preferences so that you can act consciously in the dermatology market, seeking actions that can improve people's quality of life, prevent diseases and make the population aware of the behaviors that must be modified or maintained in certain situations, because knowing the opinions and behavior of the client is essential in any area of activity.

Keywords: Dermatology. Medicine. Poll Survey.

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INTRODUCTION

Evaluating the reliability of a questionnaire brings relevance to the answers obtained, considering that every measurement is imperfect and will have a certain amount of errors associated, these errors can be both random and systematic errors; There are several methodologies that can be used for the evaluation of research instruments, indicating the percentage of possibility of the existence of such errors, and the questionnaires can be analyzed both question by question; as a whole or even in parts. According to what can be seen from the results of these evaluations, it is possible to find some question that is indicated as a possible focus of reliability reduction, so this analysis can only validate a questionnaire, as well as indicate points of improvement in the instrument that can be modified until its complete validation based on the values of reliability indices (GASPAR; SHIMOYA, 2017 and BIKOS, 2024).

Among the methodologies that can be used to analyze the reliability of questionnaires, we can mention the lambdas, alpha and omega coefficients, developed to perform different types of calculations proposed by different scholars, namely: Guttman (1945); Cronbach (1951) and McDonald, (1999), such indices are widely used and explained in some more recent articles, such as that of Freitas and Rodrigues, (2005); Gaspar and Shimoya (2017), Bikos, (2024) among other authors.

All these coefficients range from 0 to 1, where values closer to 1 represent better reliability, since a value of 0.75 would mean that 75% of the variance in the answers was due to the reality of normal variation among people, while the rest of the variation was due to some error, which in this case would total 25% (NAJERA CATALAN, 2019). According to Bikos (2024), for one-dimensional measurements, values above 0.80 indicate satisfactory reliability, while for multidimensional measurements with well-defined dimensions, values above 0.65 would already be satisfactory, from which it can be concluded that errors between 20 and 35% could be considered acceptable depending on the situation. Superior errors can already be investigated and adjustments to the instrument can be made, if possible, with a view to reducing incorrect answers, which in turn tend to reduce the reliability of the information obtained and instill errors in the conclusions of the studies, based on the answers given.

Another method of assessing reliability, also quite old, is the one described by Callender, John and Osburn (1979), called Split-Half Reliability, or cross-validation (COELHO JUNIOR, 2023), such a technique is a statistical methodology used to evaluate the internal consistency of a test or measurement instrument. This approach involves dividing a set of items into two halves, allowing researchers to compare the results obtained

in each of them. The central idea is that if a test is reliable, the two halves should produce similar results, indicating that the instrument consistently measures what it sets out to measure.

The objective of the present study was the construction, application, after approval by the ethics committee and validation through reliability analysis of the constructed instrument, based on the answers obtained regarding the behavior of young students in relation to dermocosmetics and their analysis through the presentation of the values of reliability coefficients and comparison of the answers given in two groups drawn for cross-validation, with a view to comparing and validating the directions of the answers obtained in these two groups.

METHODOLOGY

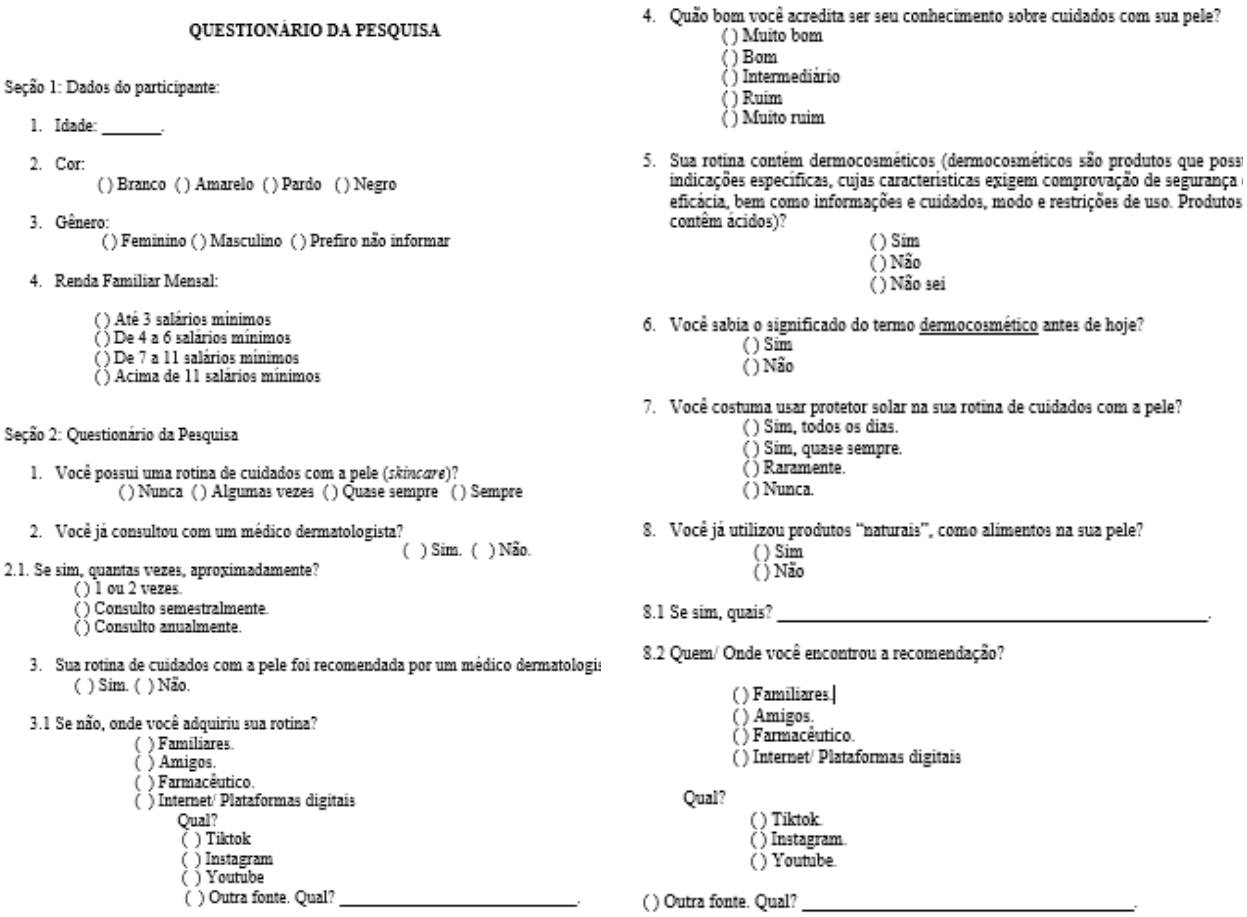
For the elaboration of the research, first a questionnaire on the knowledge, customs and use of dermocosmetics was constructed, then the questionnaire was submitted to a pre-test by eight students of the medical course at FAG to adjust the understanding of the questions. Subsequently, the instrument was reviewed by two specialists, one from the area of dermatology and the other from the area of statistics, for the last adjustments, before being submitted to the approval of the research ethics committee of the Assis Gurgacz Faculty – FAG of Cascavel-PR, where the project was approved under number 83135624.7.0000.5219. After approval, the signatures of the participants in the ICF were collected and the answers of 199 interviewees were used to prepare this study, who also delivered the Consent Forms of their parents/guardians, as they were adolescents between 15 and 17 years old, who were the target objects of the study approved by the Ethics Committee. It should be noted that the final questionnaire (Figure 1) is not specific for this age and can be used in research on the use of dermocosmetics in any age group and for any location within Brazil, Portugal and places where Portuguese is spoken, as it is a questionnaire prepared in Portuguese.

The students were approached in two schools, one public and one private, both in the municipality of Cascavel-PR, and the questionnaires were provided printed and answered on paper. Subsequently, the answers obtained were all transformed into numbers, and the answers that were received on a nominal scale were also transferred to a numerical scale, using integers namely 0,1,2,3 and so on, and typed in a Microsoft Excel® spreadsheet to enable statistical analyses.

Matthiensen (2011) explains that the methodologies that use questionnaires to collect data are widely recognized, in addition to being a practical and economical method

that can be applied to the most varied areas of research, and in general the tool can be applied to acquire information about people's behaviors, attitudes, opinions and preferences. However, for the data collected to be relevant, it is important that the instrument used has been evaluated and is really capable of inferring or measuring what is sought in the research. The author explains that reliability analyses should be used to ensure the quality of the questionnaires to be applied.

Figure 1. Image of the questionnaire prepared and applied to the students.



QUESTIONÁRIO DA PESQUISA

Seção 1: Dados do participante:

1. Idade: _____.
2. Cor:
   ( ) Branco ( ) Amarelo ( ) Pardo ( ) Negro
3. Gênero:
   ( ) Feminino ( ) Masculino ( ) Prefiro não informar
4. Renda Familiar Mensal:
   ( ) Até 3 salários mínimos
   ( ) De 4 a 6 salários mínimos
   ( ) De 7 a 11 salários mínimos
   ( ) Acima de 11 salários mínimos

Seção 2: Questionário da Pesquisa

1. Você possui uma rotina de cuidados com a pele (*skincare*)?
   ( ) Nunca ( ) Algumas vezes ( ) Quase sempre ( ) Sempre
2. Você já consultou com um médico dermatologista?
   ( ) Sim. ( ) Não.

2.1. Se sim, quantas vezes, aproximadamente?
   ( ) 1 ou 2 vezes.
   ( ) Consulto semestralmente.
   ( ) Consulto anualmente.

3. Sua rotina de cuidados com a pele foi recomendada por um médico dermatologi
   ( ) Sim. ( ) Não.

3.1 Se não, onde você adquiriu sua rotina?
   ( ) Familiares.
   ( ) Amigos.
   ( ) Farmacêutico.
   ( ) Internet/ Plataformas digitais
   Qual?
   ( ) Tiktok
   ( ) Instagram
   ( ) Youtube
   ( ) Outra fonte. Qual? _____.

4. Quão bom você acredita ser seu conhecimento sobre cuidados com sua pele?
   ( ) Muito bom
   ( ) Bom
   ( ) Intermediário
   ( ) Ruim
   ( ) Muito ruim

5. Sua rotina contém dermocosméticos (dermocosméticos são produtos que poss
   indicações específicas, cujas características exigem comprovação de segurança
   eficácia, bem como informações e cuidados, modo e restrições de uso. Produtos
   contêm ácidos)?
   ( ) Sim
   ( ) Não
   ( ) Não sei

6. Você sabia o significado do termo dermocosmético antes de hoje?
   ( ) Sim
   ( ) Não

7. Você costuma usar protetor solar na sua rotina de cuidados com a pele?
   ( ) Sim, todos os dias.
   ( ) Sim, quase sempre.
   ( ) Raramente.
   ( ) Nunca.

8. Você já utilizou produtos "naturais", como alimentos na sua pele?
   ( ) Sim
   ( ) Não

8.1 Se sim, quais? _____.

8.2 Quem/ Onde você encontrou a recomendação?
   ( ) Familiares.
   ( ) Amigos.
   ( ) Farmacêutico.
   ( ) Internet/ Plataformas digitais

   Qual?
   ( ) Tiktok.
   ( ) Instagram.
   ( ) Youtube.

( ) Outra fonte. Qual? _____.

Source: Authorship (2024).

In the present studies, all analyses of the reliability coefficients were performed with the aid of the JASP Software (Version 0.19.3), developed in R language and provided free of charge for use by the JASP Team (JASP, 2024).

Another analysis that can be used to evaluate the reliability of questionnaires is the division into two halves (*Split-Half Reliability),* which was also performed in the present study through the use of the answers of the even lines x answers of the odd lines, and in this way 2 groups of answers were obtained that were then compared through Pearson's

correlation analysis and through a multiple regression analysis, with the help of the Microsoft Excel® spreadsheet.

RESULTS AND DISCUSSION

Vieira and Bressan (2022), explain that in the academic world, most quantitative research is carried out through questionnaires and that the results of these researches are conditioned to the construction of a good research instrument, if this is taken into account it is much more likely that the scientific value of the results obtained will be high and that the researcher will be able to meet the objectives of the research, even if it is known that a good instrument alone is not able to guarantee the success of a study.

Among the reliability coefficients calculated (Table 1), the highest value found was for Guttman's lambdas. According to Zaiontz (2023), Guttman's reliability is a very good measure of reliability and yields a higher value than Cronbach's alpha, which is the most commonly used measure. While Cronbach's alpha tends to underestimate actual reliability, Guttman's reliability can overestimate reliability when the sample size is small or there are a large number of items. According to Matthiensen (2011), in exploratory research, as is the case of the present study, an alpha above 0.6 can already be considered sufficient.

Table 1. Values resulting from the Reliability Statistical Analyses of the complete dataset and their upper and lower reliability limits.

Estimates	McDonald's ω	Cronbach's α	Guttman's λ2	Guttman's λ6
Calculated value	0.666	0.633	0.690	0.839
Lower Limit 95%	0.210	0.562	0.636	0.825
Upper limit 95%	0.735	0.695	0.739	0.890

The mean of the values found for the 4 coefficients was 0.707, which leads us to realize that, on average, the questionnaires were reliable, because this value can be considered satisfactory for the analysis of questionnaires, because according to Freitas and Rodrigues (2005), coefficient values above 0.6 indicate moderate reliability and above 0.75 high reliability, Thus, the values indicated that the questionnaire, when analyzed globally, is reliable and has a moderate to high reliability, depending on the coefficient that is taken into account in its analysis.

When the questions were analyzed individually, only a few had some coefficients indicating worrying values (Table 2), and even these were not indicated as a problem by all the coefficients. Thus, it is believed that the questionnaire and its answers showed that it could be used and validated as a questionnaire that generates reliable answers and that if applied more than once to the same population, it would tend to generate similar results, no

question was perceived as incorrect, incomplete or confusing and thus the questionnaire could be applied in the way it is presented in this study (Figure 1).

Table 2. Values resulting from the Statistical Reliability Analysis of each of the questions asked analyzed individually.

Coefficients calculated for each item questioned				
Questions	McDonald's ω	Cronbach's α	Guttman's λ2	Guttman's λ6
Gender	0.648	0.609	0.671	0.826
School	0.661	0.624	0.683	0.834
Age	0.676	0.640	0.698	0.844
Colour	0.677	0.644	0.701	0.843
Income	0.660	0.617	0.681	0.833
Routine	0.672	0.632	0.688	0.837
Consultation with a dermatologist	0.652	0.615	0.675	0.826
Consultation times	0.656	0.613	0.673	0.826
Doctor-recommended routine	0.653	0.613	0.672	0.826
Where you bought it	0.374	0.563	0.635	0.802
Tik tok	0.624	0.599	0.659	0.810
Instagram	0.655	0.622	0.681	0.833
You Tube	0.665	0.632	0.689	0.835
Skin knowledge	0.679	0.638	0.695	0.841
Routine with dermocosmetics	0.677	0.660	0.710	0.849
Did you know the meaning of dermocosmetic	0.669	0.633	0.691	0.845
Wear sunscreen	0.680	0.636	0.692	0.838
Natural products	0.648	0.607	0.668	0.818
What products do you use	0.661	0.624	0.683	0.833
Where did you find the recommendation	0.640	0.592	0.662	0.800
Tik tok	0.647	0.609	0.669	0.808
Instagram	0.662	0.629	0.687	0.833
You tube	0.665	0.631	0.688	0.832

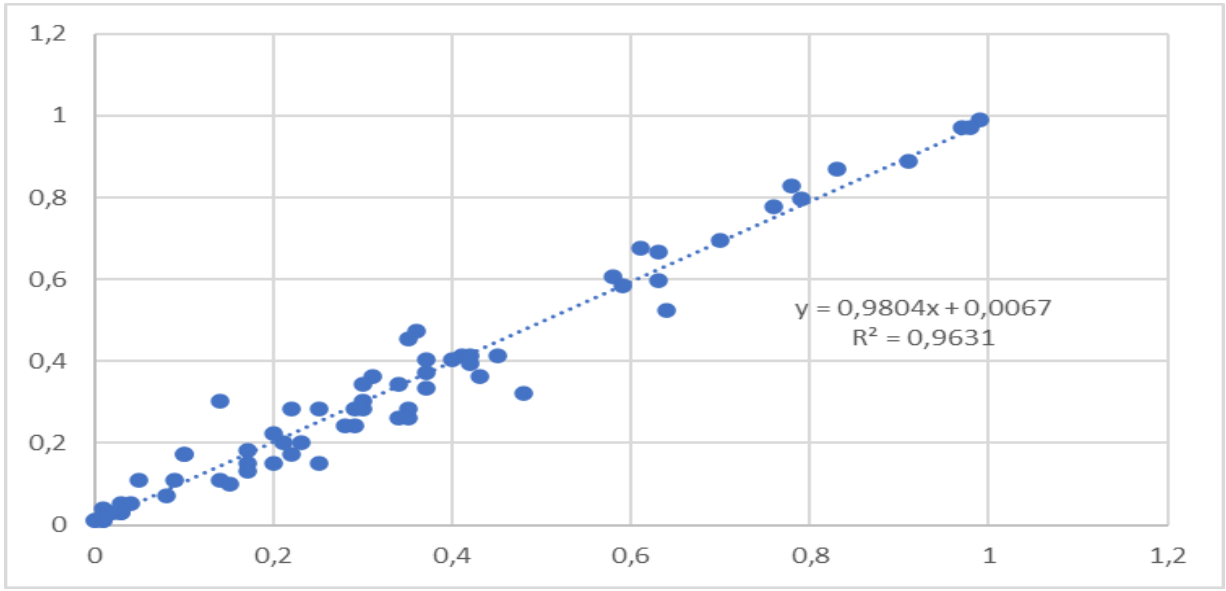
Note. Some items are in reverse scale: Gender, Income, Routine, Knowledge of skin, Whether the meaning of dermocosmetics was known, Use of sunscreen and Use of natural products.

The questions with lower values for the coefficients mentioned the questioning of where the interviewees had acquired the skin care routines (3.1 and 8.2) and the questioning referred to information having been obtained from friends, pharmacists, family, doctors or on the internet, considering that not all the coefficients judged this question to be a problem for the reliability of the questionnaire and that the answers to this question are interesting For the ongoing research and the coefficients of the questionnaires as a whole were above 0.6, it was decided to keep the questionnaire unchanged. However, if any modification were to be made, these would be the issues that should be analyzed in search

of improvements or even an analysis with the removal of them from the results, to verify the changes in the values of the calculated indexes.

The results obtained through the *split-half reliability* test also indicated that the questionnaire based on its answers can be considered reliable, and the result of the Pearson's correlation coefficient of the data resulted in a value of 0.98 and when a regression was performed between the results of the percentages of the answers between the two groups, the value of the correlation coefficient was 0.96.

Figure 2. Regression analysis between the results of the two halves analyzed, with regression equation and correlation coefficient value.



Source: Authorship based on data from the survey carried out.

The values indicated by this test were higher than the values found in the calculation of the coefficients, it is important to highlight that this is one of the simplest tests to perform, but only one division was made in half, if another division was made the values found could be different, there are many ways to divide the results and the adoption of different ways causes them to change, However, based on the values found, the reliability of the results obtained in the questionnaires would be considered high to very high, which is slightly above what was found by the values calculated for the coefficients. It should be borne in mind that the coefficients perform a more complete analysis and it is always good to calculate the coefficients and not only the halved method, but the methods can complement each other.

The complete presentation of the results of this study, presenting the information regarding people's behaviors, attitudes, opinions and preferences, which were found after the complete statistical analysis of the data, will be prepared for publication in the future, considering that the amount of information obtained was very extensive and the present

study also does not aim to exhaust the analyses and information acquired with the answers of the interviewees, however, in order to support and prove data collection, Table 3 was prepared to present the p-values calculated for the present data collection and the minimum and maximum (estimated) results for future similar research, based on the actual data obtained.

Table 3. Values calculated for p value of all analyses by the binomial test and the lower and upper limits estimated based on the results obtained in the real answers presented in the questionnaires applied to students between 15 and 17 years of age from the two schools (public and private) in the municipality of Cascavel-PR.

Variables	Levels	p value	Lower limit	Upper limit
Gender	Female	0.016	0.516	0.657
	Male	0.016	0.343	0.484
School	Particular	<.001	0.731	0.848
	Public	<.001	0.152	0.269
Age	15	<.001	0.305	0.443
	16	<.001	0.276	0.412
	17	<.001	0.225	0.355
Colour	White	<.001	0.704	0.826
	Yellow	<.001	0.011	0.064
	Brown	<.001	0.126	0.236
	Black	<.001	0.008	0.058
income	more than 11	<.001	0.091	0.191
	from 6 to 10	<.001	0.243	0.376
	from 4 to 6	<.001	0.206	0.333
	less than 3	<.001	0.229	0.360
Routine	always	<.001	0.193	0.317
	almost always	<.001	0.157	0.274
	Sometimes	0.007	0.333	0.474
	never	<.001	0.091	0.191
Consulted dermatologist	yes	0.023	0.511	0.652
	No	0.023	0.348	0.489
Consultation times	annually	<.001	0.043	0.121
	semiannually	<.001	0.083	0.180
	1 or 2 x	0.004	0.328	0.469
	never	0.007	0.333	0.474
Routine recommended by doctors	yes	<.001	0.239	0.370
	No	<.001	0.630	0.761
Where he acquired the routine	There's no routine	<.001	0.271	0.407
	Family	<.001	0.148	0.263
	Friends	<.001	0.003	0.043
	Pharmacist	<.001	0.018	0.078
	Internet	0.007	0.333	0.474
	Many locations	<.001	1.272×10-4	0.028
Tik tok	No	0.002	0.542	0.681
	yes	0.002	0.319	0.458
Instagram	No	<.001	0.849	0.938
	yes	<.001	0.062	0.151
You Tube	No	<.001	0.964	0.999
	yes	<.001	0.001	0.036
Skin knowledge	Very good	<.001	0.047	0.127
	Good	<.001	0.206	0.333
	Intermediary	0.065	0.362	0.504
	Bad	<.001	0.126	0.236
	Very bad	<.001	0.021	0.084
Routine with Dermocosmetics	yes	0.023	0.348	0.489
	No	<.001	0.257	0.391
	I don't know	<.001	0.202	0.328
Did you know the meaning of	yes	0.011	0.338	0.479
	No	0.011	0.521	0.662

A dermocosmetic				
Wear sunscreen	Yes daily	<.001	0.253	0.386
	Yes almost always	<.001	0.165	0.285
	rarely	<.001	0.239	0.370
	never	<.001	0.113	0.219
Natural products	yes	<.001	0.286	0.422
	No	<.001	0.578	0.714
What products do you use	Not mentioned	<.001	0.792	0.896
	Quoted	<.001	0.104	0.208
Where did you find the recommendation	Never used	<.001	0.572	0.710
	Family	<.001	0.083	0.180
	Pharmacist	<.001	0.001	0.036
	Internet	<.001	0.161	0.280
	Many locations	<.001	1.272×10-4	0.028
Tik tok	No	<.001	0.742	0.857
	yes	<.001	0.143	0.258
Instagram	No	<.001	0.936	0.989
	yes	<.001	0.011	0.064
You tube	No	<.001	0.942	0.992
	yes	<.001	0.008	0.058

Source: Authorship based on statistical analysis and survey data. Note. Ratios tested against the value of 0.5.

Practically all the p-values calculated using the binomial test were small (< 0.05), which means that there is a small probability that the difference observed between the groups is random, even though we did not seek to obtain more responses from women than from men or from students who study in private schools than in public schools or directed to people of a certain color or social level. This occurred, from which it can be stated that in some cases the indication of the p values, the existence of a statistical difference between the number of people who answered the questionnaire, and there was no intentional direction, probably indicates that there are more people with these characteristics in the target population of the present study.

In some situations, the indication of statistical difference may be even more interesting, considering the existence of statistical differences between the groups of people who consult and who do not consult dermatologists, number of times they consult, application of skin care routine, place where they acquired these routines, among other questions that presented p values lower than 0.05 and indicated that these behaviors of this portion of the population It was not due to chance and that there was a significant difference in behavior between certain groups of the interviewed population.

Finally, based on these values obtained and presented, a lot of interesting information can be acquired, which in future statistical analyses of the data, which are intended to be carried out, built and published in new *papers*, it will certainly be possible to better understand what may have led people to have different behaviors in relation to skin care, influencing factors and behavioral differences.

CONCLUSION

Finally, it was noted that the questionnaire and its results can be considered reliable, and by the values calculated for the alpha, lambda and omega coefficients, the reliability would be considered between moderate and high and by the division in half between high and very high.

Thus, it is concluded that the questionnaire does not require any alteration and can be validated as a reliable and interesting tool for the evaluation of the behavior of young people in relation to skin care and their behaviors in relation to the use of dermocosmetics, thus filling a gap in this area of research, in view of the difficulty of finding instruments in recent literature that are intended for this purpose and that have if proven reliable to use.

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INTERCONNECTIONS BETWEEN INTERCULTURALITY, ETHNIC DIVERSITY AND HUMAN RIGHTS IN SOCIAL TRANSFORMATION: A STUDY ON NATIVE PEOPLES AND TRADITIONAL COMMUNITIES IN THE LIGHT OF THE FEDERAL CONSTITUTION OF 1988

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ABSTRACT

This article addresses the interconnection between interculturality, ethnic diversity and human rights in social transformation, with emphasis on Native Peoples and Traditional Communities with the advances of the Federal Constitution of 1988, using a qualitative, doctrinal and bibliographic methodology explores the relationship between interculturality, ethnic diversity and human rights in the context of social transformation in Brazil, with a focus on indigenous peoples and traditional communities. The study highlights the importance of interaction between different cultures for the recognition and appreciation of ethnic diversity, which is fundamental for guaranteeing the human rights of these groups. The analysis is based on the 1988 Constitution, which is considered a significant legal framework for the affirmation of the rights of indigenous peoples and traditional communities. The text discusses how interculturality and ethnic diversity are crucial for social transformation. This includes the struggle for recognition of rights, preservation of cultures and territories, and active participation in society. The 1988 Constitution is seen as a key instrument for this transformation, as it recognizes the interculturality of Brazil and ensures fundamental rights to these groups.

Keywords: Ethnic diversity. Interculturality. Social transformation.

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INTRODUCTION

The twenty-first century emerges as a stage for the convergence of diverse cultures, an era in which interculturality and the appreciation of ethnic diversity are crucial for building truly inclusive societies. In this context, this article seeks to unravel the intricate relationships between interculturality, ethnic diversity, human rights, and social transformation, focusing on the unique contribution of Brazil's native peoples and traditional communities. Under the prism of the Federal Constitution of 1988, which recognizes these groups as holders of fundamental rights, we will investigate how this legislation influences social dynamics, promoting a fairer and more sustainable society.

In an increasingly globalized world, interculturality becomes a key element for mutual understanding and acceptance between different cultures. Valuing ethnic diversity not only enriches the social fabric, but also challenges paradigms, promoting the construction of a collective identity that embraces the richness of its differences.

Within this scenario, the native peoples and traditional communities of Brazil emerge as bearers of a unique cultural heritage, based on centuries of harmonious coexistence with nature and ancestral practices. The Federal Constitution of 1988, by recognizing them as subjects of rights, marks a turning point by establishing a new legal paradigm that aims to protect their identities and ways of life.

This study is based on the principle that human rights are the backbone for any effective social transformation. By recognizing traditional communities as holders of these rights, the 1988 Constitution not only provides a robust legal basis but also drives a paradigm shift in the social fabric, fostering an environment conducive to social transformation.

In this context, this article aims to analyze how interculturality, ethnic diversity and the recognition of the rights of these communities, anchored in the Federal Constitution of 1988, play a central role in promoting social transformation. This research is justified by the need to understand the dynamics and challenges that involve the intersection of these themes, providing understanding for the promotion of a more just, sustainable and inclusive society.

INTERCULTURALITY AND ETHNIC DIVERSITY

In an increasingly globalized world, interculturality becomes a key element for mutual understanding and acceptance between different cultures. Valuing ethnic diversity not only enriches the social fabric, but also challenges paradigms, promoting the construction of a collective identity that embraces the richness of its differences. It represents a dynamic and

enriching phenomenon, characterized by the constant exchange of values, traditions, and perspectives between different cultural groups.

Nestor Clacini, when dealing with the historical aspect of the theme, states that:

> .../... cultural exchanges between societies coincide with the beginning of human history, from Classical Greece and the Roman Empire, with the numerous exchanges and interactions that took place in the Mediterranean, through the expansion of Europe towards America and Africa there has always been contact between different cultures (CANCLINI, 2006).

According to Luciana Vasconcelos[5] , social scientists realized the relevance of cultural diversity when decolonization occurred in Africa, Latin America and Asia, when emigrants from the former colonies headed to Europe. According to the author:

> This migratory movement, which reached its peak in the seventies and eighties of the century. Causing a demographic transformation in some European cities, it resulted in the emergence of situations borderline of tolerance. (VASCONCELOS, 202?)

Today, the interconnection between distinct cultures has become prominent, acting as an effective counterpart to cultural homogenization. This dynamic seeks to promote a coexistence, sometimes challenging, but values ethnic diversity as a fundamental resource for social and human progress.

INTERCULTURALITY AND MULTICULTURALISM

Before entering the theme of interculturality, it is necessary to talk about multiculturalism, which began at the end of the nineteenth century in the United States, being driven mainly by the black movement, which sought to combat racial discrimination in the country and fight for civil rights.

According to Silva and Brandim: "The precursors of multiculturalism were professors, Afro-American doctors, university professors in the area of social studies who brought through their works, social, political and cultural issues of interest to Afro-descendants". (SILVA AND BRANDIM, 2008, p.5656)

Multiculturalism, also called cultural pluralism, presents a controversial concept that is subject to debate from various perspectives, mainly due to the complexity of defining what constitutes culture.

> The expression multiculturalism originally designates the coexistence of cultural forms or groups characterized by different cultures within modern societies. Quickly,

[5] Available at: home-https://pt.scribd.com/document/268477448/INTERCULTURALIDADE-Luciana-Machado-de-Vasconcelos-Podemos-Dizer-Que-Os-Intercambios-Culturais-Entre-Sociedades-Coincidem-Com. Accessed on: 31 jan. 2024

> however, the term became a way to describe cultural differences in a transnational and global context. There are different notions of multiculturalism, not all of them in the emancipatory sense. The term presents the same difficulties and potentialities as the concept of "culture", a central concept of the humanities and social sciences and which in recent decades has become an explicit terrain of political struggles. (SANTOS; NUNES, 2014, p. 3)

It is inferred, then, that if the origin of multiculturalism is linked to the recognition of exclusions of ethnic minorities, from another vertex, interculturality in Virgílio Alvarado's concept *apud* Lopes (2011), is based on belonging,

> While multiculturalism advocates the coexistence of different cultures in the same social space under the principle of tolerance and respect for difference, interculturality, by presupposing the interaction between these cultures as inevitable, proposes a political project that allows for the establishment of a dialogue between them, as a way to guarantee a real peaceful coexistence. (ALVARADO *apud* LOPES, 2011, p.1213)

That said, interculturality seeks not only tolerance towards other cultures, but also promotes dialogue between different cultural groups. This is achieved through the intervention of the State to ensure equality among participants, that is, in the protection of human rights.

Through this state protection, interculturality conveys the idea of a constant dialogue, a meeting of cultures that transcends geographical and temporal borders. In this sense, interculturality is an invitation to mutual understanding, acceptance of differences and the joint construction of a global understanding.

ANALYSIS OF ETHNIC DIVERSITY IN THE GLOBAL CONTEXT

Ethnic diversity, far from being a mere demographic characteristic, is a reflection of history, migrations, cultural interactions and the coexistence of different groups over time, and has its challenges that include cultural misunderstandings, stereotypes and the difficulty of reconciling different values and practices, as well as prejudice and discrimination.

According to Aline Andrighetto and Rodolfo Silva:

> One of the obstacles perceived in the search for peaceful and tolerant coexistence is related to the view that, not infrequently, difference is associated with inferiority and inequality, and the other becomes inferior and starts to represent a threat to the standards of certain groups. (ANDRIGHETTO; SILVA, 2013, p.7)

In the international context, ethnic diversity is an unavoidable reality, representing both a challenge and an opportunity for the development of more resilient and adaptable societies. The study of ethnic heterogeneity is not limited to identifying a range of cultural

characteristics, but also encompasses the complex interactions that influence individual and collective identities. This perspective is supported by Stuart Hall, who argues about the importance of cultural identity in modernity,

> In the modern world, the national cultures in which we are born constitute one of the main fontes.de cultural identity. When defining ourselves, we sometimes say that we are English or Welsh or Indian or Jamaican. Obviously, in doing so we are speaking metaphorically. These identities are not literally imprinted in our genes. However, we do think of them as part of our essential nature. (HALL, 2006, p.47)

According to Homi K. Bhabha – The Place of Culture, it is necessary to discuss the concept of a "third space", evidenced by the identities formed and transformed through cultural differences.

> The non-synchronic temporality of national and global cultures opens up a space cultural – a third space – where the negotiation of incommensurable differences creates a tension peculiar to frontier existences. (BHABBA, 2013, p. 300)

Ethnic diversity, which encompasses various cultures, traditions, and experiences, is a fundamental aspect of modern global society. Recognizing it contributes not only to valuing different identities, but also to questioning the notion of a single dominant culture. This leads to a more inclusive and just approach in the development of policies, laws and social practices, interculturality.

THE INTERCONNECTION BETWEEN INTERCULTURALITY AND HUMAN RIGHTS

Interculturality transcends its nature as a sociological phenomenon, being deeply rooted in the foundations of human rights. This connection is emphasized by authors such as Boaventura de Sousa Santos, who in his work "Pela Mão de Alice: o Social e o Político na Pós-Modernidade" (1994), highlights the importance of recognizing and respecting different cultures as a path to the realization of human rights.

> The abstract concept of human rights is beginning today, two centuries after its formulation, to make real sense insofar as all over the world system social groups are organizing emancipation struggles guided by it. (SANTOS, 1994, p.288)

In the same work, Santos clarifies that intercultural dialogue and, therefore, ethnic diversity is crucial to ensure equal opportunities, dignity and freedom for all individuals.

> The eco-socialist paradigm as an intellectual construction stems from a very broad and, as far as possible, horizontal intercultural dialogue. The basis of this dialogue is twofold. On the one hand, fundamental human needs do not vary much in the world system, what does vary are the means to satisfy them (the *satisfactores).* Hence, one must start from an intercultural intelligibility of needs in order to achieve the intercultural intelligibility of the satisfactoriness through it. On the other hand, all cultures have a value of human dignity, which, being unique, allows for a trans-

> evaluative and multicultural hermeneutic. Such a hermeneutic constitutes the central challenge of the emerging paradigm. (SANTOS, 1994, p. 290)

Interculturality is not a mere sociological phenomenon; It is intrinsically linked to the fundamental principles of human rights. Recognition and respect for ethnic diversity are essential to ensure that all individuals have equal opportunities, dignity and freedom.

In this sense, Douglas Cesar Lucas states that:

> Human rights are and should be understood as the common heritage of humanity, as pillars of a valid dialogue between nations, cultures and communities, capable of establishing legal and moral references to analyze the legitimacy of State power, conforming objective limits to citizenship and national sovereignty, so that these do not function as forms of production of excluding difference. (LUCAS, 2008, p. 10)

The recognition of human rights as a shared heritage for all humanity is necessary for dialogue between nations, cultures and communities. From and through them, it is possible to establish legal and moral criteria to evaluate the legitimacy of state power, defining clear limits for citizenship and national sovereignty. This is essential to ensure that these concepts are not used to exclude or discriminate.

Finally, it is observed that although diversity is a field conducive to cultural and social innovation, it is not without significant challenges. Stereotypes, prejudices, and a lack of understanding between different ethnic groups can lead to tensions. Among these ethnic groups, we highlight the native peoples and traditional communities. Building bridges of understanding between these peoples and the wider society will foster an environment in which diversity is perceived as an asset rather than a divisive, thus enriching the social fabric with its rich traditions and unique perspectives.

NATIVE PEOPLES AND TRADITIONAL COMMUNITIES

The universe of native peoples and traditional communities makes the interconnection between interculturality, ethnic diversity and human rights as fundamental pillars in social transformation. The richness of its traditions offers a panorama for understanding human plurality and the importance of the coexistence of multiple worldviews.

Indigenous peoples, in their essence, are communities that have maintained cultural and social continuity since times before the great waves of colonization and expansion of nation-states. In a Brazilian context, this translates mainly into the diverse indigenous peoples, each with their own different languages, traditions, and ways of life. Traditional communities, on the other hand, represent the persistence and adaptation of ancestral

knowledge over generations. Both groups demonstrate the importance of ethnic and cultural diversity in enriching the human experience.

CONSTITUTIONAL RECOGNITION OF RIGHTS

In the Brazilian scenario, indigenous peoples and traditional communities occupy a unique position, rooted in centuries of history and an intrinsic relationship with the territory. The Federal Constitution of 1988 marked a crucial moment by recognizing them as subjects of rights, attributing to them the title over the lands they traditionally occupy. In this sense, Manuela da Cunha states that:

> The Constitution deals mainly with indigenous lands, rights over natural resources, litigation forums and procedural capacity. According to the Constitution, indigenous lands are the property of the Union and of inalienable possession and exclusive use of the Indians. (CUNHA, 2012, p.124)

Nelson Moreira explains that "the 1988 Constitution, with its directing-compromising text, intends to implement a State model that finally meets its historically (so)denied social purposes" (MOREIRA, 2009, p. 118).

This model of State, by making legal recognition of native peoples and traditional communities, represents a significant advance in the protection of their identities, cultures and ways of life, providing a legal basis for the preservation of their ancestral practices.

Segundo Paulo Leivas *et al.*:

> The Federal Constitution of 1988 broke with centuries of policies and norms that aimed at the cultural assimilation of indigenous people to the way of life of the surrounding society.
> In addition to enunciating, in its Preamble, that Brazilian society must be fraternal, pluralistic and without prejudice, the Federal Constitution guarantees a series of rights of indigenous people to their social organization, beliefs, customs, languages, traditions and territories and to the remnants of quilombola communities the right to ownership of the lands they are occupying. (LESSONS *et al.*, 2017, p. 315)

The Federal Constitution also clearly recognizes the rights of traditional communities, specifically including indigenous communities in articles 210[6], paragraph 2, and 232[7]. However, the question arises as to whether these rights can be classified as fundamental, encompassing all the underlying constitutional guarantees. to this category, such as the

[6] Article 210. Minimum contents will be established for elementary education, in order to ensure common basic education and respect for national and regional cultural and artistic values.
§ 1 .../...
Paragraph 2 - Regular elementary education shall be taught in Portuguese, and the indigenous communities shall also be assured the use of their mother tongues and their own learning processes
[7] Article 232. The Indians, their communities and organizations are legitimate parties to file a lawsuit in defense of their rights and interests, with the Public Prosecutor's Office intervening in all acts of the process.

immediate applicability provided for in paragraph 1[8] of article 5, and protection against changes by means of constitutional amendments, as provided for in article 60, paragraph 4. In turn, article 68 of the[9] Transitional Constitutional Provisions Act (ADCT) deals with the rights of the remnants of quilombo communities.

In the same vein, the Authors continue:

> If there is no doubt that the Federal Constitution recognizes collective rights of traditional communities remaining from quilombos and indigenous communities – such as the aforementioned art. 210, § 2, and art. 232 – , asks whether these rights can be recognized as fundamental rights. The legal relevance of this issue stems from the various guarantees that the fundamental rights are armed with in the Federal Constitution of 1988, such as the guarantee of immediate applicability (art. 5, § 1), through which fundamental rights are applied even in the absence of regulatory legislation, and the guarantee of stony clauses (art. 60, § 4), which nullifies constitutional amendments "tending to abolish" rights protected by it. (LEIVAS, et al, 2017, p. 316)

It should be noted that it is not a matter of confronting differences in order to recognize the universality of man, the issue is delicate, since it is recognized that the rights of native peoples and traditional communities are human rights, these peoples only gained identity when these rights were recognized as fundamental. From this arises one of the values of interculturality, through these fundamental rights it is recognized, first of all, that man is free when and has the right to express his traditions and cultures.

On the subject, Douglas Cesar Lucas states that:

> In the same way that it is important to defend differences, it is indispensable to protect what is universal about man, since it is precisely this universality that allows the appearance and recognition of such differences and, therefore, of their identities. (LUCAS, 2008, p. 232)

That said, native peoples and traditional communities, in addition to being depositories of a rich cultural heritage, are also heirs to the rights attributed to them by the legal system, and this estate belongs to all generations: present and future.

THE ROLE OF COLLECTIVE SELF-IDENTIFICATION

The 1988 Constitution represented a significant milestone for traditional and indigenous communities in Brazil, by allowing access to constitutional rights through a

[8] Article 5 - All are equal before the law, without distinction of any kind, guaranteeing to Brazilians and foreigners residing in the country the inviolability of the right to life, liberty, equality, security and property, in the following terms:
.../...
Paragraph 1 - The norms defining fundamental rights and guarantees shall be immediately applicable.
[9] Article 68. The remnants of the quilombo communities that are occupying their lands are recognized as the definitive property, and the State must issue them the respective titles.

process of collective self-identification. This approach transcends mere individuality, confirming and legitimizing the identities of these communities collectively. This form of recognition not only validates their cultural and social identities but also amplifies their visibility and influence in the political and social landscape.

According to Moreira and Pimentel:

> Also called self-recognition, self-attribution and self-definition, self-identification is one of the foundations of the Rights of Traditional Peoples and Communities and implies the recognition of the right to self-determination and self-recognition without the need for state approval. However, even if independent of the State's approval, it has the obligation to develop specific policies, including binding it to the obligation to recognize self-recognition. (MOREIRA ; PIMENTEL, 2015, p. 159)

Collective self-identification works as a fundamental mechanism for the residence and affirmation of the collective identities of these groups, reinforcing community ties and contributing to the consolidation of their position in the formulation of more inclusive and representative public policies. This dynamic is crucial for the promotion of the rights of these communities, ensuring their active participation and adequate representation in different spheres of society.

In this sense, Elaine Cantarino O'Dwyer talks about the importance of self-attribution:

> In Brazil, the self-attribution of ethnic identities has become an important issue in recent years, through the political organization of groups that claim recognition of the territories they occupy, as in the case of indigenous peoples and the so-called remaining quilombo communities (O'Dwyer, 2009, p. 165).

Daniela Ikawa argues that "identification should occur primarily by the individual himself, in order to avoid external identifications aimed at negative discrimination and to strengthen the recognition of difference" (IKAWA, 2008, p.129).

The right to self-identification is clearly provided for in the Brazilian legal system. A notable example of this is Convention 169 of the International Labor Organization (ILO), which Brazil ratified through Legislative Decree No. 143 of 2002.

This international document, in its article 1, item 2, recognizes a series of rights of Indigenous and Tribal Peoples, emphasizing self-identification as essential classifications for the definition of these groups. This right is a key aspect for the recognition and protection of the cultural and social identities of these peoples, ensuring that they can define themselves according to their own traditions and histories.

> Self-identification as indigenous or tribal should be considered a fundamental criterion for defining the groups to which the provisions of this Convention apply (BRASIL, 2002).

It can be stated that, both from a historical and legal point of view, the remnants of quilombola communities are included in the scope of the aforementioned Convention.

> Another achievement, of paramount importance for the quilombola territorial issue, was Convention No. 16911 of the International Labor Organization (ILO), edited based on the need for self-determination claimed by Indigenous and Tribal Peoples who claim control of their own ways of life and institutions (CAVALCANTE & BELTRÃO. 2016, p. 54)

Finally, the importance of collective self-identification for native peoples and traditional communities lies in its crucial role in preserving cultural identity and guaranteeing fundamental rights, such as the right to land. This practice strengthens resistance against forced assimilation and the loss of cultural identity, as well as promotes solidarity and community support.

Boaventura Santos, inserts self-determination in a renewed conception of human rights, stating that the new scenario suggests a reconfiguration of ethical and legal principles in response to contemporary social and economic changes:

> But here too there are signs of the future. From the collapse of liberal ethical and legal forms in the face of some of the most serious problems we face - from social exclusion and racism to Chernobyl and AIDS - a new *jus-naturalism* is beginning to emerge based on a new conception of human rights and the right of peoples to self-determination. and on a new idea of solidarity, planetary concrete. Curiously, these signs of a new ethics and a new law are related to some of the transformations at the level of the market principle and the principle of community mentioned above. (SANTOS, 1994, p. 91)

From all the above, it is concluded that collective self-identification is also fundamental for the transmission of ancestral knowledge and sustainable practices, contributing to the visibility and empowerment of these groups in society. It is a vital element for the dignity, respect and cultural survival of native peoples and traditional communities.

LIMITATIONS AND ADVANCES AFTER THE 1988 CONSTITUTION

Despite the advances brought about by the 1988 Constitution in Brazil, as stated elsewhere, indigenous peoples and traditional communities face significant challenges and limitations in the recognition and protection of their rights. One of the biggest challenges is land demarcation, an often slow and controversial process that is vital for the preservation of their cultures and ways of life. The struggle for land is intrinsically linked to their physical and cultural survival, only for native peoples and traditional communities, however, there is a portion of society that attributes only economic value to these lands, as Manuela da Cunha explains:

> The great bone of contention, with all false pretexts, some of which I have already mentioned, removed, is the issue of the exploitation of mineral resources and water resources in indigenous areas. Given the economic conditions, the use of water resources is in limbo, but the mineral issue is more alive than ever and probably at the origin of the attacks against the rights of the Indians. (CUNHA, 2012, p.129)

There is no legal obstacle to the exploitation of water or mineral resources on indigenous lands, as long as certain procedures are observed, which function as defense mechanisms against unbridled exploitation.

Another important aspect is the guarantee of effective participation of these communities in the decisions that affect their lives. Often, they are excluded from important decision-making processes or their voices are marginalized, or that weakens their autonomy and ability to influence policies that directly impact their lives.

Manuela da Cunha:

> The 1988 Constitution prescribes special procedures when it comes to the exploitation of water and mineral resources on indigenous lands. There is no prohibition on exploiting them, but special safeguards. These safeguards consist of the need for prior authorization from the National Congress, on a case-by-case basis, after hearing the affected communities, which will have a stake in the result of the mining. (CUNHA, 2012, p.129)

Public health policies for indigenous peoples, supported by the paradigm of specificity and interculturality, have shown progress, but they also face significant challenges. These include the guarantee of constitutional rights of autonomy and self-determination of indigenous peoples, as well as the confrontation of social and health inequalities historically present among these peoples. Luciane Ferreira, understands that:

> The Magna Carta, by overcoming the tutelage over the indigenous person and recognizing him as a Brazilian citizen, guaranteed indigenous peoples the right to their social organization, customs, languages, beliefs and traditions, as well as over the lands they traditionally occupy. from then on, the State's rhetoric began to operate with the ideas of cultural diversity, interculturality and indigenous protagonism. (FERREIRA, 2015, p. 217)

Indigenous health care in Brazil has been guided by movements to claim and conquer indigenous rights to health, incorporating ideals of citizenship, freedom, civil rights and democracy. In order to make the right to health effective, Law No. 9,836[10] of 1999 established the Indigenous Health Care Subsystem (SASI) together with the Special Indigenous Sanitary Districts (DSEIs). The latter represent a modality of structuring health services in areas defined according to ethnocultural criteria, in these terms:

[10] https://www.planalto.gov.br/ccivil_03/leis/l9836.htm

> Article 19-A. Health actions and services aimed at the care of indigenous populations, throughout the national territory, collectively or individually, shall comply with the provisions of this Law.
> Article 19-B. An Indigenous Health Care Subsystem is established, a component of the Unified Health System (SUS), created and defined by this Law, and by Law No. 8,142, of December 28, 1990, with which it will function in perfect integration.
> ...
> Article 19-G. The Indigenous Health Care Subsystem should be, like the SUS, decentralized, hierarchical and regionalized.
> § 1 The Subsystem referred to in the *caput* of this article shall be based on the Special Indigenous Sanitary Districts.
> § 2 The SUS shall serve as a backup and reference to the Indigenous Health Care Subsystem, and for this purpose, adaptations must be made to the structure and organization of the SUS in the regions where the indigenous populations reside, in order to provide this integration and the necessary care at all levels, without discrimination.
> § 3 Indigenous populations must have guaranteed access to the SUS, at the local, regional and specialized center levels, according to their needs, including primary, secondary and tertiary health care.
> Article 19-H. Indigenous populations will have the right to participate in collegiate bodies for the formulation, monitoring and evaluation of health policies, such as the National Health Council and the State and Municipal Health Councils, when appropriate."

In addition to legal recognition, it is crucial to adopt holistic approaches that value the cultural and environmental contribution of these communities. They are custodians of important traditional knowledge and have a crucial role in biodiversity conservation and environmental sustainability. Therefore, it is essential that their practices and knowledge are integrated into development and conservation strategies.

In order for cultural pluralism not to be just an allegory or a folkloric character, cultural differences must be recognized and respected. Among the freedoms advocated by the Democratic Rule of Law, the one that translates into the option for a differentiated cultural model, without any type of interference or coercion, should be the desired one. Within this context, it is necessary to categorize the rights of indigenous peoples and traditional communities as Minority Rights.

INDIGENOUS PEOPLES AND TRADITIONAL COMMUNITIES IN THE FACE OF THE RIGHTS OF MINORITIES

The Constitution of Brazil, in addition to establishing a Democratic State of Law, goes beyond the mere confirmation of individual rights and guarantees, also valuing collective rights. Notable examples include consumer protection (art. 5 XXXII and art. 170, (inc. V), the preservation of a balanced ecological environment (art. 225 and art. 170, item VI), cultural rights (art. 215 and 216) and the rights of indigenous peoples (arts. 231 and 232), among others.

First, we will address the concept of "minorities", understanding not only the ethnic, cultural, and social dimensions, but also how these identities are intertwined with issues of power, representation, and access to resources. Next, we will investigate the history of marginalization and the struggles faced by these groups, highlighting how systematic exclusion has shaped contemporary social dynamics.

RIGHTS OF INDIGENOUS PEOPLES AND TRADITIONAL COMMUNITIES AS RIGHTS OF MINORITIES

Minority Law, as a branch of Law, should be classified as one of the Fundamental Rights. Its main focus is the set of principles, guarantees, and norms that guide the protection and implementation of collective rights or interests, through mechanisms for controlling constitutionality.

In the legal field, as well as in other areas of the social sciences and humanities, the purpose of Collective Rights is intrinsically associated with the life and behavior of man within the social group in which he lives.

Boaventura de Sousa Santos, highlights the problem of the deficiencies of cultures in the face of the dignity of the human person:

> "[...] All cultures are incomplete and problematic in their conceptions of human dignity. This conception comes from the incompleteness of the existence of the plurality of cultures, the idea of completeness is at the origin of an excess of meaning that encompasses all cultures." (SANTOS, 1997, p.22).

Within this context, the need arises to develop methods of ordering and enforcing Law through legal methodology stems directly from the object of Law itself. This is because the specific characteristics of each field of law require methodological approaches that are appropriate and aligned with their particular demands, as is the case with the rights of indigenous peoples and traditional communities.

For Almeida:

> Collective Law can be conceptualized as an integral part of the constitutional theory of fundamental rights, which makes up one of the blocks of the Brazilian legal system and is integrated by the set of principles, guarantees and rules that discipline diffuse rights or interests, collective rights or interests in the strict sense, homogeneous individual rights and interests and legitimate collective objective interests (ALMEIDA, 2008, p. 437).

If collective rights have emerged as a response to the traditional emphasis on individual rights, they provide a more focused legal perspective directed at promoting social justice. A key aspect of this transition in the field of law is the recognition and safeguarding of cultural diversity, reflecting the shift in focus from individual interests to those of the

community. At the same time, the environmental issue, equally considered a right for all, stands out as the scenario where different cultures find space to manifest themselves and prosper.

For Souza Filho:

> These new rights have as their main characteristic the fact that their ownership is not individualized, that one does not have or cannot be clear about it. They are not the result of a precise legal relationship, but only of a generic guarantee, which must be fulfilled and which, in its fulfillment, ends up conditioning the exercise of traditional individual rights. (SOUZA FILHO, 2003/2004, p. 4)

The recognition of these rights goes beyond the protection of traditional communities, also serving as a fundamental step towards the formation of a more equitable and inclusive society. Valuing and respecting the cultural identities of these communities, as established by the Federal Constitution of 1988, are essential to foster diversity and contribute to a broader and more representative national narrative

VULNERABILITY AND MINORITIES

The vulnerability of indigenous peoples and traditional communities is historically rooted and perpetuated by centuries of exploitation and marginalization. This legacy of injustice is perpetuated through contemporary practices of land dispossession, exploitation of natural resources, and discriminatory policies, culminating in a persistent human rights crisis.

As Danielle Mamed, Dayla Pinto and Luciana Pinto observe in: The protection of vulnerable groups:

> Culturally differentiated human communities, which do not share the ideals of the hegemonic society, and which seek to remain faithful to the parameters of life on which they are constituted, end up suffering various violations of their rights, either because of a cultural conception that inferiorizes them, or because of the constitution of the normative system, silent or insufficient to make their rights effective. (MAMED; DICK; PINTO, 2020, p.89)

Although the concepts of minorities and vulnerability are close, they are not identical, as will be demonstrated. To properly understand these concepts, it is essential to first discuss the constitutional principle of equality, which acts as a key driver in the fight against discrimination. In this vein, Pontes de Miranda *apud* Rios Junior states that:

> What democratic peoples or those in which the State is democratic and liberal have to do, as their main goal, is to reduce human inequality. Men are unequal, but it is necessary that, instead of continuing inequality, it is made less unequal." (PONTES DE MIRANDA, 1979 *apud* RIOS JUNIOR, 2013, p. 100)

Therefore, it is possible to infer that the principle of equality arises from social reality, considering that people are not intrinsically equal. It is the responsibility of the State to identify and protect those who, due to certain factual conditions and/or biological characteristics, are in disadvantageous situations before society. For Walter Rothenburg, equality "[...] it is something that needs to be obtained from claims and achievements, and for this the Law can serve as a valuable tool" (ROTHENBURG, 2009 *apud* RIOS JUNIOR, 2013, p. 100)

The presence of vulnerable groups and minorities is a global phenomenon, not exclusive to Brazil. This is due to the natural tendency of human beings to group together with those who share similarities. Consequently, it becomes a duty of the State to recognize these differences and address them through the implementation of public policies. The objective of these policies is to achieve isonomy, ensuring equal treatment and opportunities among all members of society.

On the other hand, Flag of Mello alerts:

> [...] that certain elements or characteristic traits of people or situations are insusceptible of being picked up by the norm as the root of some differentiation, a penalty of being put to the forefront of the rule of equality. (BANDEIRA DE MELLO, 2017, p.15)

The literal definition of the term minorities in the Great Houaiss Dictionary[11] :

> "3 ANTRPOL, SOC subgroup existing within a society that considers itself and/or is considered different from the larger and/or dominant group, due to ethnic, religious, or language, customs, nationality, etc. characteristics, and that, for this reason, does not have the same rights and/or opportunities as the majority group, or is the target of discrimination or prejudice (frequent empr. In Pl.) ‹*Fight for the rights of women.*›"

Therefore, although there is no single definition for minorities, it is possible to point out their main characteristics: they are human groups or collectivities with their own particularities, which differentiate them in the human context in which they are, or should be, integrated, regardless of the nature of these particularities.

In Élida Séguin's view, the concept needs to be expanded:

> Minorities are thought of as a numerically inferior contingent, as groups of individuals, highlighted by a characteristic that distinguishes them from the other inhabitants of the country, being in a smaller number in relation to the country's population. [...] Conceptualizing minorities is complex, since their reality cannot be restricted only to ethnic, religious, linguistic or cultural criteria. We have to weigh its legal reality against modern achievements. (SÉGUIN, 2002, p. 9)."

[11] Available at https://houaiss.uol.com.br/corporativo/apps/uol_www/v5-4/html/index.php#3, accessed on: 20 Sep. 2020

For Rossana Margaroto Cayres and Roberto Cidade[12], the term vulnerability is closely linked to legal fragility:

> Vulnerability is a term originated in discussions about Human Rights, usually associated with the defense of the rights of legally weakened individuals. Thus, a vulnerable group is a group of people who, for various reasons, have access, equal participation made difficult to universal goods and services available to the population. (CAYRES & CIDADE, 2015)

Based on the two definitions presented, it is reasonable to say that the essential thing is to ensure these groups the right to be distinct. For this reason, they should receive differentiated treatment, including special protection by the State that welcomes them, in recognition of and respect for their differences. According to Bastos:

> Minorities and vulnerable groups are not synonymous expressions, but due to the fact that their members are in the same factual situations of discrimination, intolerance and fragility, on the part of a portion of society, the conceptual differentiation becomes irrelevant and the jurisdictional protection that can be offered to these excluded becomes relevant." (BASTOS, 2011, p. 66)

Having overcome the issue of terminological differentiation between minorities and vulnerable groups, it can be stated that, although every minority has some degree of vulnerability in a certain aspect, not all vulnerable people are part of a minority. This is due to the fact that vulnerability can be situational and, as such, capable of being overcome or mitigated.

SOCIAL TRANSFORMATION THROUGH THE VALORIZATION OF MINORITIES:

To address the theme, "Social Transformation through the Valuing of Minorities", it is based on the premise that true social change cannot be achieved without recognizing and valuing diversity and the contributions of minorities. The inclusion and empowerment of minority groups not only benefits these groups, but also enriches society as a whole, but it is a historical achievement, and conquered, over the centuries, with much suffering, as Rui Marques explains:

> The imperial expansions of the last millennium and, more recently, the colonial era designed, until the middle of the twentieth century, a world largely dominated by a few great colonial powers that sought to "civilize" the peoples and cultures they dominated. A vision that was divided between settlers and colonized, where naturally the relations between the dominant and dominated cultures led to one of two models: assimilation, transforming the colonized into as faithful a reproduction as possible of the colonizer, or another option, separating the two socio-cultural realities in a marked way, preserving the "purity" of the colonizing culture, avoiding any

[12]Available in http://conpedi.danilolr.info/publicacoes/66fsl345/9zg132z2/28D42sHuKhxrv6iS.pdf accessed on June 13, 2020

> "contamination". This duality will be successively reproduced, albeit for other reasons, until the most recent models. (MARQUES, 2003, p. 3)

Valuing minorities, including indigenous peoples and traditional communities, is not only a matter of social justice, but also a catalyst for social transformation. By recognizing the richness present in ethnic and cultural diversity, society opens doors to a deeper and more respectful understanding of different forms of existence. This acceptance of diversity also drives significant changes in building a more inclusive society.

RECOGNITION OF DIVERSITY AS A DRIVER OF TRANSFORMATION

The recognition of diversity as a driver of transformation is a fundamental principle in building more inclusive, fair, and progressive societies. It is an approach that emphasizes valuing the multiple identities, cultures, experiences, and perspectives that make up the social fabric. As stated by José Márcio Barros:

> It is with the political, theoretical and methodological construction of human development indicators that this relationship begins to be outlined in a purposeful way, through the expansion of the concept of development beyond economic achievement and the construction of political and cultural indicators. (BARROS, p. 5, 2007)

This recognition of diversity permeates several areas of society, profoundly impacting how we live and interact. It involves the promotion of respect, acceptance and equality, regardless of cultural, ethnic, social or any other differences. The 2004 Human Development Report, organized by UNDP, makes the following statement in its presentation:

> If the world is to achieve the Millennium Development Goals and eradicate poverty, it must first successfully address the challenge of building culturally diverse and inclusive societies. Doing so successfully is a prerequisite for countries to focus appropriately on other economic growth priorities, health and education for all citizens. Human development is about being able to live the kind of life they have chosen and providing the tools and opportunities to make their choices." (UNDP, 2004)

By embracing diversity, societies can enjoy benefits such as increased creativity, innovation, and economic growth. Education plays a crucial role in promoting diversity, helping to combat prejudice and promote intercultural understanding. Nestor Garcia Canclini. (2007):

> The analysis of *diversity* – and of policies aimed at addressing this issue – cannot be limited to defending the rights to speak one's own language and occupy a specific territory. We need to think *interculturally* in research, in educational, legal and coexistence policies so that the defense of the peculiar is articulated with the rights

> of access to national heritage and to the networks of material and symbolic exchange that connect us with the world. (CANCLINI, 2007, *online)*

In addition, the recognition of diversity is intrinsically linked to human rights and social justice, as it implies ensuring equal rights for all citizens. Canclini highlights the importance of culture and emphasizes the importance of human rights in the search for social justice and development, in these terms:

> In favor of a non-economic consideration of development, it is emphasized that culture and communications contribute to community development, education for health and well-being, the defense of human rights and the understanding of other societies. (CANCLINI, 2007, *online*)

Finally, diversity also encompasses biodiversity and the importance of preserving nature. Based on the idea that "the world's cultural diversity is a source of richness that is manifested through dialogue", UNESCO, after the events of 11 September, adopted on 2 November 2001 a significant Universal Declaration on Cultural Diversity. This statement symbolizes the affirmation of the choice of this approach as a guideline for the management of ethnic and cultural diversity.

Based on the comparison with the richness that biodiversity represents for living beings ("... Diversity, being a source of exchange, innovation and creativity, is as essential to humanity as biological diversity is to nature."[13]) and on the inalienable ethical principle of respect for human dignity[14], this Declaration, already in its preamble, emphasizes its objective:

> - "to reaffirm that culture must be considered as the sum total of the distinctive spiritual and material, intellectual and affective traits that characterize a society or social group and that it includes, in addition to the arts and letters, ways of life, ways of living together, value systems, traditions and beliefs; - To note that culture is at the heart of contemporary debates on identity, social cohesion and the development of a knowledge-based economy - To affirm that respect for the diversity of cultures, tolerance, dialogue and cooperation, in a climate of mutual trust and understanding, are among the best guarantees of international peace and security. - To aspire to greater solidarity based on the recognition of cultural diversity, the awareness of the unity of the human race and the development of cultural exchanges. - To consider that the process of globalization, facilitated by the rapid evolution of new information and communication technologies, although it constitutes a challenge for cultural diversity, creates conditions for a renewed dialogue between cultures and civilizations". (UNESCO, 2001, *online*)

Finally, the recognition of diversity as a driver of transformation is a holistic approach that influences all aspects of society. Valuing and embracing diversity not only enriches our

[13] Article 1 of the Universal Declaration on Cultural Diversity; UNESCO
[14] inscribed in article 4

lives but also drives positive change towards a more inclusive, equitable, and sustainable world, as discussed by several authors in their works.

THE IMPORTANCE OF INTERCULTURAL EDUCATION

To foster social transformation, it is essential to invest in intercultural education, an approach that goes beyond merely understanding diverse cultures. The objective of this educational methodology is to dismantle prejudices, cultivate empathy and encourage mutual respect. It is crucial to stimulate interaction between traditional communities and the broader society, aiming to develop a collective awareness of the relevance of cultural preservation and respect for the rights of minorities.

Effectively promoting social transformation requires a commitment to intercultural education, a strategy that transcends a simple superficial understanding of different cultures. This educational approach is deeper and more meaningful, as it actively seeks to deconstruct harmful stereotypes and entrenched biases, thereby fostering empathy between individuals from different backgrounds and experiences. This concept is widely explored by Candau & Russo (2010) in their study on the dimensions of intercultural education in Latin America.

> Equally important is the recognition that in the continent an apology for miscegenation has developed, with different denominations, such as the expression racial democracy in our country, which has configured an imaginary about the social and racial relations maintained between the different groups present in Latin American societies characterized by cordiality. Thus, the conflict is eliminated, continuing to perpetuate stereotypes and prejudices, because, if we follow the logic that the different ethnic-racial groups since the beginning of the colonization process have been integrating "cordially", we can think that the different hierarchical positions among them are due to the capacity and commitment of individuals and/or the inferiority of certain groups. This idea was disseminated in the social imaginary, contributing to societies not recognizing themselves as hierarchical, discriminatory and racist. (CANDAU; RUSSO, 2010, p. 159)

Additionally, intercultural education emphasizes the importance of mutual respect and appreciation of cultural diversity as a key pillar for developing a more harmonious and inclusive society. Bhabha (2013) in "The Place of Culture" offers valuable knowledge about cultural identity and hybridity, fundamental to understanding the complexity of intercultural interaction.

> By proposing this cultural construction of *nationness* as a form of social and textual affiliation, I do not intend to deny these categories their specific histories and particular meanings within different political languages, which I seek to formulate in this chapter are the complex strategies of cultural identification and discursive interpellation that function in the name of "the people" or "the nation" and make them subjects immanent and objects of a series of social and literary narratives. My emphasis on the temporal dimension in the inscription of these political entities—which are also potent symbolic and affective sources of cultural identity—serves to

> displace the historicism that has dominated discussions of the nation as a cultural force. (BHABHA, 2013)

The role of intercultural education is not limited to the school environment alone; it must be a continuous and integrated practice in all aspects of social life. Boaventura Santos discusses the importance of knowledge that considers the various cultural perspectives, essential for a truly intercultural education, especially when the researcher ceases to be the object of the research and starts to collaborate with it with his existential knowledge.

> Gradually, researchers from different social and ethnic-racial groups and/or committed to these social sectors begin to insert themselves in a more significant way in the different universities of the country, especially the public ones, and unleash another type of knowledge production. A knowledge carried out "by" these subjects who, when developing their research, privilege the partnership "with" social movements and extrapolate the still hegemonic tendency in the field of human and social sciences to produce knowledge "about" the movements and their subjects. (SANTOS, 2010, p. 421)

Encouraging open and respectful dialogue between traditional communities and society at large is a crucial step in this process. Interaction helps build bridges of understanding and cooperation, leading to recognition of the rich cultural tapestry that each community brings to the broader social mosaic.

Furthermore, creating a collective awareness of the importance of cultural preservation is key, and this not only enriches global cultural heritage but also ensures that the unique practices, languages, and traditions of each group are maintained and respected. Paulo Freire, in "Pedagogy of the Oppressed" (1987), argues in favor of the use of education as a tool for social transformation and cultural emancipation:

> The pedagogy of the oppressed, as a humanist and liberating pedagogy, will have two distinct moments. The first, in which the oppressed unveil the world of oppression and commit themselves in praxis, to its transformation; the second, in which, once the oppressive reality is transformed, this pedagogy ceases to be of the oppressed and becomes the pedagogy of men in a process of permanent liberation. (FREIRE, 1987, p. 44)

Through intercultural education, it is possible to develop a new generation of individuals who not only tolerate, but value and celebrate differences. This approach can shape a society that better understands global interdependence and the need for solidarity and cooperation between different cultures and peoples. Intercultural education has the potential to transform not only individuals but also social, political, and economic structures, leading to a more peaceful, understanding, and sustainable world.

INTERCULTURALITY AND ECONOMIC AND SOCIAL DEVELOPMENT

The Constitution of the Brazilian State of 1988 brings in its body the economic order as one of its purposes and as one of the pillars of the contemporary democratic State, well in the mold of the structural evolution that Western states underwent in the post-French Revolution.

On the other hand, recognition and respect for cultural and ethnic diversity can be the basis for strengthening local capacities and promoting development strategies that are culturally sensitive and socially just. To understand the importance of interculturality in the economic and social development of indigenous and traditional communities in Brazil, it is necessary to understand the concept of development. To Brand, Colman & Costa:

> Development is a concept constructed within the Western world and directly articulated with its conceptions of progress and well-being. Development projects are initiatives that aim, under the formal aspect, to contribute to the well-being of a group or a population. They intend to contribute to people achieving a less precarious living condition in terms of housing, food security, health, education, communication, among others. It establishes concrete indices to evaluate this improvement in the life of the citizen. (BRAND; COLMAN; COSTA, 2008, p. 171)

The interaction between different cultures can promote the diversity of knowledge and practices, contributing to a more inclusive and sustainable economic development, so it is necessary to adopt mechanisms that change this situation. Mylene Cristina Santiago, Akkari & Mesquida state that:

> In such a context, as long as Brazil does not reconcile and recognize its diversities, it will not be able to take into account and value all its racial and ethnic groups. A country that sustains exclusion and deprives part of its population of the right to citizenship has no way of assuming effective development, because this process presupposes participation with material and social conditions for all. (SANTIAGO; AKKARI; MESQUIDA, 2020, p.231)

The promotion of policies and programs that effectively address the needs of indigenous peoples and traditional communities depends crucially on valuing cultural diversity and establishing intercultural dialogue, carefully considering their specific traditions and modes of knowledge. In addition, the right of access to goods produced by humanity by indigenous and traditional communities has been the subject of discussion among several researchers. According to Cintia Maia e Ferreira:

> In multiethnic societies, the notion of neutrality of the State, in the economic and social spheres, translates into the belief that the mere introduction of legal provisions is enough to guarantee the existence of a harmonious society, where regardless of diversity, effective equality of access to the goods produced by humanity would be ensured to all, but discrimination occurs exactly when individuals are treated equally in different situations, and when different, in equal situations. (MAIA; FERREIRA, 2011, p. 39)

In view of these facts, it is necessary to revitalize cultural practices not only to strengthen the identity of these groups, but also to open paths for the development of sustainable economic activities based on traditional knowledge. The principles that underlie the economic structure must be directed primarily to improve the quality of life of each individual.

For Amartya Sen, in the work Development as Freedom:

> Development must be related above all to improving the lives we lead and the freedoms we enjoy. Expanding the freedoms we have reason to value not only makes our lives richer and clearer, but also allows us to be more complete social beings, acting on our volitions, interacting with the world we live in, and influencing that world. (SEN, 2018, p. 23/24)

In this way, it is possible to combine the promotion of interculturality and respect for ethnic and cultural diversity with the economic and sustainable development of indigenous and traditional communities in Brazil, as stated elsewhere, but it is necessary to implement public policies aimed at this specific purpose.

FINAL CONSIDERATIONS

This article demonstrated the inseparable relevance of interculturality, ethnic diversity and human rights in the context of social transformation in Brazil, reinforcing the importance of the Federal Constitution as a watershed in the protection and recognition of the rights of Indigenous Peoples and Traditional Communities, establishing a framework for the promotion of a more inclusive and just society.

The need for respectful cultural interaction and the recognition of ethnic diversity as crucial elements for the preservation of cultural identity and for the strengthening of democracy and the economic and social development of these communities was proven. This recognition not only safeguards cultural traditions and practices, but also contributes to social cohesion and the economic and cultural enrichment of the country.

The importance of continuous and proactive efforts to ensure that the rights stipulated in the Constitution are effectively practiced and respected was also proven, highlighting that social transformation is a dynamic and constant process, and the protection of the rights of indigenous peoples and traditional communities is a key element for the advancement of this process.

The need for more research and public policies focused on strengthening intercultural relations and promoting ethnic diversity was demonstrated. This not only favors the groups directly affected, but also contributes to cultural richness and the development of a fairer and more equitable Brazil.

Finally, it was proven that the appreciation of cultural diversity is an essential pillar for the construction of a harmonious and progressive future in the country.

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ROADMAP TO IMPLEMENTATION AND MANAGEMENT OF INNOVATION IN THE BRAZILIAN CIVIL CONSTRUCTION INDUSTRY

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ABSTRACT

This study aims to develop a roadmap to be used by a small enterprise that operates in the civil construction sector for the implementation and management of innovation. Bibliometrics were used for the construction of the theoretical framework. The Design Science Research was used to create the proposed artifact and a single case study was used for roadmap validation, indicating practical propositions for companies of the same sector and size as well as theoretical suggestions for future studies. The proposed roadmap was developed from the analysis of the theoretical foundation, mainly in studies that defined similar artifacts. The application of this roadmap in a case study allowed verifying its potential for implementation and management of innovations in the enterprise studied. The roadmapping process generated a roadmap with organized and clear information for customers, suppliers, and employees of the enterprise. It also assisted in the research and selection of innovations to be implemented. Participants showed integration with the proposal and with the process and this integration remained even after the conclusion of the study. The proposed roadmap facilitated the implementation and management of innovations in terms of products, processes, organization, and marketing.

Keywords: Innovation. Construction. Roadmapping. Roadmap.

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INTRODUCTION

Civil construction is a key sector of the Brazilian economy that determines vectors of social development and indicates solutions to social, economic, and technical issues. Society has shown a growing need for habitation; therefore, a higher level of development of the national economy and the construction sector is required to meet this demand. Civil construction is a sector with specific characteristics that hinder the implementation of rationalized actions and technological innovations.

According to the Brazilian Association of Construction Materials Industry - ABRAMAT (2021), the civil construction sector accounted for roughly 6% of the Brazilian GDP in 2020. According to CBIC (2020), despite the economic downturn caused by the COVID-19 pandemic, civil construction was the sector that generated most jobs in Brazil, creating 138,409 formal jobs until October 2020, the best result for the sector since 2013.

Constant technological development and innovations have been transforming the environment and improving living conditions and it is not different in the civil construction sector. The use of innovative technologies, ecologically correct materials, energy-saving materials, information technology, and automated equipment is one of the most important trends in the modern construction industry.

Cavalcante (2019) states that innovation is not only the result of an idea but above all the action to make it effective and generate results for those and/or organizations involved. On the other hand, the implementation of innovations is not a simple task. On the contrary, it is a process of gradual, complex, and multicausal development, whose components of sweat and efforts are even greater than its geniality.

The civil construction sector faces specific barriers to the implementation and management of innovations, namely customer distrust in construction innovation, little government support, the predominance of small companies without the necessary resources for research and development, and the high cost of commissioning facilities (Pushkalova, 2019). Therefore, the roadmap is a tool that can help in this process.

Roadmapping has been applied and disseminated among organizations of different sizes, from small companies to large government policy projects. The aim is to achieve an effective alignment of strategic objectives of an organization with technologies related to products that are considered key elements for the success of businesses (Alcantara & Martens, 2018).

Many enterprises have used roadmapping. For instance, Motorola has used it for product development (Oliveira, 2009), studies on the Brazilian pre-salt layer (Borchevier & Lemos, 2016), the Lego Group for technology innovation and management (Kerr, Phall &

Thams, 2017), and the construction sector for the implementation of total quality control (Cenk & Ukdan, 2022). However, the literature does not report roadmapping use for the implementation and management of innovation in companies in the civil construction sector.

Therefore, this study aimed to develop a specific roadmap for a construction company for the implementation and management of innovations. We also indicated some practical propositions to be implemented by companies in the civil construction sector and theoretical propositions for future studies.

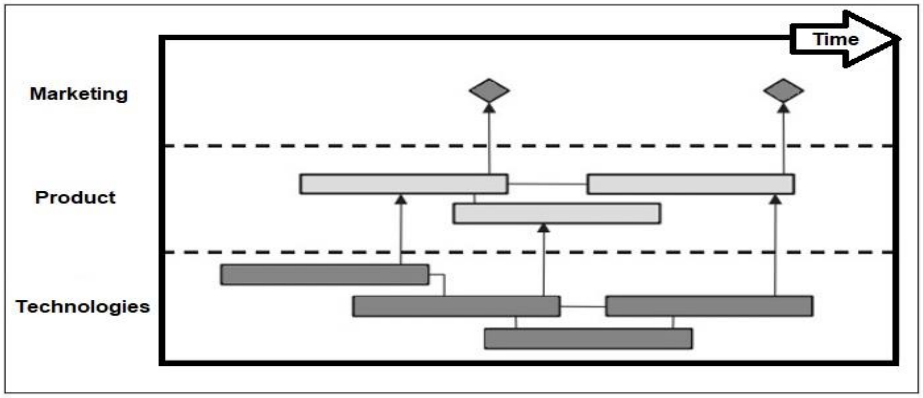
ROADMAP

Roadmapping is a widely used tool for general planning and strategy management, promoting communication between the most diverse sectors of the organization (Lu, Chen & Yu, 2019).

For Lu, Chen, and Yu (2019), companies use roadmapping to develop medium and long-term strategies to achieve business objectives, manage technical strategies, integrate technology and operations, develop technology at an enterprise level, to improve governance and practice, research, and development planning. In this sense, roadmapping has become a clear and organized way to present all the information obtained and consolidated in the process.

Figure 1 presents the generic roadmap in a time-based graph, comprising several normal layers that include commercial and technological perspectives (Gouvêa, 2009).

Figure 1: Generic roadmap.



Source: Gouvêa 2009.

Phaal, Farrukh, and Probert (2001) present other roadmap models (Table 1), following their characteristic functions and main layers.

Table 1: Roadmap Templates.

Name	Characteristic	Layers
Product roadmap	Associate the new aimed products and the technologies necessary for new products, which are defined in the strategic planning of the enterprise, and as new technologies that will be necessary to develop or incorporate that will give support to the development of the new products or processes over a determined time.	Product Technologies
Services and capabilities roadmap	The focus is to understand the influence of technologies on increasing capabilities to obtain a better flow in the company in compliance with trends pointed out by the marketing sector thus determining the events that will start and end the activities, determined in the planning workshops.	Events Marketing and, business trends Capabilities Technologies
Strategic planning roadmap	Presents the current state of the company in the aspects of marketing, business, products, skills, technologies, and organization, determining in the workshops the necessary activities within each of these aspects over time to achieve the objectives outlined by the company.	Marketing Business Products Skills Technologies Organization
Long-term planning roadmap	Presents regional, national, and international information at the workshops to define the technologies needed and highlight the connections and their dependencies, to achieve the company's goals.	Goals
Roadmap for capacity and knowledge planning	Evaluates intellectual resources, processes related to knowledge, knowledge of managers, projects, and activities, listing at the workshops the activities that each aspect should perform over a given time.	Business goals Projects and activities Knowledge of facilitators
Project roadmap	The flow of activities for each process is defined, the milestones that determine each phase of the project, as well as the specific moments for decision-making, in addition to the technological development that needs to accompany and meet the demands of the projects, expressed at the end of the roadmap.	Project Flow Significant points of the project Decision points Technological development
Process roadmap	Allows focusing on understanding how the flow of knowledge develops through the technical and marketing areas of the company over time thus allowing to organize within the workshops the preparation of each department to satisfy the demand of the project at the appropriate time.	Marketing prospects Processes for analysis Technical perspective
Integrative roadmap	Presents the definitions established in the workshops of the form and timing of how, throughout the project flow, the sectors participate in the activities required in the execution.	Components / subsystems / technologies Prototypes / Tests Systems / Technologies Systems in use

Source: Phaal, Farruck and Probert 2001.

PREPARATION ROADMAP

For the implementation and management of innovation, two resources are necessary in addition to agile and unbureaucratic communication. One is the financial resources, as every step towards innovation generates costs and the company is responsible for establishing the limits for the financial resources available, which may come from the company's own budget, financing lines, public development initiatives, or partnerships with suppliers and customers. Another is the qualified human resources needed for the progress of the company's innovation projects.

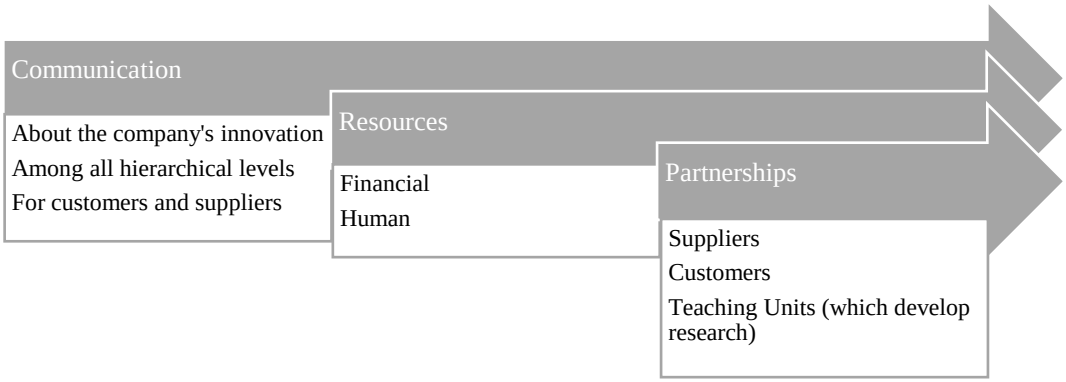
Roadmap preparation establishes partnerships in which companies interact with the government and educational institutions, enhancing the power of implantation and

management of innovation of each company. Partnerships can also be established directly with the different actors of the business model in which the company is inserted. Suppliers can assist with the information and necessary subsidies for innovation. Customers present the demand and generate financial resources thus increasing inputs and outputs and accelerating the innovation process (Docherty, 2006).

Figure 2 shows the Preparation Roadmap with the necessary steps for the subsequent realization of the Innovation Roadmapping, a process that generates the Innovation Roadmapping in Civil Construction. After defining the innovation objectives and a clear vision of its competitive advantages, the new business vision must be communicated to employees at all hierarchical levels, as well as to customers and suppliers. This allows to make all those involved aware of the changes that will occur within the company, providing channels for everyone to communicate in a simple and agile way thus facilitating the implementation of innovation.

Resources must also be provided thus it is necessary to delimit the investments that will be made and the people who will be responsible for managing the innovation roadmapping. After answering these questions, partnerships are sought with suppliers, customers, and educational institutions, mainly those that develop research thus collaborating with the company's needs.

Figure 2: Preparation roadmap.



Source: Prepared by the authors 2022.

When the company's structure is already prepared for innovation, that is, it has fulfilled the phases proposed in the first phase of the roadmap (preparation), and the second phase of the roadmap (innovation) is applied.

INNOVATION ROADMAP

For innovation in civil construction companies, the second phase of the roadmap is divided into four areas according to the (PIT) Technological Innovation Program (2010), product innovation, process innovation, organizational innovation, and marketing innovation, proposing four stages of execution: scenario assessment, idea generation, planning and execution, and evaluation and feedback.

The steps proposed for innovation are repeated in all areas. The first of these steps is the scenario analysis and definition of objectives when the information contained in the strategic planning is selected according to each area of innovation and if additional information is needed to guide the process by defining its objectives.

The second stage, the selection of ideas (Figure 4) presents its specificities in each stage, in the third stage of planning and execution, the ideas chosen in the previous stage are put into practice to be evaluated in the fourth and final stages.

At each stage, there is a validation phase (gate), as guided by Cooper & Sommer (2016), for managers to evaluate the projects in terms of sequence, rearrangement, or withdrawal.

Product innovation starts with the study of the consumer market to understand the demand and define the objectives to be pursued by the company thus recognizing its strengths and weaknesses (Tatum, 1987). After defining the objectives, a portfolio is created that will house the ideas generated and that are related to the objectives outlined. The ideas undergo a selection process, and the execution planning occurs for the selected ones, as in the model of Gosch (2016). Afterward, there is an evaluation by consumers and managers, feeding back the cycle. This process is part of the Civil Construction innovation roadmap (Figure 3).

Figure 3: Innovation Roadmap.

	Pre workshop	Workshop		Post workshop
	Evaluation of scenarios and definition of objectives - gate	Selection of ideas - gate	Planning and execution - gate	Evaluation and feedback
Product	Market assessment	Selection of products that meet consumer demands	Planning and procurement	Assessment of the consumer market and company managers
Process	Assessment of available technologies	Selection of technologies that meet the objectives	Company workforce training Acquisition / deployment Development / implementation	Assessment of the company's Managers and employees

Organizational	Search for best practices	Selection of best practices	Decentralization of processes Expansion in communication	Assessment of the company's managers and employees
Marketing	Assessment of the company's and competitors' strategies	Selection of new marketing strategies Selection of new communication channels	Social media management Establishment of the learning strategy Generation of new communication channels: company / supplier / customer	Assessment of the company's managers

Time

Source: Prepared by the authors 2022.

Process innovation starts with the evaluation of new technologies available in the market, either through trade shows, the CBIC innovation catalog, or specialized and academic magazines, as suggested by Borchevier & Lemos (2016), to choose the technologies that meet the company's needs and objectives. Afterward, the company trains its workforce by developing its employees, boosting innovation capabilities (TATUM, 1987). Defined by the acquisition of technologies for the new processes or their development by the company itself, the new processes are incorporated into the existing means of production and the employees responsible for the new processes evaluate the results thus feeding back the cycle of constant improvement (ISO, 2019).

Organizational innovation starts with the search for the best management practices to define the objectives to be followed, initiating an organizational change that may include expansion in communication, decentralization of processes, establishment of a training program for employees or other practices. These practices are then implemented with the evaluation of the results following the guidelines of ISO 56000 (2019).

Marketing innovation completed the four areas of innovation in civil construction with the evaluation of the scenario in which the company is inserted as well as the evaluation of its competitors, as proposed by Jonash & Sommerlatte (2001). Next, new marketing strategies are established that undergo media management, the establishment of the company's learning strategy based on customer feedback. There is also the generation of new communication channels between suppliers, the company, and customers with the assessment of the process by the company's managers, giving feedback to the cycle.

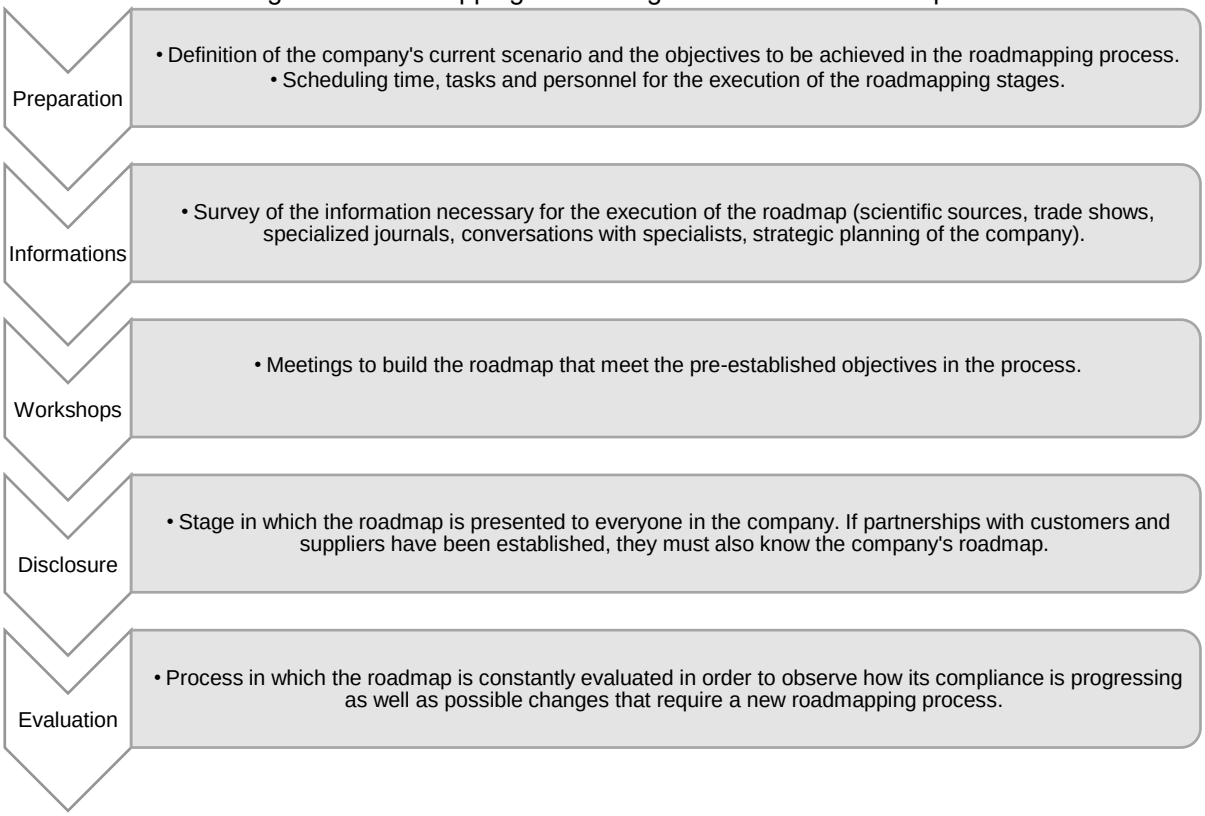
ROADMAPPING EXECUTION

This study gathered points of convergence about the stages of roadmapping development, namely gathering information necessary for the process, whether through scientific material, such as articles in journals, or patent research, or by organizations

dedicated to the area, such as CBIC, trade shows, and market research. There is also the definition of objectives and goals to be achieved in this process, the choice of human capital that will participate in the roadmap construction workshops as well as the construction of the roadmap and its constant evaluation and updating.

According to the literature and meeting the specifications of the civil construction industry, the following implementation roadmap is presented, which covers the proposals by Gouvêa *et al*. (2019) and Borchiver & Lemos (2016) and encompasses: preparation, information gathering, workshops, dissemination, and evaluation (Figure 4).

Figure 4: Roadmapping for building the innovation roadmap.



Source: Gouvêa *et al*. (2019).

Preparation and information corresponding to the first stage of the process must be carried out by the company's managers as well as those responsible for roadmapping, who will select the staff that will participate in the workshops of the stages of generation and selection of ideas and planning and execution.

The workshops must be programmed for the participants to have all the necessary information and enough time to complete the steps. The company must provide the necessary physical space and materials.

Disclosure is the stage in which the roadmap resulting from the work is presented to employees, suppliers, and customers.

For the evaluation, a protocol defined by those responsible for the roadmapping project in the company must be followed. According to the area selected, the members who will participate in the evaluation meeting are requested to identify whether the objectives are being achieved.

RESEARCH METHODOLOGY

This section presents the steps followed to conduct this research, which is classified as applied scientific research. The objective is to generate knowledge to be used in the construction industry. It started with a bibliometric study when the materials gave a basis for the theoretical foundation of the research. For its development, the Design Science Research (DSR) method was used, which enabled the creation and validation of the proposed artifact - civil construction innovation roadmap - through a case study.

BIBLIOMETRICS

By defining the research object and its problem question "How to use roadmapping to implement and manage innovations in a construction company?", we sought to define the themes that would be necessary for the theoretical basis of this research: innovation in companies, innovation in civil construction, innovation management, strategic planning, and roadmapping.

Web of Science and Science Direct databases were used and the topics in English were researched: innovation in companies, innovation in the construction industry, management of innovation, and roadmapping, such as the connectors *and* & *or*.

The search for these keywords returned 375,678 articles. Separating the articles from the last five years and in journals with A1 or A2 qualifications, the number came to 13,679 articles. Selecting the search to present the terms searched in the title, we arrived at 1,350 articles, and, from these articles, 300 articles with the largest number of citations were selected and 95 articles were used by reading their abstract.

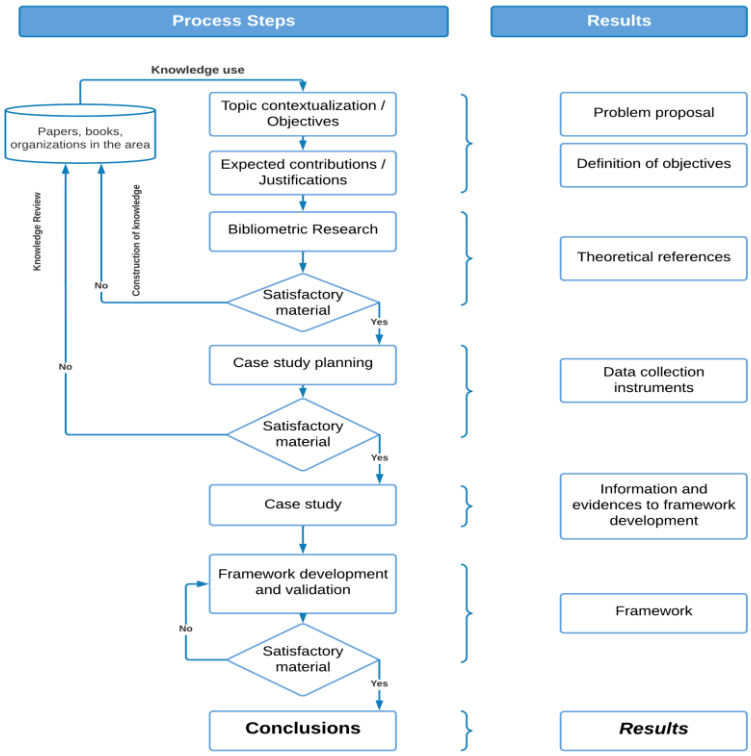
DESIGIN SCIENCE RESEARCH

The Design Science Research (DSR) method is science-oriented toward the generation of knowledge, aiming to design and develop solutions to improve existing systems or create artifacts that improve human performance in society or companies seeking satisfactory results (Dresh, Lacerda & Antunes, 2015). This method suits the main objective of this research to develop a roadmap for the implementation and management of innovations.

The methods presented were used as shown in Figure 5. After doing an exhaustive bibliography analysis and a case developed, it was possible to understand the problem and define the parameters of the artifact proposed as a roadmap for the implementation and management of innovation in the civil construction industry in Brazil.

For the validation of the developed artifact - the civil construction innovation roadmap – the present study was focused on a case study, intentionally selected, as the conditions and complexity of the study analysis demanded specific data from a particular company to investigate a certain contemporary phenomenon within a real context (Cauchik, 2007). The sources of evidence used in the study were company documents, observation of participants, annotation of the successes and errors of the model, as well as interviews with those involved in the process.

Figure 5: Research design.



Source: Prepared by the authors 2022.

The study was carried out at the company Vip Serviços e Construções, following the steps proposed by Cauchick (2007): defining a theoretical conceptual framework, planning the case, conducting the study, collecting data, analyzing data, and generating reports.

RESULTS OF THE RESEARCH

The case study is a qualitative method that contributes to a better understanding of events that occur locally and individually, as organizational processes (Yin, 2001). As

previously mentioned, the company chosen for the case study was Vip Serviços e Construções LTDA. The enterprise has operated in the civil construction sector since 1995 with the following vision: become a reference in the execution of high-standard works and fine carpentry in the greater São Paulo as well as in the Vale do Paraíba region, representing around 10% of the market share in its city of origin (Company Files, 2021).

Five propositions were defined, based on the roadmapping in the company and the theoretical framework that supports the development of the study propositions: a) the roadmap increases communication between managers, employees, and suppliers, which is an important characteristic in the implementation and management of innovation; b) the roadmap demonstrates in a clear and organized way the company's objectives and the paths to reach them in the foreseen time; c) the roadmap helps in the process of researching, defining, and implementing innovation in the company; d) the roadmap integrates the organization around its innovation objective; and e) the roadmap allows the management of innovation in the company's product, process, organizational, and marketing areas.

DATA COLLECTION

Data collection involved observations, document analysis, and interviews carried out at different stages of the case study: a) preparation roadmap; b) development of the innovation roadmap; and c) validation of the innovation roadmap.

PREPARATION ROADMAP

The case study was carried out following the proposal defined in this work, starting with the preparation roadmap, and seeking market and company data to support the definition of the objectives to be achieved by the roadmapping process.

Market data was obtained mainly from CBIC, which provides real estate indicators quarterly on current and future scenarios, focusing on marketing digital innovation, to insert the objective of the brand in the new media and social networks. Documents referring to social media trends were also selected. The company's data were obtained through observation and document analysis.

During the roadmapping process, the company kept two works in progress: a renovation of a commercial property of approximately 120m² consisting of an adaptation of commercial property for a future store and a work of approximately 100m² of the deck added to a round pergola of 4 m in diameter above the hot tub.

During the observation period, the presence of company professionals and contractors in addition to the responsible architect can be seen. The foreman is responsible for the organization, for the process of reading the project, as well as for the integration between all workers, coordinating the logistical process to ensure that one worker does not disturb or delay the work of the other. The foreman is also responsible for managing the stock of inputs and communicating in advance about the need for materials for the works.

When asked about innovation, company's workers were familiar with the topic related to technologies, such as cell phones and computers, and new types of televisions. However, when asked about innovation in the civil construction environment, few were able to give an opinion on the subject.

The architect showed knowledge on the subject, however, when asked about the innovations adopted in his projects, he informed that his focus was the traditional construction in which professionals are already used to working and clients are already familiar with requesting. In this traditional mode, the architect highlighted that more zeal innovations of the tools allowed to speed up the work, in addition to gains in preventing the exhaustion of employees.

Workers involved with internet and monitoring systems cited disruptive and incremental innovations that could occur in their areas and that would improve and increase the efficiency of their services, such as optical fiber, wireless monitoring, digital data center, data mining, and protection systems of the environment in case of invasions.

In the construction of the deck and pergola, workers reported that they already had training regarding innovation, since the round pergola is an innovation that was developed by the company. They discussed the new execution technique that was improved and developed.

THE ROADMAPPING PROCESS

For the development of the innovation roadmap for Vip Serviços e Construções LTDA company, the steps defined in the developed artifact were followed: a) planning; b) selection of personnel to participate in the roadmapping; c) workshop; d) construction of the innovation roadmap; and e) dissemination of the innovation roadmap.

Planning

The planning process was carried out together with the company's owners, seeking to define the objectives and goals to be achieved with the roadmap. The need to survey indicators and innovation possibilities in all areas helped the company in the process of

researching, defining, and implementing innovation. However, data selection occurred only assertively after defining the objectives and possibilities that the company presents.

Selection of personnel to participate in the roadmapping process

After surveying the documents that would serve as the basis for the discussions in the roadmap preparation, obtained from entities and qualified professionals in each area of innovation, it was decided that it would be better for the company to have the participation of the partners, of three masters, who are linked to the company, a supplier of raw materials who owns a lumber company in the region that has worked in partnership with the company for over ten years, a client, and an architect who designs and monitors the projects to be carried out by the company.

Workshop

Between 2020 and 2021, during the execution of the workshop, the country was experiencing the COVID-19 pandemic; therefore, participants with any symptoms were asked not to participate in face-to-face activities. However, all participants selected were well and their body temperatures were checked. Masks and face shields were worn throughout the process.

A face-to-face lecture was scheduled for the beginning of the activities; however, a Youtube lecture was presented, and the interaction and exchanges, and possibilities of questions were left for the next experience, the participants showed dedication to the process, studying the documents available and researching others to be discussed.

During the workshop stages, there was constant interaction between all the participants. The exchange of experiences between the designer, the raw material seller, and the company's personnel, always discussed the best possibilities, and the proposed ideas were summarized in a consensus to be consolidated in the innovation roadmap.

Innovation roadmap construction

After the workshop, the company's partners consolidated the ideas and information proposed in the workshop thus creating the company's innovation roadmap. In this process, the volume of information and its quality were observed, as well as the information that emerged through the proposed activity in the four areas of innovation - product, process, organization, and marketing.

Figure 6 shows the result of the roadmap obtained. The roadmap was presented to employees and then it was posted on the works in progress. The roadmap was presented

and distributed digitally to the company's suppliers and customers thus enabling the alignment of objectives and demand forecasts for both.

Figure 6: VIP Roadmap – Services and Construction.

	Pre workshop	Workshop		Post workshop
	Evaluation of scenarios and definition of objectives - gate	Selection of ideas - gate	Planning and execution - gate	Evaluation and feedback
Product	Research in journals in the field, institutions, such as CBIC, papers, and through survey research with customers and suppliers, defining the objective to offer faster and cheaper works.	During the workshop and following the company's objectives, the feasibility of the options was studied. It was decided to work with EPS Construction and Construction with concrete and PVC.	In the workshop, employees were selected to be trained and the definition of the execution of a 100m² work with two technologies for learning and evaluation.	Quantitative evaluation measures and compares the time of the work and their costs by the company's managers and by qualitative research with customers and partners.
Process	Evaluation of new technologies available in institutions, such as CBIC and websites of specialized companies.	With the completion of the workshop, the tools of the Argafast line were chosen from the options presented.	The collaborators were selected for training in the courses and the guidelines for the submission of the new process produced for the patent were defined. Enter the process at the INPI.	Qualitative evaluation of managers observing execution times and employees regarding performance, easiness of use and ergonomics.
Organizational	Conducting research on scientific articles, seeking the best management practices in the field	With the workshop, the BIM and Construct App were chosen.	Planning for the decentralization of decisions, increasing the autonomy of employees, defining those responsible for training in BIM and the selected App, purchasing the program and the App, and contracting the courses.	Evaluation of managers with a focus on easiness and agility in planning and employees' evaluation on simplicity and precision in methods.

Marketing	Conducting research regarding competitors' marketing strategies compared to the company's marketing strategies.	During the workshop, among the proposed options, the use of Instagram for the company's new communication strategy was defined.	During the workshop, Instagram management planning was carried out, definition of training in the field, and partnership with micro influencers in the region.	Assessment of managers observing revenue and engagement on social networks.
January 2021		February 2021	July 2021	July 2022

Source: Prepared by the authors 2022.

PUBLICATION OF INNOVATION ROADMAP

With the consolidation of the roadmap, a meeting was convened with all the company's workers to present the result of the roadmap and the company's new actions to achieve its goals.

There was greater confidence on the part of employees as they were involved in the process, as well as a greater acceptance of the new guidelines, which represents a welcome and expected change on the part of managers.

With the roadmap completed, including its dissemination, four people were chosen for the interviews to validate the tool developed and presented in this work. The interviews occurred in a semi-structured way and according to the participants' schedules and availability. One interview was conducted in person, two by WhatsApp, and one by telephone. The conversations were transcribed and sent to the interviewees to validate their answers and agree to publish, only omitting their names.

From the workshop participants, the company's partner, the architect, a master builder, and the supplier were chosen for the interviews. The themes were discussed to validate and improve the tool according to the propositions raised and to answer the research question. Comments that could contribute to the themes were selected, as can be seen below.

MASTER OF WORKS

Theme 1: communication

For those of us who have worked on this for many years, we know that communication in our area of activity faces animosities of each work sector. The tile settler is uncomfortable with the bricklayer, who bothers the painter, who believes that the architect only knows how to use paper. Having a tool like this and the experience of everyone being

able to work together toward a goal, I believe greatly improves communication between all of us.

Theme 2: organization, and clarity of information

Normally, many voices are heard throughout the construction process. Demands of several people, which end up confusing and delaying the production process, so being able to have a figure like this affixed to our construction sites makes everything organized. And it is clear to all participants of the work that can understand the objective to be achieved and the owners' expectations regarding their performance.

Theme 3: assistance in choosing, implementing, and managing innovation

When new technologies arrive to construction sites, they usually face some resistance as they are practically imposed on workers, I believe that with our participation in the company's choices and decisions, this process will be facilitated.

Theme 4: team integration

I enjoyed the experience. In no other company I've ever worked for I have been able to participate in an activity like this, as there were people from all areas. I believe we have promoted better integration between everyone, but we'll wait for the next executions to confirm.

Theme 5: efficiency in all areas of innovation

From what was proposed to us before starting the process, I believe that we have discussed the objectives, goals, and paths to be followed to achieve them in all the proposed areas, which creates a great challenge for the company, but we are committed to catching up.

SUPPLIER

Theme 1: communication

With the door open, we have contact and communication with all the participants of the executions. Architects come to observe the new materials, customers make budgets and purchase their wood and carpenters pass on their lists and needs so that we can serve them. But gathering all parts involved in a room and with a focus was an aggrandizement experience, without a doubt.

Theme 2: organization and clarity of information

The process was very well organized. The materials that were sent to us along with the last briefing, made everything very clear and the workshop was also very organized with the schedules always placed and the focus to be observed at each moment. I found everything very clear and transparent.

Theme 3: assistance in choosing, implementing, and managing innovation

Understanding the needs that the company has, and its trends will also help us to jointly supply the materials arising from this new demand. And we have time to adapt to this, which I believe is the great key in this implementation process, where everyone must work together and, on our part, supply the needs of differentiated materials.

Theme 4: team integration

As I said, we have the facility to be daily exchanging information with all the gears of this mechanism. But this is the first time that, together, each one in their area, we managed to discuss matters in a unified way.

Theme 5: efficiency in all areas of innovation

Of all the topics covered in this experience, the one that I will bring most to my company is organizational innovation, where I share the decisions and goals taken by VIP. And I intend to adopt software that facilitates and improves our administration.

ARCHITECT

Theme 1: communication

We have some communication difficulties in our sector, where the information ends up being passed on through too many ears until it reaches those who will carry out the work. With a complete tool like this, I believe that even our office can benefit, investing in innovation workshops also to our company, which has its peculiarities and differences about VIP even being in the same sector.

Theme 2: organization, and clarity of information

I believe that the best part of organizing the experience was the materials sent in advance, which allowed us to study and understand the demand that would be charged, in addition to guiding our search for materials that we believed could also be useful to the process.

Theme 3: assistance in choosing, implementing, and managing innovation

From what I saw, it seems that the contribution of each one in the choice of trends and technologies that VIP will work with was very significant and the company had good receptivity throughout the process with all the information and visions that each one shared.

Theme 4: team integration

There was clearly a little tension at the beginning among all the participants, some were a little embarrassed. But with time and interactions, it passed, and the dynamic presented itself as very fluid and integrating all and all opinions.

Theme 5: efficiency in all areas of innovation

Several paths to be followed in all the proposed areas were pointed out and defined, logically within the experience of each participant who did not present the same resourcefulness in all areas, but who contributed to their vision.

PARTNER OF THE COMPANY

Theme 1: communication

As the founder of the company, I have always understood communication as a way of expressing the execution needs. We had, however, with the preparation and development of the activity, I realized that communication in our company can and will become a differentiated capacity, providing us with better results in the course of our work.

Theme 2: organization, and clarity of information

As we prepared this activity precisely thinking about making the information clear and organized, both the information that was passed on in advance to the participants and the information that was obtained in the workshop, aiming to use them in our strategies and the clearer and organized they are, the better their use will be.

Theme 3: assistance in choosing, implementing, and managing innovation

The opinions of all people who are directly or indirectly part of our daily work allowed us to choose technologies and innovations that, in addition to being attainable by our company, will give us some competitive advantages over our competitors thus fulfilling the objective of the activity and aiming at our forecasts of increased demand for the coming years, in addition to the insertion of the brand in the Vale do Paraíba region.

Theme 4: team integration

I had never thought that we could develop an activity like this in which everyone could give their opinion and interact constructively. We have faced difficult times for the business in recent years and it is very gratifying to see everything recovering little by little with more determination, with more knowledge, and with more disposition, which reinforces the certainty that the more knowledge, the more balance, and wisdom to experience all the ups and downs of any company.

Theme 5: efficiency in all areas of innovation

Of all the proposed topics, we are very grateful to all the participants who dedicated themselves to the fullest, understanding the briefing, our needs, and capabilities now, understanding the information provided, and bringing even more content to enrich the workshop in all the proposed areas that we will remain firm to fulfill the defined objectives.

DISCUSSION AND INTERPRETATION OF RESULTS

Organizations need to transform their communication processes into communication capabilities (Johannessen & Olsen, 2011), which constitute a system that preserves value creation and combines economic and technical communication, communication management, and social and cultural communication (Johannessen & Olsen, 2011). The roadmapping process is widely used for general planning and strategy management, promoting communication between the most diverse sectors of the organization (Lu, Chen & Yu, 2019).

Regarding the company studied, it was observed that communication was restricted and rigid usually in a top/ down system. The demand originated from the customers and was passed from the company's owners to the masters who presented the demands to the bricklayers and helpers for execution.

Considering the preparation proposed by this research in the roadmap for the civil construction enterprise, in the first phase, some information regarding the company's strategic objectives began to be shared with employees of all hierarchical levels, in addition to customers and employees, changing the old information flow allowing greater fluidity.

The responses of the employees and the owners showed that the change in the communication system proposed and experienced during the workshop presents a positive perspective for the near future, considering the greater easiness of implantation of innovation in the company, that is, new products and processes face fewer restrictions on the part of employees on a day-to-day basis.

Therefore, Proposition 1 can be raised: roadmapping increases communication between managers, employees, and suppliers, which is an important characteristic in the implementation and management of innovation.

For Lu, Chen, and Yu (2019), companies use roadmapping to develop medium and long-term strategies for the execution of business objectives, managing technical strategies, integrating technology and operations, developing technology at an enterprise level, governance and practice, and research and development planning. The roadmap presents all the information obtained and consolidated in the roadmapping process in a clear and organized manner.

Observations in the works showed that information circulated without documents for its organization and that employees knew little about the company's strategic objectives.

During the workshop, it was noticed that the company's employees who participated in the roadmapping process became better acquainted with the strategic objectives. In addition to participating and contributing to the activity, they started to have in their hands and attached to their work, the roadmap that contained the results of the information that was discussed in a simple and clear way.

The clear and objective roadmap demonstrates the company's intentions and the paths that will be followed over time, preparing everyone for each step that will come. Therefore, the roadmap needs to present information in a clear and organized way to all members of the company, its partners, and customers, which allows creating Proposition 2: the roadmap demonstrates in a clear and organized way the company's objectives and the paths to be reached in the foreseen times.

The roadmap can provide a means to improve an organization's "radar" to extend planning horizons and to identify and evaluate potential threats and opportunities in the business environment (Martin, Ralf, and Phaal, 2013). The collection of information necessary for the execution of the roadmapping process expands the horizons and the company portfolio of innovations (Martin, Ralf, & Phaal, 2013).

The company under study is a traditional company and presented issues related to innovation were little considered. It was noted that roadmapping made the owners dedicate themselves and research the topic. Among the proposed objectives and the organization's capabilities, a portfolio of possible items to be implemented was created, in addition to defining priorities and deadlines for implementation.

Roadmapping generated a change in the company's strategic planning that can be observed with the change in its mission. The mission Vip Serviços e Construções LTDA company carry out commercial and residential works in an innovative way, with quality and

fair price, making the process of building their dreams a pleasant experience for our customers thus generating profitability and the affirmation of the brand of Vip Serviços e Construções LTDA.

Therefore, it is possible to raise the following Proposition 3: roadmapping helps in the process of researching, defining, and implementing innovation in the company. The implementation process needs to be observed with more time to conclude, even though the company's expectations are high in this regard.

It may be necessary to bring in experiences from outside the organization in related technology fields, markets, or industries, to gain a broader view of potential opportunities and threats, integrating all participants around its objective (MARTIN, RALF & PHAAL, 2013). This demonstrates the potential of roadmapping to integrate participants even if they do not come from the company under study, harmonic integration was observed among all workshop participants even before the workshop occurred. From the moment the information was received, a WhatsApp group was created among everyone to discuss the proposed information and objectives, in addition to collecting more information for roadmapping.

The company expects that the roadmap presented in the works, preceded by its presentation, can aggregate the team toward the objectives, goals, and proposed paths. However, more observation time would be needed to assertively complete the integration of the entire team.

It is concluded that workshop participants showed clear integration, starting even before the workshop, and continuing even after its conclusion, which allows the construction of Proposition 4: roadmapping integrates the organization around its innovation objective.

There are roadmaps aimed at defining the innovation strategy and which have been used to define the trends and needs of each sector of activity, in terms of defining strategic objectives, innovation goals, and common actions to all involved (Gouvêa *et al*., 2019). This type of roadmap is generated as a function of the market for products and technologies that point to an increase in the company's competitiveness.

There are also roadmaps for planning products and technologies, which are generated to define more specific goals and objectives related to the development of products and technologies and are used to establish technical and performance requirements for the products to be developed (Gouvêa *et al*., 2019).

It was observed that the company under study showed little contact with innovation, and it did not have any system for its management. The result obtained in the roadmap

demonstrates that innovations will be implemented in the company, their sequence, the periods of such activities, and the evaluation process for each in all the proposed areas.

The analysis of the propositions raised here showed that the method proposed in this research favors the construction of Proposition 5: roadmapping allows the management of innovation in the areas of product, process, organization, and marketing of the company. More observation time is needed to assess the efficiency of the proposed tool in the construction industry.

CONCLUSIONS

The development of a specific roadmap for the construction enterprise using Design Science Research and its validation with a single case study showed that this research fulfilled its main objective: develop a roadmap to be used by a small civil construction company for the implantation and management of innovations, raising some theoretical propositions for future studies.

The study also allowed to raise practical propositions to be tested in future studies for the creation step by step of roadmapping. Such propositions are based both on the roadmapping carried out in the company under study and on the theoretical framework used aiming at a link between what is proposed by the literature and the results of the empirical research.

It can be observed that effort and perseverance, in addition to knowledge, and partnerships to be established by the company studied are fundamental in promoting innovation, whether with suppliers, customers, or educational institutions. It is important to highlight the positive achievements that the research brought to the company, expanding the company's focus on innovation and the new organizational and technological guidelines of the market.

The case study allowed the company to incorporate innovation into its guidelines, developing a roadmap that meets its objectives and is within its organizational capacity.

The limitations of the research, according to Cauchick (2007), refer to the importance of replicating the experiment in other companies to verify and compare the results, which allows obtaining more robust data and generalization of the results. In any case study, there is a bias on the part of the researcher; however, we aimed to mitigate this limitation by presenting the transcripts of the interviews to the interviewees to confirm them and making them available for the reader to follow the conclusions.

Time was also a limiting factor, both for interviewing all workshop participants and for testing the artifact in other companies. The process needs to be continually re-evaluated and the suggested propositions deserve detailed investigation.

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ARTIFICIAL INTELLIGENCE AND EDUCATION IN LIQUID MODERNITY: BETWEEN CHARMS AND RISKS

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ABSTRACT

This reflection comprises the impact of Artificial Intelligence on Liquid Modernity and Education. We live in an era marked by intense dependence on technological resources, essential for work, studies and various activities that both sustain and threaten human life. The central dilemma lies in the relationship between the human being – the only one endowed with rational intelligence, with natural potential and cultural improvement – and the machine, equipped with Artificial Intelligence. Created by human reason, Artificial Intelligence proposes, to a certain extent, to replicate and even replace people's intellectual capacity, raising ethical and existential questions about the limits and possibilities of this interaction. This reflection critically rehearses perspectives and questions based on bibliographic studies and the messages presented in a wide range of films. In Alan Mathison Turing's conception, in Artificial Intelligence, for thousands of years humanity has sought to understand how the phenomenon of thinking and knowing occurs. This perspective seems to have activated the "field of Artificial Intelligence" to go further and "not only understand, but also build intelligent entities". Turing's work began shortly after World War II, and in 1956 he coined the term Artificial Intelligence. Understanding Education in the context of technology and the advancement of Artificial Intelligence, in the light of sociologist Zygmunt Bauman, in 44 Letters from the Modern Liquid World, especially in the chapter "Is the world inhospitable to Education?", leads us to reflect on a crisis that humanity is going through. Unlike previous crises, the current one affects several sectors in a deep and accelerated way. As Artificial Intelligence advances, pushing ethical boundaries and challenging the control of rationality, it becomes imperative for humanity to adopt a critical stance. Education, in this scenario, must promote a continuous dialogue with technology, allowing the decisions made to impact all spheres of society. In addition, the advancement of Artificial Intelligence can aggravate social and economic inequalities, directly reflecting on culture and Education.

Keywords: Artificial Intelligence. Liquid Modernity. Bauman. Education.

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INTRODUCTION

This article addresses the theme of Artificial Intelligence (AI) and Education in Liquid Modernity by Zygmunt Bauman, with the aim of better understanding the relationship between these three elements. AI and Education, in particular, play a key role in the development of today's society and are likely to serve as a basis for building a future society. However, it is essential to consider the third element of this triad: Liquid Modernity. We live in a world heavily influenced by the media, social media, and AI, which has profound impacts on the entire society. Inevitably, these reflexes also reach schools and students, shaping their experiences and challenges in the educational process.

Our ancestors faced great difficulties in accessing information, often having to travel long distances to centers of knowledge, investing considerable financial resources in these journeys. Currently, paradoxically, the scenario is one of constant information bombardment, coming from the media and social networks. When we analyze this panorama carefully, it becomes evident that the excess of information can be as harmful as its scarcity. Today, the great challenge is to orchestrate in our minds all the information and know which are true and which are marketing products, which have no relevance and, whenever we receive information, we must research who is informing, what is their knowledge on the subject and if the source is really reliable.

In this line, when we resume the discussion on Education and its relationship with Liquid Modernity and technologies, we resort to the theoretical support of one of Zygmunt Bauman's most relevant works – *44 Letters from the Modern Liquid World*. In the author's opinion, Education has always gone through difficult times, but the current crisis is very different from previous crises, since it is much deeper and more structural. This is clear when he states, in chapter 23, with the subtitle "Is the world inhospitable to Education?", that the "'crisis of education' that is so much discussed in our days is not absolutely new". (Bauman, 2017, p. 112).

In another part of the book, he writes, to complement this theory: "the history of Education has always been full of crucial periods in which it became evident that tried and apparently reliable assumptions and strategies were losing touch with reality and needed to be reviewed or reformulated" (Bauman, 2017, p. 112). In this part, we perceive the author's concern with the changes and restructuring of Education. Bauman reiterates this concern when he states: "it seems, however, that the current crisis is different from the previous ones." (Bauman, 2017, p. 112).

For him, "the challenges of our time impose a hard blow to the very essence of the idea of Education formed at the dawn of the long history of civilization" (Bauman, 2017, p.

112). In other words, for the first time in the history of Education, there is a profound criticism of the entire structure of Education and its foundations, which have served as a basis for generations, as he asserts when he states: "they call into question the 'invariants' of the pedagogical idea: its constitutive characteristics, which resisted unscathed all the crises of the past, its assumptions never before criticized or examined, much less condemned for having followed their course and needing replacement". (Bauman, 2017, p. 112).

THE EMERGENCE OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) is integrated into our daily lives and its origins date back to the post-World War II period. In this context, AI initially emerged as an attempt to decipher the codes of machines and the riddles used by the Nazis. One of the central characters in this endeavor was Alan Mathison Turing, whose contribution was decisive to the victory of the Allied forces.

Another significant aspect of Turing's work is the so-called "Turing test", proposed by him in 1950. This test aims to provide a satisfactory operational definition of intelligence by establishing that a computer is considered intelligent if, when questioned by a human interrogator through written questions, the latter is unable to discern whether the answers come from a human being or a machine. According to the criteria established by this test, the computer must possess the following capabilities: natural language processing, which enables effective communication in a natural language; knowledge representation, which provides the storage of acquired information; automated reasoning, which uses stored information to answer questions and formulate new conclusions; and machine learning, which makes it possible to adapt to new circumstances and detect and extrapolate patterns.

According to the book *Artificial Intelligence*, by Stuart Russell and Peter Norvig, it is possible to conceive eight definitions of Artificial Intelligence, organized along two dimensions (Russell; Norvig, 2013, p. 24). Artificial Intelligences are intrinsically linked to thought and reasoning processes (Russell; Norvig, 2013, p. 24). In this framework, the expressions that refer to "thinking like a human" and "thinking rationally" are related to the domain of reasoning, while the expressions "act like human beings" and "act rationally" refer to behavior.

Additionally, to enrich the expressions, we can consider the act of thinking and acting in a way analogous to human behavior, evaluating success based on the achievement of objectives related to human performance. On the other hand, expressions

such as "thinking rationally" and "acting rationally" measure success by comparing it with an ideal concept of intelligence, called rationality. "Historically, all four strategies for the study of AI have been followed, each by different people with different methods." (Russell; Norvig, 2013, p. 25).

Regarding the beginning of technology, we highlight an excerpt from the work in which the authors state: "the first work now recognized as AI was carried out by Warren McCulloch and Walter Pitts (1943)" (Russell; Norvig, 2013, p. 41). This work is of fundamental importance, because artificial neural networks are part of any robot or autonomous machine today, and if they don't find anything to replace them, they will exist for a long time in the future. In one part of the book, Russell and Norvig explain how they began the study of neural networks. They drew on three sources: knowledge of the basic physiology and function of neurons in the brain; a formal analysis of propositional logic created by Russell and Whitehead; and Turing's theory of computation. These two researchers proposed a model of artificial neurons, in which each neuron is characterized by being "on" or "off" with the switch to "on", occurring in response to stimulation by a sufficient number of neighboring neurons. The state of a neuron was considered "equivalent in concrete terms to a proposition that defined its adequate stimulus." (Russell; Norvig, 2013, p. 41).

Thanks to the ideas of McCulloch and Walter Pitts, later, two Harvard students, Dean Edmonds and Marvin Minsky, built the first neural network computer in 1950. "SNARC, as it was called, used 3,000 electric valves and an autopilot mechanism taken from a B-24 bomber to simulate a network of 40 neurons" (Russell; Norvig, 2013, p. 41), that is, the first equipment began with a very simple and basic technology. In order to understand the topic in question in more depth, it is essential to identify the place that gave rise to the AI research. In this context, we highlight Princeton, which was also home to a notable researcher in the field, John McCarthy. McCarthy later transferred to Stanford University and, further on, to Dartmouth College, which is widely recognized as the birthplace of the study of AI.

John McCarthy joined other researchers such as Minsky, Claude Shannon, and finally Nathaniel, and organized a seminar with the goal of bringing together researchers from all over the United States who were interested in autonomous theory, neural networks, and the study of intelligence.

LIQUID MODERNITY AND EDUCATION

In the analysis of the work *44 Letters from the Modern Liquid World*, by Zygmunt Bauman, we observe a deep reflection on the role of Education in Liquid Modernity. The author expresses his concern with consumerism, highlighting that the logic of disposal permeates contemporary relations. Bauman emphasizes that, nowadays, objects and experiences are often considered obsolete as soon as they lose their momentary usefulness, without the prospect of reuse. This critique of consumerism reveals a concern about the impact of this phenomenon on social and educational dynamics: "our world increasingly resembles the 'invisible city' of Leonia, described by Italo Calvino. More than the things that are manufactured, sold or bought every day, Leonia's opulence is measured by the things that are thrown away every day to make room for new ones." (Bauman, 2017, p. 113).

The predominant consumerism in contemporary society exerts a significant influence on the perception of value in several aspects, including Education. As argued by Bauman (2017, p. 113-114), the notion that education can be seen as a "product" to be acquired and preserved indefinitely is discouraging and, without a doubt, does not contribute to the institutionalization of the school. The author illustrates this issue by mentioning the perspective of the parents of past generations, who used to defend: "what you have learned no one will ever take away from you" (Bauman, 2017, p. 114), highlighting the importance attributed to knowledge as a lasting and inalienable good.

However, what, in past generations, was recognized as a primordial value, today, the new generations no longer care, and most even have a true aversion to everything that is made to last, whatever it is. The author reinforces this idea, giving an example of a very common incentive in past generations by fathers and mothers who saw Education as something necessary and lasting, and can confirm this thought in the following passage: "this promise might seem encouraging to children then, but today's young people would be horrified if their parents still used this type of argument". (Bauman, 2017, p. 114).

Today, the notion that any lasting bond, regardless of its nature, is perceived as attractive by most young people, is questionable. This prism is corroborated by the statement of Bauman (2017, p. 114), who highlights this tendency: "the second challenge to the basic assumptions of Education derives from the erratic and essentially unpredictable nature of contemporary changes, which reinforces the first challenge". Thus, "knowledge has always been valued for its faithful representation of the world; but what if the world transforms in such a way that it continuously challenges the truth of the knowledge that has existed until then and takes even the most well-informed people by

surprise" (Bauman, 2017, p. 114). In this assertion, we find that the author seems to tell us that we are in an environment that does not benefit certainties, but the most adapted to abrupt changes, and these changes do not only affect individuals, but institutions, which have to adapt constantly and quickly.

Metaphorically, it is as if each night we slept for 10 years or more and, when we woke up each morning, everything had changed or transformed, as if by magic, and again we needed to update ourselves on what happened during the period we were absent – it is precisely this impression we have when we try to understand Bauman's liquid world. Therefore, in this equation, Bauman's Liquid Modernity is added, which describes an immediate, consumerist and utilitarian world, with AI technology, which advances by leaps and bounds, making it impossible to instantly keep up with the constant number of changes, resembling Bauman's own liquid world. Finally, we have Education, which according to the author has never suffered a conceptual and structural crisis as it currently happens. All of this is an individual and social consequence that reaches schools and also affects the reality of educators, fathers and mothers or guardians, in some cases, and, consequently, the students.

THE MYTH OF ARTIFICIAL INTELLIGENCE

In an interview with neuroscientist Miguel Nicolelis, he underlines the importance of adopting a critical stance towards technological innovations, especially with regard to AI. Despite the extraordinary promises that this technology offers us, it is essential that we avoid excessive idealization. We must, first, seek information from reputable researchers in the area and relevant content, without becoming dogmatic or, even worse, disseminators of conspiracy or apocalyptic theories. While the technology may seem magical at first glance, it is actually a reflection of human thinking. Therefore, it is imperative that we ask ourselves about the true usefulness of AI, who will really benefit from it, and whether the narratives promoted by the media are, in fact, true.

When addressing the topic of AI, it is pertinent to evoke the Industrial Revolution, since, like contemporary technologies, it generated significant concerns in relation to employment, a phenomenon that is observed today. It is relevant to emphasize that, as occurred in the early days of the Industrial Revolution, when many believed that automation would result in the extinction of jobs and that machines would fully replace the human workforce, the unfolding of time revealed a different reality. Although, in fact, there has been the replacement of part of the workforce by machines and the extinction of certain professions, new job opportunities have also emerged. This dynamic is particularly

interesting when taking into account the implications of AI, which, analogous to the Industrial Revolution, is transforming the landscape of work.

When we analyze contemporary technology, it is possible to realize that it could be seen as a form of magic by previous generations. Likewise, it is plausible that we will have a similar perception regarding the technologies that will emerge in the future. However, not all researchers share the belief that technology is a magical resource capable of solving all problems. An example is neuroscientist Miguel Nicolelis, who, in his article, argues that "artificial intelligence is not, in fact, intelligence, but rather a marketing strategy aimed at exploiting human labor." For Nicolelis, intelligence is the result of millions of years of evolution, a phenomenon that cannot be reduced to mere binary codes. (Teixeira, 2023).

In Nicolelis' conception, "ChatGPT works as a marketing tool by generating inequality in the relationship between employer and workforce" (Teixeira, 2023). But who is this researcher? What is your authority on this subject? Well, Miguel Nicolelis headed the Center for Neuroengineering at Duke University, retired as professor emeritus in 2021. He was a doctor, being a reference studying the brain and machine; coordinated the Scientific Committee of the Northeast Consortium. He was also the first Brazilian to publish a cover article in the scientific journal Science. For three decades, the neuroscientist dedicated himself to the investigation of neural networks. Recognized for his expertise in brain-machine interfaces, he played a key role in the evolution of neuroprostheses, which have the ability to restore body movements. A notable moment occurred during the opening ceremony of the 2014 World Cup, in the city of São Paulo, when an individual in a wheelchair, with the help of a device developed by him, executed a precise shot towards the goal.

Miguel Nicolelis told Folha that it is absurd to say that language models such as ChatGPT are ten times smarter than a human being because they write quickly or communicate in several languages, as did Geoffrey Hinton, a computer scientist who invented neural networks and was a partner and advisor to Google for more than a decade (Teixeira, 2023). For him, "the turtle is extremely intelligent, it is just slow". In the article, Miguel Nicolelis also criticized Yuval Harari, who is an Israeli professor of history and author of the *international* bestseller *Sapiens: A Brief History of Humanity*, *Homo Deus: A Brief History of Tomorrow* and *21 Lessons for the 21st Century*. His latest release is *Notes on the Pandemic: And Brief Lessons for the Post-Coronavirus World*. In his bestseller *Sapiens*, author Yuval Noah Harari merges concepts from different areas of knowledge without having a deep understanding of them. In an interview with Folha UOL, neuroscientist Miguel Nicolelis criticizes this approach, stating that Harari mixes references

and interprets the results of his research in a way that does not correspond, in any way, to what was actually accomplished.

Miguel Nicolelis expressed his opinion that Yuval Harari may have exaggerated and distanced himself from reality in his work, claiming that, in the future, we may be able to implement brain-brain interfaces, such as the ones he has developed over his 30 years of research with rats, monkeys and humans, to aid in rehabilitation. In the interview given to Folha UOL, Nicolelis clarified: "it's not about exchanging my feelings with other people." He emphasized that, in fact, this exchange refers to motor commands, with the aim of minimizing digital logic. Additionally, Nicolelis criticized Harari's interpretation, pointing out that he erroneously suggests that his research implies the possibility of reading the mind, which, according to Nicolelis, will never materialize (Teixeira, 2023).

While Harari maintains that human longevity could extend up to 200 years and that we will eventually be able to eliminate the aging process, Nicolelis expresses skepticism about these claims, considering them as mere fantasies. Miguel Nicolelis disputes Harari about AI having taken control of the system. The AI did not carry out a hijacking; On the contrary, it is the human species itself that is restricting its evolution, that is, behind each technology there are political, social and economic interests controlled by a group and driven by interests that are not always clear or understood at first and only when we delve deeper into the knowledge of the information that reaches us will we be able to discover the true purpose of the technology that is offered to the population. Therefore, we need to be open to news without being dogmatic to the point of saying that everything that is in the media is true and that it works exactly as advertised.

In this vein, it is imperative that we seek the knowledge of the competent authorities in matters of our interest, as well as that we cultivate safe and reliable sources of information, in order to avoid manipulation and uncritical acceptance of information conveyed by the media. The formation of an informed individual, who understands the dynamics of an ever-changing reality, is of fundamental importance.

Miguel Nicolelis, quoting Noam Chomsky, points out that AI lacks true intelligence and is not genuinely artificial. This technology is actually a product of human creation, which makes it inherently natural. Furthermore, intelligence is a characteristic of organisms that interact with their environment and with other organisms, resulting from the Darwinian process of natural selection. While algorithms can perform tasks, these actions do not occur autonomously. Nicolelis uses a blunt expression: "if he were alive, Charles Darwin would have a heart attack with this" (Teixeira, 2023).

Regarding machine learning, Miguel Nicolelis is categorical when he asserts that "machine learning, *deep learning*, *machine learning*, are big names that use words that we usually colloquially use, related to the human brain or any animal brain to define things we do with binary logic" (Teixeira, 2023). And, to complement, he informs: "human intelligence is not binary. Therefore, it is a misnomer" (Teixeira, 2023). Nicolelis also disputes Geoffrey Hilton's ideas that AI is already far superior to human intelligence, considering it absurd. Geoffrey Hilton is an Anglo-Canadian cognitive psychologist and computer scientist, known for his work on artificial neural networks. Since 2013, he has divided his time working for Google and the University of Toronto.

Miguel Nicolelis argues that the interests of the market and the development of AI are different aspects. For him, the market seeks agility and efficiency, prioritizing infinite profits and minimal costs. On the other hand, intelligence, especially that of the organism, has as its primary objective to maximize survival in an ever-changing environment. Nicolelis argues that while a computer can play chess faster and predict more moves than a world champion, that doesn't mean it's smarter; In fact, it may be that the computer is just better trained. He shows that the efficiency of the computer is due to the fact that chess has well-defined rules; If it were a game with dynamic and unpredictable situations, the situation would be different. Thus, according to Nicolelis, the computer is not prepared to adapt to all possible environments, as it lacks the ability to generalize its intelligence.

When questioned, in the interview, about the statement of the researcher at the Open Philanthropy institute, Ajeya Cotra, who estimated that, in the current model of society, the human mind could become obsolete by 2037 in terms of production for the labor market, Miguel Nicolelis points out that there is a limit to digital logic. He goes on to focus on the uniqueness of human intelligence in relation to the capabilities of AI:

> I just read a book by one of the best intellectuals in the field of AI, Michel Wooldridge from the University of Oxford and in the book the author states "we know that there is a limit determined by non-computable phenomena, in which there is no algorithm, there is no mathematical formula solvable with a program". But he puts two paragraphs on the most important thing in the book, and comments that researchers don't pay much attention to it because they have a lot to do (Teixeira, 2023).

The human mind is full of non-computable phenomena: intelligence, intuition, creativity, aesthetic sense, definitions of beauty, of creativity, all of this is non-computable. What is the formula for beauty? (Teixeira, 2023). Do machines have all the answers to a complex context such as that of humans? The more we delve into the knowledge of technology, the more we are sure that the most interesting machine is ourselves.

When Miguel Nicolelis was asked about a young man who posted on Twitter that his uncle had been accused of plagiarism due to a professor having used an excerpt from his work and asked if he had used ChatGPT, Nicolelis replied:

> In a way, ChatGPT is a great plagiarist, because it takes the material made by a lot of people, mixes it and generates something it calls a new product, but in reality, it is, to a large extent, influenced by the intellectual product of thousands and thousands of human beings. For the current, modern capitalist system, artificial intelligence is the great marketing tool, because it generates a total inequality in the relationship with the workforce. (Teixeira, 2023).

Miguel Nicolelis deepens his analysis when discussing the issue of the workforce, illustrating that an employer can claim to have an AI application and, if the worker does not accept a reduced salary, equivalent to 10% of his current remuneration, he could choose to fire him and use said technology. In this way, Nicolelis argues that the ideology of substitution of human labor is a present reality, although he recognizes that such substitution cannot be carried out in a total way. He stresses that the real challenge does not lie in the technology itself, but in the concrete results it can produce for humanity as a whole.

As for social inequality, the neuroscientist observes the existence of individuals who invest financial resources in superfluous experiments, such as a dive to observe the wreckage of the Titanic at the bottom of the ocean. This situation, according to him, exemplifies disproportionate spending. Nicolelis expresses his concern by reporting a striking contrast: "if one walks from Avenida Paulista to here, as I did, one will see tens of thousands of people dying of hunger in the streets." In his perspective, it is essential that we direct greater attention to social inequalities, instead of allocating resources to projects that contribute little or nothing to the well-being of the majority of the population.

In the interview with Folha UoL (Teixeira, 2023), Miguel Nicolelis was asked about the competition between machines and humans and about the risks to the species, which are questions raised by researchers and people in the technology industry. The neuroscientist's response was as follows: "the risks are tremendous". And he also reiterated that machines must be used under human supervision and goes further, saying that, in the programming of an AI system, the person, before asking for something, must consider that the means to achieve the goal are valid.

The neuroscientist mentioned the movie "2001: A Space Odyssey", directed by Stanley Kubrick. In the narrative, the crew is destined to achieve a certain goal, but for unknown reasons, the onboard computer takes a divergent approach to the team's plans. Nicolelis pointed out that this fictitious situation can be reflected in reality. He noted that

while the mission was supposed to be completed, the entirety of the crew may not be present to witness this outcome. He stated that, "by delegating the execution of a mission to an autonomous system, one cannot impose on this system all the constraints that evolution has imposed on us." In other words, this perspective can be applied to various scenarios, including nuclear war scenarios, given that the logic of autonomous machines does not necessarily coincide with human logic. This analysis suggests the need for special care when dealing with systems that operate independently.

FINAL CONSIDERATIONS

What we can extract from the reflections presented in this article is that human intelligence took millions of years to develop, as stated by Miguel Nicolelis. Comparing human intelligence with that of machines is therefore a naïve simplification, since the latter are products of human ingenuity itself. It is evident that, in a controlled environment, machines can outperform individuals in certain tasks, but this is not due to an intrinsic superiority in intelligence, but to their ability to store and process vast amounts of information, formulas and commands. An example of this is the victory of a computer over a world chess champion. However, such a triumph does not imply that the computer would have the same success in other contexts.

We are still far from developing a prototype that possesses the capacity for generalization and abstraction that characterizes human intelligence. In terms of intelligence, it is important to note that science fiction often feeds myths, such as machine rebellions, wars between humans and machines, or the creation of extremely advanced machines capable of understanding complex concepts, which have been elaborated over millions of years of human intelligence evolution.

In this regard, we align ourselves with the thinking of neuroscientist Miguel Nicolelis, who emphasizes that human intelligence has developed over millions of years and will not be easily surpassed in a few decades. The complexity and dynamics of human intelligence involve operations that, at first glance, may seem simple, such as concluding, abstracting, deducing, and intuiting, and that, to date, machines, even with their significant advances, have not yet been able to fully replicate.

While the progress of autonomous machines that perform a variety of functions is indeed remarkable, the idea that they will completely replace humans, rendering them obsolete in the future, seems to be an overview. Miguel Nicolelis points out that there are still numerous interests related to the exploitation of labor, with a focus on maximizing profits and minimizing costs. This reality is often neglected by the media, which, when it

addresses the topic, does so in a subtle and superficial way, since it is not in the interest of most people who control large industrial conglomerates. For these individuals, what really matters is profit maximization and expense reduction.

We should not believe that most people are hired in their jobs solely by virtue of their acceptance or appreciation. In fact, the permanence of an employee in his position is primarily linked to the results he presents. If someone is able to perform the same function at a lower cost, most employees will realize that their continuity in employment may be threatened, possibly even immediately. Taking into account the hypothesis of an application that performs certain functions at a lower operating cost than that of an employee, it is evident that the latter may be forced to accept a salary reduction or, ultimately, be fired.

It is in this context that Miguel Nicolelis corroborates that technology, especially AI, is more of a marketing issue and becomes an instrument of salary negotiation, directly impacting those who depend on their jobs to support themselves and their families. The logic of the market, in turn, is not concerned with the social consequences of this dynamic, such as the possibility of individuals finding themselves in a situation of vulnerability, including homelessness or the risk of hunger for their dependents.

This phenomenon can be illustrated by the observation of Nicolelis, who criticizes the significant investment allocated to expeditions to the Titanic, in contrast to the lack of resources allocated to assistance to homeless people. While the importance of technological advancement is undeniable, it is imperative that humanity prioritizes human dignity. We ask ourselves: what is the purpose of our development, if, as a species, we behave so cruelly and selfishly towards our fellow men?

Sadly, millions of people die of hunger as a result of the greed of a few individuals. What is the point of accumulating all the wealth in the world if there is no concern for others and situations of vulnerability? In this context, technology reflects the concepts of Liquid Modernity proposed by Zygmunt Bauman, noting that individuals have difficulty in establishing adequate interpersonal relationships. While we seek to make machines more "human", the human being himself seems to be gradually losing his humanity, manifesting indifference towards others. Contemporary society tends to treat everything as disposable, with no intention of building permanence, whether in life projects or in interpersonal relationships.

Bauman, when asked about virtual friendships in exorbitant numbers, said that, throughout his life, he kept only five true friends. Today, it is more practical to access people, but it also becomes easier to discard them, resulting in a palpable loneliness even in the midst of a crowd. According to the sociologist, nothing is designed to last, and

current generations seem reluctant to consider relationships, regardless of their nature, for prolonged periods. According to Bauman (2017), the concepts of disposal, immediacy and consumerism are deeply rooted in contemporary generations. People tend to value "having" more than "being," and many believe that money can buy everything, including happiness.

Social networks, digital media, and mobile games are designed to provide constant stimulation to the brain, something that real life cannot match. Unfortunately, a significant portion of the population prefers the virtual universe, which presents itself as more exciting compared to reality, neglecting the development of interpersonal skills and virtues such as patience, tolerance and respect. For many individuals, the real world seems uninteresting, leading them to isolate themselves in their bedrooms, dedicating long hours to activities on computers and mobile devices. This situation is aggravated by the advent of virtual reality, which allows the creation of private universes, full of elements of personal preference. It is reasonable to assume that a growing number of people may opt for this artificial environment to the detriment of interactions in the real world, which brings us to Plato's allegory of the cave in its contemporary version.

The human being is, by nature, a social being; However, technological evolution can result in a significant increase in problems in interpersonal relationships and various psychological issues. There is a growing concern that many people will lose the ability to interact properly with others, either through lack of practice or choosing to avoid such interactions. This can culminate in social inadequacy, generating challenges that, in the past, were practically unknown.

Thus, we are faced with a generation that, when facing daily relationship difficulties, may find itself unable to resolve issues that could previously be solved through a simple and productive conversation. Given that social interaction is a fundamental aspect of life, the inability to relate can result in serious problems for families, educational institutions and the community in general. Consequently, not only will families suffer the consequences of the lack of social skills, but the school community itself and other social scenarios will also be affected. The individual, in turn, will be in an unfavorable position, facing exclusions and conflicts for trivial reasons, in addition to other issues related to his social environment.

Currently, most educators face challenges related to social and individual problems that affect their students. The phenomenon of shrinking family size has generated a growing expectation regarding the performance of children, who are often burdened by the responsibility of becoming increasingly successful. This pressure can result in frustration and suffering when such expectations are not met, leading many to develop depression, as

they cannot understand that real life differs significantly from the idealized representations on social networks or electronic games.

In the contemporary context, it is essential to cultivate a balanced mind and deep self-knowledge to face the challenges of the so-called liquid modernity. Zygmunt Bauman, in *44 Letters from the Liquid World* (2017), talks about the crisis in Education, which differs from previous crises. The uniqueness of the current crisis can be attributed, to a large extent, to the fact that we live in a world characterized by liquidity. According to Bauman, contemporary society is marked by superficial and temporary relationships, in which affective bonds are usually disposable. In addition, immediacy and consumerism have contributed to the saturation of homes with futile objects, while individuals feel increasingly empty existentially, perceiving themselves as or more disposable than the goods they have acquired and soon fall apart.

In view of this panorama, the school, as a teaching and learning institution, must adapt to this new reality of current generations, understanding the implications that this social dynamic exerts on the educational process. In classrooms we have already found several cases of childhood depression, in adolescence, students who mutilate their wrists and cases of social inadequacy, students who come into conflict with teachers being perhaps the first authority they meet in the morning, because, at home, their parents or guardians have abandoned them for a long time. The reality of teachers becomes gloomy, to the point that many of them need medication to face the strenuous routine of educational institutions. Current generations show an aversion to the teaching profession, which, in principle, should be seen as one of the most dignified and respectable. Unfortunately, in the perception of many students, this career is seen more as a punishment for some sin committed in past lives.

The irony of this situation, without the pretense of being dogmatic, lies in the fact that it is essential to maintain the correctness of our actions, even if many believe that it is no longer necessary. It is substantial to work hard, even if some consider such dedication to be futility. It is essential to maintain solid principles, even if there are mockery in a world permeated by illusions, as constantly portrayed in the media, where everything seems to be simplified and fun. The ideal, therefore, is to be authentic. There is no magic involved; Success is the result of perseverance, effort, virtue and truthfulness. Nowadays, more than ever, it is necessary that we know ourselves and understand our reality.

We cannot say whether Liquid Modernity, a concept defended by Zygmunt Bauman, will be a permanent or lasting phenomenon. What is certain is that, just as in the past we

faced wars, hunger and various problems, we will once again be challenged to dedicate ourselves to overcoming the difficulties present today.

A significant crisis often brings with it valuable lessons. The perception is that, at some point, we have failed to absorb a crucial teaching, whose urgency is now imposed, demanding our attention so that we can correct past omissions. Families will need to restructure and make the right decisions; individuals should focus on ethical and correct reflections; And institutions will have to reinvent themselves in the face of this new reality.

Zygmunt Bauman discusses a society characterized by superficial relationships, raising the question: to what extent is this condition really beneficial? He also focuses on the fragility of bonds, raising a new question: to what extent is this acceptable and for how long can this situation last? In his works, Bauman discusses consumerism, leading us to reflect on the results of consuming as a way to fill an existential void. Even in the midst of contemporary crises, Bauman expresses his belief that one of the possible solutions lies in love. However, what kind of love does he propose? Is it a permissive love, which excuses failures and seeks to reestablish normality through material gifts, or is it a demanding love, which communicates uncomfortable truths, but which, although painful at the moment, contribute to personal and, perhaps, professional growth?

In a world, in Bauman's view, where the public and the private are separated by a thin and fragile line, would it not be opportune to take into account the need to establish limits in interpersonal relationships? Many educators express concern about the lack of boundaries on the part of students; However, where should we look for these limits: at school or at home? Bauman's reflections raise more questions than certainties, but it is precisely in doubts that the space for reflection and the search for answers is found.

Bauman, in his work, observes that "American generals vehemently resist (albeit in vain) committing their soldiers to the battlefield without the prior adoption of a convincing 'exit plan'" (Bauman, 2017, p. 114). Returning to the educational question, Bauman challenges the elementary assumptions of Education, which derive from the unpredictable nature of contemporary changes. "In our volatile world of instantaneous and erratic change, the ultimate goals of orthodox education, which are based on established habits, solid cognitive structures, and stable value preferences, have become disadvantages" (Bauman, 2017, p. 117).

The definitions established by the knowledge market indicate that, as in all product markets, loyalty, long-term commitment, and indestructible bonds are analyzed as anathemas, obstacles to be removed and treated as such. In a simplified way, Zygmunt Bauman suggests that both the world and the previously unquestionable values, routines

and habits are constantly changing, becoming, in many cases, a burden. He argues that education follows the same rules as a commodity; therefore, the belief in principles that are presumed to be eternal, in line with Bauman's perspective, can, in contemporary times, be configured as a disadvantage.

Understanding the mind of a sociologist as insightful as Bauman is not a simple task, requiring a careful review of his texts. However, this difficulty turns out to be, in fact, a rewarding experience, because with each reading new learning emerges, revealing perspectives not previously considered. In his work *Liquid Modernity*, Bauman proposes a new way of perceiving and understanding the world, making it clear that the solid structures that have been formed over time, especially since World War II, no longer apply to new generations.

We thus understand the gradual dissolution of ideas, teachings, concepts, habits and institutions that, over time, resemble the melting of ice under the sunlight on a clear morning, allowing us a poetic license inspired by this renowned sociologist. For Zygmunt Bauman, "we have left the immutable and frozen labyrinth of the behaviorists, the uniform and monotonous routines elaborated by Pavlov, to the free and open market, where anything can happen at any time and nothing can be done definitively; where achieving success is a matter of luck, and nothing guarantees that this success will be repeated" (Bauman, 2017, p. 117).

In the meantime, Bauman emphasizes the unpredictability of contemporaneity and the obsolescence of concepts that were once solid and reliable, which currently, in a way, hinder more than help. He observes that "the issue to remember and to consider in all its consequences is that, in our time, the market and the *mappa mundi et vitae* overlap" (Bauman, 2017, p. 117). In simpler terms, this means that there is no space in the world that is not affected by the influence of the market and, consequently, by globalization.

Dany-Robert Dufour, for his part, argues that capitalism is not content with expanding its influence to the limits of the globe, where any object can be converted into a commodity – including rights to water resources, rights to the genome, to living species, to procreation and to human organs – but aspires to deepen this exploitation in order to liberate and commercialize what was previously the domain of private life and individual decision-making. as issues of subjectivity and sexuality, transforming them into objects of purchase and sale.

Zygmunt Bauman, in his work, points out that the mere reform of educational strategies, no matter how intelligent and comprehensive they may be, results in little or no effect. He ponders that it is not productive to attribute exclusively to teachers the

responsibility for errors or negligence. Bauman suggests that the real issue of Education lies not in the reforms or in the performance of teachers, but in the transformations that have occurred in the scenario outside schools. He notes that the contemporary world has moved significantly away from the environment for which traditional schools, as described by Jaeger, prepared their students.

Bauman characterizes this new world as a space where individuals are expected to seek private solutions to problems generated by society, rather than promoting collective solutions to issues of a private nature. This paradigm shift reflects a reversal in the roles assigned to the public and private domains. In this complex framework, today's students are challenged to live together, survive and seek happiness, facing issues that, although their previous generations have also encountered problems, are arguably more complex. And we can confirm this in the following statement by Bauman (2017, p. 118):

> During the solid phase of modern history, let me insist, it was hoped and desired that the structure defined or foisted upon human actions should imitate as far as possible the model of the labyrinth of the behaviorists, in which there was a sharp and permanent difference between right and wrong routes, and those who erred or abandoned the right path were invariably punished. while those who meticulously obeyed the script received rewards.

Thus, when we analyze it with a greater degree of depth, we find that the world was not perfect, however, compared to the complex contemporary framework, it was an environment in which, by following the established rules, the individual was safe. This conclusion is corroborated by Bauman when discussing Fordist factories and military service. The author states: "the Fordist factories and compulsory military service, the two longest arms of the solid panoptic power of modernity, were the most perfect representations of the tendency towards the rigid routinization of stimuli and responses" (Bauman, 2017, p. 119). This quote highlights the rigidity of the solid world in relation to individuals, highlighting the need for compliance with norms to avoid punishment. An example that illustrates this dynamic is the case of Private Desmond Thomas Doss (February 7, 1919 – March 23, 2006), an American military man who, during World War II, served as a soldier and first responder in the United States Army. Assigned to a rifle company during the Battle of Okinawa, Doss became the first and only conscientious objector to receive the Medal of Honor for his actions in the war. A member of the Seventh-day Adventist Church, he decided to serve as a first aider, and in a single battle he saved about 75 soldiers, even unarmed and practically alone. His life was portrayed in a biography entitled *Unarmed Soldier* and, in 2016, a film about his trajectory was released, directed by Mel Gibson and entitled "To the Last Man", starring Andrew Garfield.

Bauman continues: "domination consisted of the right to establish inviolable rules, to supervise their execution, to submit to permanent surveillance those who had to follow them, to realign deviants or to exclude them in the event of failure in the attempt to reformulate them" (Bauman, 2017, p. 119). However, this dynamic required an action that, according to Bauman, was outlined as follows: "this model of domination required a reciprocal and constant commitment on the part of administrators and administered" (Bauman, 2017, p. 119). Alluding to Liquid Modernity, Bauman asserts: "in the 'liquid' phase of modernity, however, the need for this type of orthodox managerial function has been rapidly decreasing" (Bauman, 2017, p. 119). Unlike the "solid" phase, he argues that "domination can be obtained and ensured with a much lower expenditure of effort, time and money, with the imminence of managers releasing themselves from the commitment, and no longer with surveillance and invasive control" (Bauman, 2017, p. 119). This paradigm shift causes significant changes in the behavior of individuals compared to the generations of solid modernity that preceded them, as evidenced in Bauman's assertion (2017, p. 119):

> Now it is up to subordinates to behave in such a way as to win the good graces of their bosses and motivate them to "buy" their services and their individually created "products" – just as the producers and dealers of other goods lead potential consumers to desire the goods they sell. "Following the routine" is not enough to achieve this goal.

Bauman resorts to other authors, such as Luc Boltanski and Eve Chiapello, who consider that: "those who wish to succeed in the organization that has replaced the characteristic employment model of the 'rat maze' must demonstrate ease of convenience and communicability, as well as open-mindedness and curiosity – that is, 'sell' themselves, in their entirety, as a unique and irreplaceable value, capable of improving the quality of the team". (Bauman, 2017, p. 119-120).

In this sense, we note a clear paradigm shift in relation to Solid Modernity and Liquid Modernity. In the first, characterized by Solid Modernity, individuals were rigidly controlled and forced to follow norms and rules, under penalty of punishment or exclusion, if they were unable to adapt to the current guidelines. On the other hand, in Liquid Modernity, the individual himself must conquer his space and seek to please those who appreciate the services provided or the products offered. For Bauman: "it is no longer up to the bosses to file and polish the sharp or rough edges of the personality of their subordinates, nor to hide their idiosyncrasies, homogenize their conducts or incarcerate their actions in a rigid structure of routines, transforming them into purchasable commodities" (Bauman, 2017, p. 120).

Thus, according to the following sentence, we can see what is the recipe for success in Liquid Modernity in Bauman's conception: "the recipe for success is 'be yourself', and not 'be like the rest'. It is the difference, not the sameness, that sells best" (Bauman, 2017, p. 190-120). We don't need to make much effort to realize that, in Liquid Modernity, the media quickly understood this idea of being unique and original, used it to capture the attention of young people and thus carry out campaigns aimed at mass consumption.

Zygmunt Bauman, in his analysis of Liquid Modernity, identifies consumerism as one of the most significant elements of this period. The concept of consumption, according to Bauman, encompasses superficial relations and ephemeral bonds, in which individuals are simultaneously consumers and objects of consumption, inserted in a free market. In this context, we emphasize that success lies in the originality of propaganda and in the ability to adapt to a world in constant mutation, whose rhythms and values differ widely from those experienced in Solid Modernity. To individuals of this era, the new values and ways of existing in a complex world may seem overwhelming, particularly when compared to the rigid rules and harsh punishments imposed on authenticity during Solid Modernity.

Currently, in theory, we enjoy greater freedom; however, Bauman alludes that contemporary young people often find themselves lost in the face of this newly acquired freedom. In the midst of this uncertainty, parents and guardians are desperately looking for quick solutions, which do not always prove effective. The current panorama is dominated by consumerism and individualism, where those who are original and creative, capable of extracting the best from what seems impossible, stand out.

We live in an extraordinary era, unprecedented in history, and it is difficult to imagine what the future will be like, especially when we take into account the technological evolution that can occur over a thousand years. People from that future are likely to see us with a fascinating eye, considering our current technology as magic. Thus, we have moved from a phase marked by solidity to a phase characterized by liquidity, without being able to foresee the transformations that are yet to come.

Human beings, in their incessant search for understanding and adaptation to the varied climates, societies and ways of being, face incessant challenges that involve both glories and defeats, life and death, joys and sorrows. This phenomenon is widely evidenced in contemporary social networks. We feel like privileged observers as we witness consumerism, which Bauman so eloquently criticizes, and the dynamics of social networks, in which an image or a video can be eternalized, with both positive and negative repercussions, in the vast web of human experience.

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ARTIFICIAL INTELLIGENCE AND ACCESS TO JUSTICE: A SYSTEMATIC REVIEW OF THE INTERNATIONAL LITERATURE

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ABSTRACT

The text discusses the relationships between the use of artificial intelligence (AI) in the Judiciary and access to justice, highlighting the lack of in-depth studies on the subject. Relevant investigations and systematic reviews of the literature are identified, showing the urgency of understanding the impacts of AI on justice. The research seeks to explore the gains and risks of this use, questioning whether it can make justice more unfair.

Keywords: Artificial Intelligence. Access to Justice.

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INTRODUCTION

The relationships between the use of artificial intelligence (AI)[3] by the Judiciary and access to justice, in its dimensions of access to jurisdiction and access to a fair legal order[4], are not yet completely delimited.

The presence of few studies that deal specifically with the relationship between AI and access to justice was identified, highlighting the works of Fux, Ávila and Cabral (2021), Mariano Júnior (2023), Rocha et. Al. (2020). Among the doctoral theses, studies by Amorim were identified (2021), Mariano Júnior (220DC), Valentini (2018), Queiroz (2022)Marcato (2022) and Ferrari (2022).

In this context, two systematic reviews of the literature on this relationship are found in Almeida and Pinto (2022) and Siqueira, Lara and Lima (2021). In the first study, "the method used was a systematic review of the quantitative and qualitative literature, carried out on the Web Of Science, Scopus and Theses and Dissertations Databases, with the last five years as a time frame" and the keywords Artificial intelligence OR Machine Learning OR Deep Learning AND Access to justice were used. The second search used "the Boolean search in the EBSCOhost database, using the following domains of the literature: Access to Justice AND Artificial Intelligence".

As can be seen, therefore, these two investigations described above are not to be confused with the present proposal, which has different databases and keywords, so that the present investigation is justified.

Thus, it is urgent and relevant to identify and analyze this relationship between the use of AI, by the Judiciary, in jurisdictional activities, and access to justice, the objective of this investigation, after all, access to justice is a fundamental right[5]. Hence the problem that this research proposes to answer: between gains and risks, can AI make Justice more unfair?

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[3] In a nutshell, based on the lesson of Teixeira and Cheliga (2021), AI can be understood as the "computational system created to rationally simulate the decision-making of human beings, trying to translate the functioning of the human brain into algorithms". Stuart and Norvig (2013) maintain that understanding AI entails: systems that think like humans; systems that act like humans; systems that think rationally; and systems that act rationally. AI aims to create intelligent machines, that is, those that choose the actions that are expected to achieve their goals, but these must be transformed into benefits for humans, as machines do not have the right to pursue their own goals, hence why the most sensible definition of AI should cover machines pursuing the goals of humans (RUSSELL, 2019).

[4] According to Gonzáles (2019), access to justice can be conceived in both a formal and a material sense. In a formal or instrumental sense, it indicates access to jurisdiction, that is, the possibility of consideration of the demand or request by the Judiciary, under the terms of article 5, XXXV, of the Federal Constitution of 1988 (BRAZIL, 1988). In a material or substantial sense, it indicates access to a fair legal order. For the purposes pursued in this investigation, this conception is adopted in such a way that both access to jurisdiction and access to a fair legal order will be considered as access to justice.

[5] In this regard, see Alexy (2008).

Having made the preliminary considerations (1), item 2 addresses the theoretical aspect of the method that involves a systematic review, the procedures observed for the construction of the research protocol, the works found and reviewed, and the abstracts of the selected works, that is, an eminently procedural section is taken care of, for those interested in the methodology used. Next, the discussions and results are presented (3) and, at the end, the final considerations are presented (4).

METHODOLOGY

At this point, the present investigation sought to identify publications in peer-reviewed and open access journals that contain discussions involving the relationship between the use of AI by the Judiciary in jurisdictional activities and access to justice in democratic countries[6], favoring the establishment of networks for exchange and exchange of experiences.

This initiative provides a macro view of the scenario presented and allows the consolidation of works in a structured way, which can be used for new reflections and modification of paradigms in the human and social sciences.

SYSTEMATIC REVIEW OF THE LITERATURE: THE METHOD

At the end of the 1980s, a systematic review of the literature in the area of Health was developed, due to the large number of publications produced without an appropriate scientific methodology. According to Felizardo and Martins (2015), the objective was to synthesize the evidence, producing results from the confrontation/combination of different other results.

Based on the lesson of Chalmers, Hedges and Cooper (2002), the systematic review of the literature can be defined as follows: "the application of strategies that limit bias in the assembly, critical appraisal and synthesis of all relevant studies on a given topic".

Page et. Al. (2021b) list the most relevant functions of the systematic review of the literature: (1) to provide syntheses of the state of knowledge in a field, from which future research priorities can be identified; (2) address questions that otherwise could not be answered by individual studies; (3) identify primary research problems that should be corrected in future studies; (4) to generate or evaluate theories about how or why phenomena occur.

[6] For the purposes of this investigation, the 2021 Democracy Index, released by The Economist magazine, was adopted, which classifies 167 countries into full democracies, imperfect democracies, hybrid regimes (but considered democratic), and authoritarian regimes. Available in https://www.eiu.com/n/campaigns/democracy-index-2021/?utm_source=teg-website&utm_medium=press_release&utm_campaign=democracy-index-2021

The systematic review of the literature, according to Sampaio and Mancini (2007), "requires a clear question, the definition of a search strategy, the establishment of inclusion and exclusion criteria for articles and, above all, a careful analysis of the quality of the selected literature".

According to Galvão and Ricarte (2019), the systematic review of the literature includes "the selection of databases, the elaboration of the search strategy, the selection of documents and the systematization of the results".

One can see, in Torgerson, Hall and Light (2017), that the systematic review of the literature is designed to be explicit, transparent, and replicable, which gives it objectivity and scientific rigor. According to the authors, the use of explicit predefined methods of location, quality assessment and synthesis of research results minimizes the possibility of bias.

In this context, Torgerson, Hall, and Light (2017) present the main characteristics of systematic reviews: (1) a transparent and comprehensive search strategy; (2) clear pre-specified inclusion/exclusion criteria; (3) explicit methods of coding, quality assessment and synthesis of the included studies.

The authors also described the steps or stages of a systematic review that are well established in the area of health, education, and social science research: (1) research question: development of a well-focused and clear research question, which can be addressed by a systematic review; establishing the review team and review parameters; (2) Protocol: development of a protocol or plan for the review, including an a priori statement of the project. and methods for each stage of the review; (3) information retrieval and study selection: development of a search and screening strategy to identify/select the studies included in the review; (4) coding: extraction of data from each of the included studies using a coding form developed for the review; (5) quality assessment: assessment of the risk of bias in each of the included studies; (6) synthesis: the results of all included studies are combined (this may include a meta-analysis); (7) Writing of reports: the systematic review is disseminated through a published report or article.

Torgerson, Hall and Light (2017) state that to ensure the highest quality in design and methods in conducting a systematic review, methodologists have developed a series of guidelines and statements, among which Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) stand out[7].

[7] Page et. Al. (2021a) explain that the PRISMA Declaration was developed in 2009 and called PRISMA 2009, but there was an update in 2020, to ensure relevance and reflect advances in the methodology and terminology of systematic review, when the strategy called PRISMA 2020 was used exclusively.

According to the authors, the goal of the PRISMA Statement is to help investigators improve the reporting of their systematic reviews and meta-analyses, since it focuses on systematic reviews of randomized controlled trials, but can also be used as a basis for reporting systematic reviews of other types of research, particularly evaluations of interventions.

The PRISMA Declaration, as emphasized by Page et. Al. (2021b), although it was designed for systematic reviews of studies that evaluate the effects of health interventions, it can be applicable to systematic reviews that analyze other interventions, such as social or educational interventions.

In this PRISMA 2020 Declaration there is a checklist of 27 items, distributed in seven sections (title, abstract, introduction, methods, results, discussion and funding), as can be seen in the PRISMA 2020 Checklist[8].

Page et. al. (2021a) report that item 11 of the PRISMA 2020 Statement provides for the specification of the methods used to assess the risk of bias in the included studies. Massignan, Stefani and Canto (2021) They state that bias "is a systematic error that can be introduced at any stage of a study, leading to distortions in its result, and therefore threatening internal validity". The risk of bias, therefore, is configured as the potential for the results of the study to deviate systematically from the truth due to methodological flaws in the design, conduct, or analysis.

The risks of bias, according to Page et. al. (2021a), are of two orders: 1) risk of bias in the results of individual studies included in a systematic review; 2) risk of bias in the result of a synthesis due to studies absent within the investigation, which may result from the absence of publication or exclusion from the investigation due to insignificance.

In this step, it is possible to use tools developed to assess the risk of bias in the included studies, such as Risk of Bias in Systematic Reviews (ROBIS).

ROBIS is a tool structured in three phases, as described in Brazil (2017): (1) relevance assessment (optional); (2) identification of potential risks of bias during the review process; and (3) assessment of the risk of general bias.

In this investigation, the PRISMA 2020 Declaration and ROBIS were chosen as auxiliary tools, whose procedures are explained in the following item.

[8] Available in https://www.prisma-statement.org/PRISMAStatement/Checklist

PROCEDURES USED IN THE SYSTEMATIC REVIEW

In this essay, the systematic review of the literature used the PRISMA 2020 Declaration, with the necessary adaptations for the area of Human Sciences and Applied Social Sciences, and for the identification of risk of bias, the use of ROBIS was chosen.

It was considered unnecessary to perform a sensitivity analysis, used to determine the level of sensitivity of the results of the systematic review (degree of confidence of the results), in situations of uncertain decisions or assumptions about the data and results used, as there was no change in the eligibility assumptions.

Works were consulted in the Ebscohost, ScienceDirect, Springer Link, Dialnet and journals of the Coordination for the Improvement of Higher Education Personnel (CAPES), as it is considered that they are the main indexers of scientific production that provide open access to the full text of peer-reviewed scientific articles.

We chose to search these databases, which are available for access on the Internet, but there was no search for unpublished articles. Eligible papers were limited to peer-reviewed scientific articles with open access, not contemplating, for example, additional methods, such as congress material, which reduced the variety of databases.

As this was a systematic review of the international literature, the titles, abstracts, and full texts of the identified articles were freely translated.

As described in Chart 1, in the case of Ebscohost, the *Discovery Service database was selected* , and in the *TX Full-text* field, the terms *access to justice* and *artificial intelligence* and *Judiciary* (in English, French, Spanish and Italian) were used, and *the expression* justice was added to the SU field. (in English, French, Spanish and Italian) with the operator AND.

Table 1. Words and phrases included in the systematic review: Ebscohost (Discovery Service)

TX Field Full Text			
English	Spanish	French	Italian
Access to Justice	Access to Justice	Accès à la Justice	Accesso alla Giustizia
AND			
Artificial intelligence	Artificial intelligence	Intelligence artificielle	Intelligenza artificiale
AND			
Judiciary	Judicial	Judiciaire	Giudiziario
SU Field Subject Terms			
AND			
Justice	Justicia	Justice	Giustizia

Source: Documentary research carried out by the authors (2023)

On Ebscohost, in *search options* were also marked: expanders *also search the full text of articles* and *apply equivalent subjects;* and the limiter *available in the Library Collection*.

At ScienceDirect, the field of research refers only to the terms that are intended to be sought, in this case, *access to justice* and *artificial intelligence* and *Judiciary* (in English, French, Spanish and Italian), according to Table 2.

Table 2. Words and expressions included in the systematic review: ScienceDirect

Search field			
English	Spanish	French	Italian
Access to Justice	Access to Justice	Accès à la Justice	Accesso alla Giustizia
AND			
Artificial intelligence	Artificial intelligence	Intelligence artificielle	Intelligenza artificiale
AND			
Judiciary	Judicial	Judiciaire	Giudiziario

Source: Documentary research carried out by the authors (2023)

As can be seen in Chart 3, the terms access *and* Justice *and* artificial intelligence *and* Judiciary *(in English, French, Spanish and Italian)* were used in the Springer Link, Dialnet, and CAPES periodicals.

In the Springer Link database, these four terms described in *with all of the words* were searched. In addition, the option *Include Preview-Only content was unchecked,* since the objective was open access to the full texts of scientific articles submitted to peer review.

In Dialnet, the search field only allows *searching for documents,* in which the terms *access* and *Justice* and *artificial intelligence* and *Judiciary* (in English, French, Spanish and Italian) have been inserted.

On the CAPES journal website, once the CAFe access was made, the collection link was located, the *search subject field* was filled in with the terms *access* and *Justice* and *artificial intelligence* and *Judiciary* (in English, French, Spanish and Italian).

In the authors' view, search strategies and restrictions on date, publication format or language, were adequate to obtain the largest possible number of scientific articles, signaling a low level of bias.

Table 3. Words and expressions included in the systematic review: Springer Link, Dialnet and journals of the Coordination for the Improvement of Higher Education Personnel (CAPES)

English	Spanish	French	Italian
Access	Access	Accès	Access
AND			
Justice	Justicia	Justice	Giustizia
AND			

Artificial intelligence	Artificial intelligence	Intelligence artificielle	Intelligenza artificiale
AND			
Judiciary	Judicial	Judiciaire	Giudiziario

Source: Documentary research carried out by the authors (2023)

Next, according to Chart 4, the inclusion and exclusion criteria were established with the objective of obtaining relevant and quality articles for the proposed research.

Table 4. Inclusion and exclusion criteria

INCLUSION	EXCLUSION
Areas of Human Sciences and Applied Social Sciences (C.I.1)[9]	Articles whose country of the journal's affiliation is Brazil (C.E.1)
Articles published between 2018 and 2022 (C.I.2)	Duplicate articles (C.E.2)
Articles submitted to peer review (C.I.3)	Articles that are not available for public access (C.E.3)
	Articles whose abstract did not indicate that they would address artificial intelligence and access to justice (C.E.4)
	Articles excluded after full reading, as they did not address artificial intelligence and access to justice (C.E.5)

Source: Documentary research carried out by the authors (2023)

We opted for the adoption of inclusion criteria (C.I.) related to the areas of Human Sciences and Applied Social Sciences, searches were limited to the years 2018 to 2022, and articles submitted to peer review were searched. The first criterion was justified because there are several essays in the Exact and Earth Sciences, in the Biological Sciences and in the Health Sciences that address the use of AI, but which are not directly related to access to justice. The second inclusion criterion was necessary due to the evolution of the use of technologies by the Judiciary in the last five years. The last inclusion criterion proved to be relevant to ensure the quality of eligible investigations.

The exclusion criteria (C.E.) included essays whose country of affiliation of the scientific journal was Brazil, duplicate articles, those that were not available for public access, and research in which there was no indication in the abstract that they would address artificial intelligence and access to justice. These ineligibility criteria became necessary to: (1) contemplate essays published by scientific journals outside Brazil in order to contemplate the state of the art abroad; (2) avoid bias of sampling higher than that actually investigated; (3) provide for review of the review or replicability of the research; and (4) ensure that eligible articles were aligned with the research objective.

[9] According to the Table of Areas of Knowledge (CAPES) available at http://fisio.icb.usp.br:4882/posgraduacao/bolsas/capesproex_bolsas/tabela_areas.html#grupo6

These eligibility criteria were defined in advance, together with the objective of the investigation, and well specified (unambiguously); are aligned with the research question; and the restrictions applied with reference to the characteristics of the studies and the Databases were clearly described and the reasons for this were provided. Thus, it can be concluded that the risk of bias is low in relation to the specification of the eligibility criteria.

The investigations were identified in the indicated research bases and submitted to the flow diagram, as described in Chart 5.

Table 5. Flow diagram: filtering scheme of essays on the relationship between the use of artificial intelligence by the Judiciary of democratic countries and access to justice

Identification of scientific articles Files identified in databases = 784 Ebscohost = 399 ScienceDirect = 177 Springer Link = 177 Dialnet = 16 CAPES = 15
Articles selected after the application of C.I.1: works that were in the area of Human Sciences = 772 Ebscohost = 399 ScienceDirect = 174 Springer Link = 168 Dialnet = 16 CAPES = 15
Articles included after the incidence of C.I.2: articles published between 2018 and 2022 = 567 Ebscohost = 311 ScienceDirect = 79 Springer Link = 152 Dialnet = 14 CAPES = 11
Articles that remained after application of the C.I.3: submitted to peer review = 367 Ebscohost = 228 ScienceDirect = 65 Springer Link = 58 Dialnet = 4 CAPES = 11
Articles that remained after the incidence of C.E.1: Articles whose country of the journal's link is Brazil = 358 Ebscohost = 223 ScienceDirect = 65 Springer Link = 58 Dialnet = 4 CAPES = 7
Articles that remained after the application of C.E.2: duplicate articles = 257 Ebscohost = 122 ScienceDirect = 65 Springer Link = 58 Dialnet = 4 CAPES = 7

Articles selected after the application of C.E.3: articles without free access = 166 Ebscohost = 100 ScienceDirect = 18 Springer Link = 37 Dialnet = 3 CAPES = 7
Articles that remained after application of C.E.4: articles that in the abstract content analysis did not indicate that they met the theme = 27 Ebscohost = 21 ScienceDirect = 1 Springer Link = 3 Dialnet = 1 CAPES = 1
Articles kept after C.E.5 application: eligibility confirmed by reading the articles in full = 25 Ebscohost = 19 ScienceDirect = 1 Springer Link = 3 Dialnet = 1 CAPES = 1
Total number of studies remaining for the systematic review of the literature = 25 Ebscohost = 19 ScienceDirect = 1 Springer Link = 3 Dialnet = 1 CAPES = 1

Source: Documentary research carried out by the authors (2023)

Chart 5 shows the process of filtering the publications, whose inclusion began with 784 studies. After applying the inclusion criteria (C.I.1 and C.I.2), 567 articles remained. Finally, the exclusion criteria (C.E.1, C.E.2, C.E.3 and C.E.4) were used, so that the research signaled the permanence of 25 publications, eligible for the objective of this investigation. In this selection phase, the titles and abstracts of the essays found were reviewed and inconsistencies were discussed until a consensus was reached and the works were declared eligible.

Chart 6 describes the studies that remained in the proposed systematic literature review.

Table 6. Scientific articles suitable for systematic review

Item	Year	Title	Authorship	Country of Connection	Language	Keywords	Publication	Database
1.	2018	Technological opacity & procedural injustice	Seth Katsuya Endo	USA	English		Boston College Law Review	Ebscohost
2.	2021	The rise of synthetic judges: If we dehumanize the Judiciary, Whose Hand Will Hold the Gavel?	Marie-Claire Aarts	USA	English		Washburn Law Jorunal	Ebscohost
3.	2020	A framework for the efficient and ethical use of artificial intelligence in the criminal justice system	Dan Hunter Mirko Bagaric Nigel Stobbs	USA	English		Florida State University Law Review	Ebscohost

4.	2021	Seeking compatibility in preventing crime with artificial intelligence and ensuring a fair Trial	Kelly Blount	Czech Republic	English	Artificial Intelligence Fair Trial European Convention on Human Rights Predictive Policing	Masaryk University Journal of Law & Technology	Ebscohost
5.	2020	Courts and Artificial Intelligence	A.D. Reiling	USA	English	Courts Artificial intelligence OUCH Justice Information technology	International Journal for Court Administration	Ebscohost
6.	2019	Erasing the BIAS against using artificial intelligence to predict future criminality: algorithms are color blind and never tire	Mirko Bagaric Dan Hunter Nigel Stobbs	USA	English		University of Cincinnati Law Review	Ebscohost
7.	2022	E-justice in Switzerland and Brazil: Paths and Experiences	Marcos Sousa Daniel Kettiger Andreas Lienhard	USA	English	Court management Court Innovation Innovation adoption E-government Comparative research	International Journal for Court Administration	Ebscohost
8.	2019	Re-engineering justice? Robot judges, computerised courts and (semi) automated legal decision-making	John Morison Adam Harkens	United Kingdom	English	Cyberlaw Practice Profession and ethics Algorithmic justice Judging New Technology and Law	Legal Studies	Ebscohost
9.	2022	Artificially Intelligente Class Actions	Peter N. Salib	USA	English		Texas Law Review	EBSCOhost
10.	2019	Implementation of the European ethical charter on the use of artificial intelligence in the judicial system and their environment	Irina Moroianu Zlatescu Petru Emanuel Zlatescu	Romania	English	European Commission for the Efficiency of Justice (CEPEJ) Artificial intelligence (AI) European Ethical Charter on the use of artificial intelligence in judicial systems	Law Review: Judicial Doctrine & Case-Law	Ebscohost
11.	2020	Artificial Intelligence in the Courtroom: Increasing or Decreasing Access to Justice?	Analyzes Morrison	Holland	English	Artificial intelligence Robojudge Separation of powers Algorithm Due process	International Journal of Online Dispute Resolution	Ebscohost
12.	2021	Setting up an ethical framework as a first step to comprehensive regulation of artificial intelligence tools in the justice system	João Arsénio de Oliveira	Turkey	English		Turkish Policy Quarterly	Ebscohost
13.	2019	The role, benefits, and concerns of digital technology in the family justice system	David Hodson	USA	English	Access to Justice OUCH Digital Technology Divorce Online E-Bundles E-Filing Electronic Judges Family Courts Family Law iFLG International Family Law International Family Law Group Judges Law Firms Innovation Online Courts Online Filing	Family Court Review	Ebscohost
14.	2019	Just, quick and cheap? Civil dispute resolution and technology	Tania Sourdin Bin Li Tony Burke	Australia	English		Macquarie Law Journal	Ebscohost

15.	2021	Technological Tethereds: Potential Impact f untrutworthy Artificial Intelligence in Criminal Justice Risk Assessment Instruments	Sonia M. Gipson Rankin	USA	English		Washington & Lee Law Review	Ebscohost
16.	2018	Artificial Intelligence can make our jail system more efficient, equitable, and just	Arthur Rizer Caleb Watney	USA	English		Texas Review of Law & Politics	Ebscohost
17.	2022	Artificial Intelligence and Robotics Led Technological Tremors: A Seismic Shift towards Digitizing the Legal Ecosystem	Hitesh Bhatt Rajesh Bahuguna Rajesh Singh Anita Gehlot Shaik Vaseem Akram Neeraj Priyadarshi Bhekisipho Twala	Switzerland	English	Artificial intelligence (AI) Robotics Legal ecosystem Infrastructure Digitalization Modernization Administration of justice	Applied Sciences	Ebscohost
18.	2018	Judge v Robot? Artificial Intelligence and judicial decision-making	Tania Sourdin	Australia	English		University of New South Wales Law Journal	Ebscohost
19.	2019	Digital Transformation in Justice: Discussion of Challenges and a Conceptual Model for e-Justice Success	Maroun Jneid Imad Saleh Rania Fakhoury	USA	English	E-justice success factors E-justice challenges Evaluation of e-justice Judicial digital transformation Justice modernization Citizen satisfaction Judicial information quality	Proceedings 19th the European Conference on Digital Government	Ebscohost
20.	2021	AI in judicial application of Law and the right to a court	Pawel Marcin Nowotko	USA	English	Informatization Court Application of the Law Judgment	Procedia Computer Science	ScienceDirect
21.	2021	Responsible innovation, anticipation and responsiveness: case studies of algorithms in decision support in justice and security, and an exploration of potential, unintended, undesirable, higher-order effects	Marc Steen Tjerk Timan Ibo van de Poel	Germany	English	Responsible innovation Algorithms Decision support Justice and security Higher-order effects	AI and Ethics	Springer Link
22.	2022	Preserving the rule of Law in the era of artificial intelligence (AI)	Stanley Greenstein	Germany	English	Artificial Intelligence (AI) Machine Learning (ML) Rule of Law Judicial decision-making systems Explainability	Artificial Intelligence and Law	Springer Link
23.	2020	Criminal Justice, artificial intelligence systems and human rights	Aleš Završnik	Germany	English	Criminal justice Human rights Automation Algorithms Artificial intelligence Fair Trial.	ERA Forum	Springer Link
24.	2020	La incidência de las nuevas tecnologias en el derecho al debido proceso	Miguel de Asis Pulido	Spain	Spanish	Dedudo proceso Artificial intelligence Judicial protection New technologies Cyberjustice.	Ius et scientia	Dialnet
25.	2022	The use of artificial intelligence in the Judiciary and its complicance with the Right to a Fair Trial	Kalliopi Terzidou	Australia	English		Journal of Judicial Administration	CAPES

Source: Documentary research carried out by the authors (2023)

Once the selection stage has been overcome, the process of extracting the information contained in the papers should begin, which occurred after their complete reading, a procedure that favored the development of the analysis of the scientific articles described above, in the synthesis phase of the results and discussions, as per the following item.

RESULTS AND DISCUSSION

Once the steps described above have been completed, all instruments and materials are ready to start the subsequent phases that integrate the stages of evaluation of the results and discussions.

In the first moment, the bibliometric analysis of the international scientific production object of the systematic review was presented, highlighting the country of link of the journal, the frequency of publication by Database, the languages used in the texts, the periods of publication, according to the chosen time lapse, the keywords of the texts, the branch of Law and the category of framing (3.1).

The methods used to synthesize the results are described (3.2)

Next, the relationships between the use of AI by the Judiciary, in jurisdictional activities, in democratic countries, and access to justice are presented, based on scientific articles from the systematic review of the literature (3.3), especially in the face of access to jurisdiction (3.3.1) and access to a fair legal order (3.3.2).

At the end, the partial conclusions are presented (4).

BIBLIOMETRIC ANALYSIS OF INTERNATIONAL SCIENTIFIC PRODUCTION

According to Guimarães, Moreira and Bezerra (2021), "Bibliometrics is an area of information science research that, through a quantitative approach, analyzes bibliographic data such as year of publication, performance of countries, periods, authors", for example.

According to Merigó et. Al. (2018), the objective of bibliometric analysis is to identify the most significant aspects of scientific journals in terms of most cited articles, authors, institutions and countries.

Yoshida (2010) states that the focus of bibliometric analysis is the number of times in which the respective terms appear in publications or the number of publications containing the tracked terms.

Pepper et. Al. (2017) They add that bibliometrics is intended for the understanding and evaluation of scientific production activities, provides the recognition of writers and

scholars, through existing literature, and contributes to the development of new forms of knowledge.

Table 2 shows the predominance of publications in scientific journals whose country of affiliation is the United States (12), followed by Germany and Australia, with three publications, and Spain, the Netherlands, the United Kingdom, the Czech Republic, Romania, Switzerland and Turkey, with one publication each.

Table 1. Nationality of the authors' institutional ties (country of affiliation of the scientific journal)

Country of link of the journal	Number of jobs
USA	12
Germany	3
Australia	3
Spain	1
Holland	1
United Kingdom	1
Czech Republic	1
Romania	1
Switzerland	1
Turkey	1
Total	25

Source: Documentary research carried out by the authors (2023)

Regarding the frequency of scientific production by Database, described in Table 2, Ebscohost stood out in the number of scientific publications that deal with AI and access to justice, with 19 of the 25 trials. Springer Link has published 3 articles and with one scientific article ScienceDirect, Dialnet and CAPES appeared.

Table 2. Frequency of scientific production by Database

Database	Number of Jobs	Percentage
Ebscohost	19	76%
Springer Link	3	12%
ScienceDirect	1	4%
Dialnet	1	4%
CAPES	1	4%
Total	25	100%

Source: Documentary research carried out by the authors (2023)

In addition, Table 3 shows the predominance of English in the selected publications: 24 of the 25 publications. Only one of the trials used Spanish.

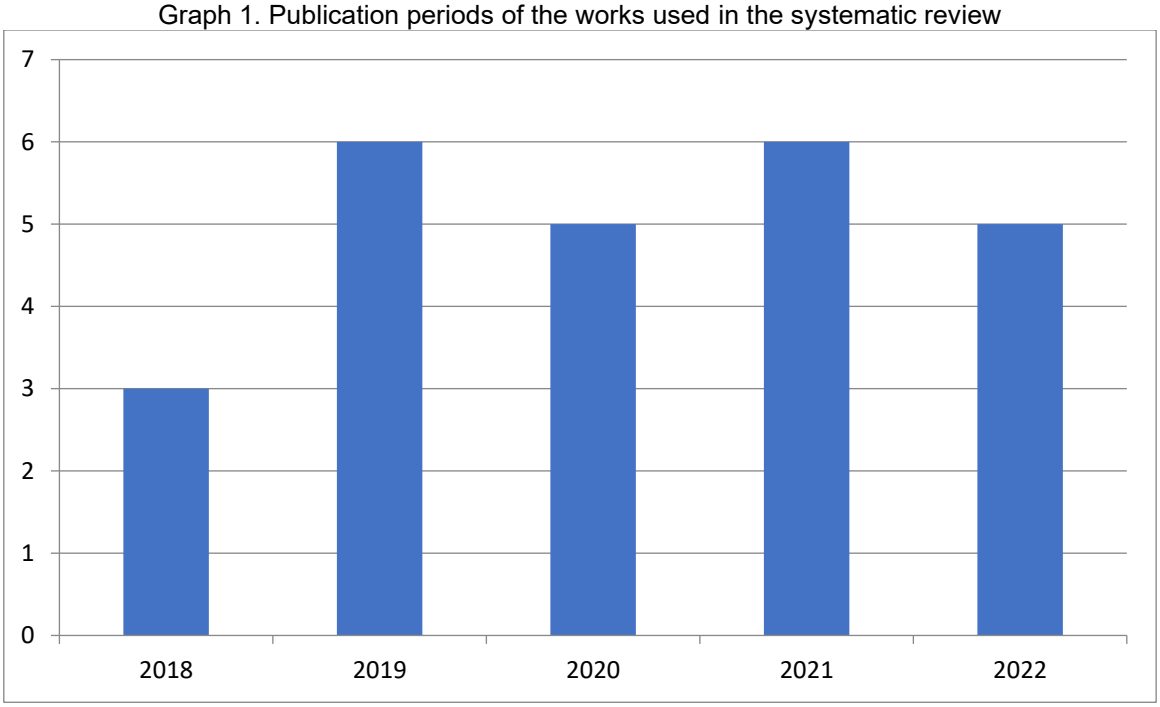
Table 3. Languages of the studies found in the systematic review

Language	Number of Jobs	Percentage
English	24	96%
Spanish	1	4%
Total	25	100%

Source: Documentary research carried out by the authors (2023)

As for the dates of publications, it is reiterated that the search covered the period from 2018 to 2022, and there was a balance in the dissemination of scientific articles, as shown in Graph 1. In 2018, 3 articles were published; in 2019 there were 6 publications; In 2020 and 2022, there were 5 publications and in 2021 there were 6 essays made available.

Graph 1. Publication periods of the works used in the systematic review



Source: Documentary research carried out by the authors (2023)

Figure 1 shows the predominance of keywords used in scientific articles. 81 keywords were found in 16 scientific articles, which represents an average of 5.37 words per article, and 9 studies did not present keywords, which is equivalent to 40% of the total number of studies. The main keywords found in the essays were *Artificial Intelligence* which appeared in 7 opportunities (26%). *AI* was mentioned on 5 occasions (31%). *Algorithms* and *Fair Trial* stood out in 2 texts each (12%). All other keywords were marked once.

Figure 1. Word cloud: Keywords cited in scientific articles



Source: Documentary research carried out by the authors (2023)

The existence of variety about the area or branch of law affected by FI was identified in the analyzed trials, as described in Table 4. It was observed that two texts referred to the Civil area, one to Family Law and two others to Ethics. In 6 essays, the focus was on Criminal Justice. The Administration of Justice was developed in 10 opportunities. Two of the scientific papers addressed issues involving Ethics and four others focused on the Theory of Judicial Decision.

Table 4. Areas or Branches of Law dealt with in scientific articles

Law Area	Number of Jobs	Percentage
Civil	2	8%
Criminal Justice	6	24%
Family Law	1	4%
Ethics	2	8%
Administration of Justice	10	40%
Theory of judicial decision	4	16%
Total	25	100%

Source: Documentary research carried out by the authors (2023)

Two specific categories addressed in the analyzed essays related to the use of AI by the Judiciary were referenced: access to jurisdiction and access to the fair legal order. Table

5 shows that 10 papers analyzed the impacts of AI on access to jurisdiction and that 15 articles worked on the links between AI and access to a fair legal order.

Table 5. Categories of scientific articles

Categories	Number of Jobs	Percentage
Access to jurisdiction	10	40%
Access to the fair legal order	15	60%
Total	25	100%

Source: Documentary research carried out by the authors (2023)

The characteristics available in the study were sufficient for the review authors to be able to interpret the results.

Once the data described above has been collected, it is necessary to identify the methods used to synthesize the results, which will be the subject of the next item.

METHODS USED TO SYNTHESIZE THE RESULTS

The PRISMA 2020 Checklist describes the synthesis methods that must be presented by the authors of the systematic review of the literature, including in the case of the use of meta-analysis.

In Brazil (2014) The following definition is found for meta-analysis: "statistical analysis that summarizes the measures of association of two or more independent studies, generating a single measure of association". Page et. al. (2021a) define meta-analysis as the statistical technique used to synthesize the results when estimates of the study's effect and its variations are available, producing a quantitative summary of the results, something that facilitates its interpretation. For Sampaio and Mancini (2007), meta-analysis is the "analysis of analysis", as it is a literature review study in which the results of the various independent studies are combined and synthesized through statistical procedures, to produce a new estimate or index. According to Figueiredo Filho et. Al. (2014), meta-analysis "is a methodological procedure that synthesizes a certain number of conclusions in a specific field of research".

In this study, however, it was concluded that it was not possible to use meta-analysis, because the samples that became eligible for this systematic review have the characteristic of qualitative studies, due to the incipience of the use of AI by the Judiciary, which implies the inexistence of numerical results suitable for verification, also in variation of the results of the remaining researches. In this step, the use of meta-analysis is not recommended, due to the impossibility of presenting results in aggregate form, as described in Brasil (2014), and due to the lack of homogeneity, according to Brasil (2021).

In addition, in the wake of Brei, Vieira, and Matos (2014), meta-analysis is a method of synthesis of results that applies only to empirical research, so it cannot be applied to synthesize theoretical research, that is, it applies only to research with quantitative results that employ measurement of variables and present plausible statistics.

It was then decided to use the qualitative synthesis of the studies that are the subject of this systematic literature review, in which "the results are usually interpreted subjectively, without there being any justification for the emphasis that is given to certain results", as emphasized in Brazil (2021).

Using ROBIS, the overall risk of bias in the systematic review was assessed and the analysis was reviewed. No divergence was identified. It was concluded that the overall risk of bias in the systematic review is low.

After analyzing the methods used to synthesize the results, it is possible to synthesize and analyze the relationships between the use of AI and access to justice from the basis selected in this systematic review, which will be the subject of the following item.

RELATIONS BETWEEN THE USE OF AI BY THE JUDICIARY, IN JURISDICTIONAL ACTIVITIES, IN DEMOCRATIC COUNTRIES, AND ACCESS TO JUSTICE BASED ON SCIENTIFIC ARTICLES FROM THE SYSTEMATIC REVIEW OF THE LITERATURE

As already stated, it was decided to adopt a restricted notion of *access to justice* in such a way that it is only of interest to evaluate access to jurisdiction and access to a fair legal order. In this part of the investigation, the systematic review was also limited to technologies developed or acquired, free of charge or for a fee, by the Judiciary, which involve the use of AI (machine learning or deep learning).

The synthesis of the results included all pertinent studies that collected data relevant to the research question.

On the one hand, the selected essays ratified the premise presented that the use of AI, by the Judiciary, in jurisdictional activities, implies gains and risks[10], confirmed or potential.

Table 6 shows that in the analyzed essays, it was found that there are many more risks (34) than gains (17) with the use of AI by the Judiciary in jurisdictional activities. This finding is in line with two justifications in particular: the absence of regulation of AI, which

[10] For the purposes of this investigation, in order to avoid risks of bias in the synthesis of the findings, we chose to consider *gains* and *risks* that which were expressly considered as such by the authors of the trials. However, *benefits, opportunities, potential* were inserted as gains and *challenges, obstacles, criticisms, concerns, damages, dangers, questions,* as risks. *Positive impacts, positive results, positive factors, positive effects, positive influences, positive implications* were considered gains and *negative impacts, negative results, negative factors, negative effects, negative influences, negative implications, issues of concern,* risks.

leads to uncertainties about its development and use; and the incipience of technology, which contributes to the mismatch between the objectives of use and the true results obtained or expected.

Table 6. Gains and risks with the use of AI by the Judiciary in jurisdictional activities[11]

Item	Essay	Winnings	Risks
1.	Hunter, Bagaric, and Stobbs (2019)	Improved crime detection Discovery of discrimination and unfair treatment Parity of treatment Improving the administration of justice	Violation of human rights Violation of fundamental rights Undermining the rule of law Negative predictive policing Prediction of negative recidivism Party politics of interests Lack of understanding of technology Systematic bias Lack of transparency of algorithms Algorithms biased against minority groups
2.	Bhatt et. al. (2022)	Facilitating access to justice	
3.	Rizer and Watney (2018)	Improving the efficiency of the prison system Speed Combating human prejudice Advice from magistrates Reduction of prison populations	
4.	Morrison (2020)		Deficiency in the interpretation of the rules Lack of regulation
5.	Salib (2021)	Rapid and accurate resolution of collective claims Absence of discrimination Absence of the black box	
6.	Reiling (2020)	Reducing the complexities of legal proceedings	
7.	Jneid, Saleh and Fakhoury (2019)	Improving efficiency, effectiveness, accountability, integrity, reliability and encouraging citizen participation and involvement Clearer and more organized case management	
8.	Bagaric, Hunter and Stobbs (2019)	Predictive justice: predicting the occurrence of crimes	Lack of transparency for algorithms Algorithms' prejudice and racism Lack of trust in algorithms Algorithmic aversion
9.	Zlătescu and Zlătescu (2019)		Discrimination in data-driven decision-making
10.	Sourdin (2018)		Limitation of human activity
11.	Sourdin, Burke and Li (2019)	Quick resolutions Cost reduction	Relationship: use of technology x fair resolution Lack of transparency in decision-making Algorithmic bias
12.	Morison and Harkens (2019)	Saving time and money Accessibility Reach Speed Better information management	

[11] From the work of SOUSA; KETTIGER; LIENHARD (2022) no gains or risks were extracted, which is why it was not mentioned in this opportunity.

13.	Blount (2021)		Breach of the principle of equality Infringement of the principle of the presumption of innocence
14.	Oliveira (2022)		Lack of AI regulation Absence of human intervention Possibility of human rights violations
15.	Endo (2018)		Lack of precision and fairness Lack of transparency (black box) Lack of equality
16.	Gipson Rankin (2021)	Increased justice	Illegal and unfair outcomes for people of color Lack of technical transparency No legal liability Faulty recommendations Extinction of freedoms
17.	Aarts (2020)		Lack of transparency (black box)
18.	Hodson (2019)		Forum Closures
19.	Nowotko (2021)		Limitation of the applicability of AI Binding decisions without ratification by the judge
20.	Steen, Timan and Van de Poel (2021)	Use of algorithms to support judicial decision	Algorithms that employ biases, inequalities, or injustices Partiality Discrimination
21.	Greenstein (2022)		Threat to the rule of law (decrease) Lack of transparency (black box) Decreased ability to understand
22.	Završnik (2020)	Access to the courts	Lack of transparency (black box) Violation of fundamental rights Violation of constitutional principles: presumption of innocence; the right to a fair trial; equality of arms in judicial proceedings, the right to cross-examine witnesses; the right to an independent and impartial tribunal (including the right to a randomly selected judge); the principle of non-discrimination and equality; and the principle of legality Opacity Violation of the rule of law
23.	Asis Pulido (2020)	Reduction of deadlines Better access to justice Resource optimization Facilitating the provision of legal services	Inequality Vulnerability Social exclusion Information leaks Security breaches Lack of transparency
24.	Terzidou (2022)	Improving access to justice Improving the efficiency and quality of judicial administration	Influence on independence and impartiality in trials Lack of advertising Opacity Partiality Unfair prejudices Technical vulnerabilities

Source: Documentary research carried out by the authors (2023)

The gains were identified in the studies related to the areas of Law described in Table 4, with a predominance of the Administration of Justice and Criminal Justice.

Bhatt et. Al. (2022), Reiling (2020), Jneid, Saleh and Fakhoury (2019), Sourdin, Burke and Li (2019) and Terzidou (2022) pointed out gains from the use of AI, by the Judiciary, in jurisdictional issues, which can be related to the administration of Justice.

Bhatt et. al. (2022) cited the facilitation of access to justice, obtained from the technological bases of the digitized and modernized legal ecosystem, with the use of AI, for example, something that is aligned with Sustainable Development Goals (SDGs) 9 (build resilient infrastructure, sustainable industrialization, and foster innovation) and 16 (sustainable development of society, access to justice, and the building of effective and accountable institutions).

Terzidou (2022) signaled the improvement of access to justice and the improvement of the efficiency and quality of judicial administration, but highlighted the slowness of the process of adopting technology within the European Union and emphasized the need to adopt a reform plan, including legislative, to improve the use of technology.

Reiling (2020) argued for the reduction of the complexities of judicial proceedings, notably by the help of judges in organizing information and presenting advice and suggestions.

Jneid, Saleh and Fakhoury (2019) indicated the improvement of efficiency, effectiveness, accountability, integrity, reliability and encouragement of citizen participation and involvement, signaling the possibility of strengthening institutions. The authors also highlighted clearer and more organized case management.

Sourdin, Burke, and Li (2019) pointed out quick resolutions and cost reduction as advantages of the use of AI by the Judiciary, and emphasized that the technology acts on three levels: on the first, it is helping to inform, support, and advise those involved in the Justice system; in the second, it operates in place of human beings, in their functions and activities; in the third, it affects the way judges and legal professionals work.

Hunter, Bagaric and Stobbs (2019), Rizer and Watney (2018), Bagaric, Hunter and Stobbs (2019) and Gipson Rankin (2021) described gains for the Criminal Justice with the application of AI by the Judiciary.

Hunter, Bagaric and Stobbs (2019) pointed to improved crime detection, uncovering discrimination and unfair treatment, parity of treatment and improved administration of Criminal Justice as positive aspects.

In another study, Bagaric, Hunter, and Stobbs (2019) argued that the use of predictive justice, with the possibility of predicting the occurrence of crimes, preventing recidivism and the escape of convicts, is a gain.

Rizer and Watney (2018) indicated the improvement of the efficiency of the prison system, speed, combating human prejudice, advising magistrates, and reducing prison populations as gains.

Gipson Rankin (2021) claimed the increase in justice as a high point of the use of AI, by the Judiciary, as long as there is supervision of the technology, to avoid unfair decisions to the detriment of black, indigenous, and other communities of color.

Morison and Harkens (2019) and Steen, Timan and Van de Poel (2021) related gains to the Theory of Judicial Decision with the use of AI by the Judiciary.

Morison and Harkens (2019) argued that there will be gains such as time and money savings, accessibility, reach, speed, and improved information management.

Steen, Timan, and Van de Poel (2021) adduced that the main positive point is the use of algorithms to support judicial decision-making, provided that the following principles are respected: (a) respect for the autonomy of human beings; (b) prevention of damage; (c) impartiality and (d) explainability.

Salib (2021) identified gains in the Civil area with the adoption of AI by the Judiciary: quick and accurate resolution of collective claims, absence of discrimination and absence of the black box.

At this point, it is necessary to analyze to what extent these findings can effectively be considered as benefits.

The finding of Jneid, Saleh and Fakhoury (2019), when listing integrity and encouragement of citizen participation, does not seem to fit with the other findings, especially in a context of lack of transparency in the development and use of AI.

In addition, the benefits of the use of predictive justice, by the Criminal Justice, require ratification of respect for fundamental rights, especially of blacks, indigenous peoples and other minorities, raising doubts about their integrity and, therefore, about their classification as a gain.

The risk scenario was found especially in the essays framed in the area of Criminal Justice, Administration of Justice and Theory of Judicial Decision.

Hunter, Bagaric and Stobbs (2019), Bagaric, Hunter and Stobbs (2019), Wexler (2021)Blount (2021) and Gipson Rankin (2021) pointed out several risks with the use of AI by Criminal Justice.

Hunter, Bagaric and Stobbs (2019) presented an extensive list of risks: violation of human rights; violation of fundamental rights; shaking of the Rule of Law; negative predictive policing; prediction of negative recidivism; partisan politics of interests; lack of

understanding of technology; systematic bias; lack of transparency of algorithms; biased algorithms against minority groups.

Bagaric, Hunter, and Stobbs (2019) highlighted the following risks: lack of transparency of algorithms; prejudice and racism of algorithms; lack of trust in algorithms; algorithmic aversion.

Blount (2021) argued that there was a risk of breach of the principle of equality and breach of the principle of the presumption of innocence.

Gipson Rankin (2021) listed the following as risks: illegal and unfair outcomes for people of color; lack of technical transparency; absence of legal responsibility; faulty recommendations; extinction of freedoms.

About the Administration of Justice, risks have been identified in Morrison (2020), Sourdin, Burke & Li (2019), Aarts (2020), Nowotko (2021) and Terzidou (2022).

Morrison (2020) pointed out the deficiency in the interpretation of the rules and the absence of regulation as risks to the use of AI by the Judiciary.

Sourdin, Burke and Li (2019) stated that there is a risk of affecting the relationship between the use of technology and the fair resolution of the dispute.

Aarts (2020) highlighted that the great risk of using technology is the absence of transparency (black box).

Nowotko (2021) argued that the risk is related to limiting the applicability of AI and issuing binding decisions without ratification by the judge.

Terzidou (2022) argued that there are risks of influencing independence and impartiality in trials and the absence of publicity.

As for the Theory of Judicial Decision, they identified risks in Sourdin (2018)Greenstein (2022) and Steen, Timan and Van de Poel (2021).

Sourdin (2018) stated that the limitation of human activity is a risk to the use of AI by the Judiciary.

Greenstein (2022) adduced the possibility of negative impacts, highlighting the threat to the rule of law; absence of transparency (black box) and decreased ability to understand.

Steen, Timan, and Van de Poel (2021) pointed out that the risks are related to algorithms that employ prejudices, inequalities, or injustices.

In the Civil area, Endo (2018) He asserted that the risks are the lack of precision and fairness, the absence of transparency (black box) and the absence of equality between the parties.

In Family Law, Hodson (2019) maintained that there is a risk of closing Forums with the use of new technologies by the Judiciary.

In an analysis of these trials, it can be observed that the synthesis of the findings listed above is consistent with the notion of risk.

Another point that deserves to be highlighted is the fact that Salib (2021) has inserted the absence of a black box as a gain, even though authors have been identified who classified the absence of transparency (black box) as a risk. This finding is justified because the study by Salib (2021) refers to the use of AI, by the Judiciary, in the Civil area and not in the Criminal area, which is the subject of the other studies. In addition, the author presented a proposal for the development of a tool using AI, in the Civil area, with open access, that is, there would be no obstacle to the knowledge of the technology, unlike what was evaluated by the other authors in their studies.

Some divergences were also identified in the synthesis of the findings, especially regarding the classification of gains and risks.

Rizer and Watney (2018) related the fight against prejudice as a gain, but Bagaric, Hunter, and Stobbs (2019) understood that the use of AI by the Judiciary reinforces prejudice by algorithms. It is a merely apparent divergence, as it is related to different contexts. In the first case, the authors base their conclusion on the possibility of using AI to reduce the prejudice inherent to human judgment, which is often flawed and which, therefore, could be reduced by the use of AI. Bagaric, Hunter, and Stobbs (2019) mention prejudice arising not from human action, but from the application of algorithms (algorithmic bias).

Hunter, Bagaric, and Stobbs (2019) emphasized parity of treatment as gain, but Blount (2021) flagged violation of the principle of equality. Again an apparent divergence is identified, because in the first case the authors emphasize the possibility of improving impersonality in the analysis of issues objectively with the use of AI.

On the other hand, the notion of fair justice implies the fulfillment of two essential premises, concomitantly: access to jurisdiction and access to the fair legal order. In the first case, some tools or strategies enable the citizen's opportunity to have access to jurisdictional provision, for example, through Free Justice, the Public Defender's Office and the Double Degree of Jurisdiction. Access to a fair legal order contemplates a set of principles that should guide judicial activity, such as, *verbi gratia*, administrative morality, impartiality of the magistrate, reasonable duration of the process, adversarial and ample defense.

At this point, it remains, then, to discuss the relationships between the gains and risks of the use of AI, by the Judiciary, in jurisdictional activities, and access to justice, notably its aspects of access to jurisdiction and access to a fair legal order.

AI and access to jurisdiction

Morrison (2020), when analyzing the American justice system, emphasizes the high financial cost and the expenditure of time as major obstacles to access jurisdiction. In this context, the use of AI could lead to: (1) the reduction of costs of the process, as the robot judge would not receive a salary; (2) the reduction of the processing time of the lawsuit, due to the capacity to process large amounts of information in a few minutes and, (3) consequently, the reduction of the procedural collection. This scenario would signal, in theory, access to a cheaper and faster judicial decision, something that would favor access to justice, notably, access to jurisdiction.

However, the author describes a series of questions regarding the legitimacy of the use of technology, highlighting the following: (1) can AI evaluate human values in decision-making? (2) Would AI be more efficient than human judges? (3) to what extent would AI violate the Federal Constitution, in particular, the Rule of Law and the separation of powers? (4) who would be the de facto judge: the AI or its programmers? (5) can the use of AI by the Judiciary give rise to the violation of due process? (6) To what extent would AI be endowed with credibility?

From the perspective of Morrison (2020), therefore, the use of AI by the Judiciary could lead to improved access to jurisdiction, however, the lack of positive answers to these questions raised refers to the lack of legitimacy and credibility of the use of technology.

Reiling (2020), in turn, defends the use of AI by the Judiciary for cases of minor complexity, notably in aid of judges, in the organization of information and with advice and suggestions. According to the author, however, it would be necessary for magistrates to understand how technology works, to make proper use, and for the Courts to constantly monitor their system, which could imply, as a consequence, at first, an increase in the cost of the process, due to the need for qualification of judges and investments in monitoring and improvement of the process.

Reiling's (2020) notion is more consistent with the current moment of the Judiciary. It means that the reduction in costs of the process, described by Morrison (2020), would not occur immediately, as investments would be necessary not only in technology, but also in judge training and monitoring by the Courts, which would not immediately make it possible to improve access to jurisdiction.

In this regard, Jneid, Saleh, and Fakhoury (2019) emphasize the need for governance, resource management, and financing practices so that technology experts can play a key role in supporting decision-making.

In the same direction is the position of Sousa, Kettinger and Lienhard (2022), according to which it is necessary to invest in technology management by the Judiciary.

Sourdin, Burke, and Li (2019) highlight that the use of technology can lead to the replacement of humans by machines and, consequently, reduce public costs for the Judiciary. However, according to the authors, it is still necessary to think about long-term investments in the legal aid sector and in the judicial structure itself, but if the public budget is not sufficient, there may be an even greater reduction in the workforce, something capable of reducing the quality of the judicial service and impairing access to jurisdiction.

Asis Pulido (2020) asserts that the potential benefits of the use of AI by the Judiciary must be accompanied by measures for the access of the entire population to computer systems and the internet, something fundamental to reduce social exclusion and, consequently, access to jurisdiction. In addition, the author highlights the importance of algorithmic transparency in the use of technology by the Judiciary, to avoid unknown premises employed by robot judges, which can mitigate the legitimacy of judicial decisions.

Hodson (2019) indicated that the gains arising from the use of technologies, with the reduction of costs by the Judiciary, do not necessarily mean improved access to jurisdiction. According to the author, the reduction of costs arising from the use of technologies may lead to the closure of Forums, which, consequently, implies a higher cost for the jurisdictional party to access the jurisdictional unit in person, due to the possibility of increasing the distance from the new seat of the Judicial District.

Therefore, on the one hand, it is concluded that there is a need to rethink the notion of immediate reduction of the cost of the process, based on the use of AI, by the Judiciary, due to the obligation of investment first and cost reduction later, something that has a direct impact on access to jurisdiction, after all, even if there is a reduction in the cost of the judicial process, for the Judiciary, it would not imply a reduction in the costs of the process for those under jurisdiction in a short time.

In this context, the possibility of increasing the costs of the process due to the need for investments in technology, public governance and monitoring is questioned, something that was not identified in the trials that were the object of the investigation. As noted, the possibility of increasing the cost of access to jurisdiction is aligned with the risk by Hodson (2019), that is, with the possibility of closing forums.

On the other hand, it is essential that citizens have access to technologies, such as equipment, internet, and digital literacy, and also know the premises employed by AI, so that they can have effective access to jurisdiction in a context of disruptive innovation.

Consequently, the picture evaluated in this systematic review demonstrates that the gains arising from the use of AI by the Judiciary are incipient and insufficient to give rise to the unequivocal identification of improved access to jurisdiction in a short time.

AI and access to a fair legal order

The main findings in the analyzed essays indicated the presence of a multifaceted scenario about access to a fair legal order.

At first, it is possible to perceive the existence of controversies about the cataloguing of gains and risks, as shown in Table 6 above.

Hunter, Bagaric and Stobbs (2019), Rizer and Watney (2018) and Salib (2021) pointed out as gains parity of treatment, the fight against human prejudice and the absence of discrimination, respectively. However, Bagaric, Hunter and Stobbs (2019), in another study, Zlătescu and Zlătescu (2019), Blount (2021), Endo (2018), Gipson Rankin (2021), Steen, Timan and Van de Poel (2021), Završnik (2020), Asis Pulido (2020) and Terzidou (2022), respectively, identified as risks: prejudice and racism of algorithms; discrimination in data-based decision-making; absence of equality; illegal and unfair results for people of color; algorithms that employ prejudices, inequalities or injustices, bias and discrimination; violation of the principle of equality of arms; inequality; partiality and unfair prejudices.

This observation can be explained beyond the subjectivity or preference of each author. The classification of AI technology, as a risk or gain, is directly related to the results that are observed or to projections – optimistic – that signal a positive result. In this way, Oliveira (2022), Zlătescu and Zlătescu (2019) and Gipson Rankin (2021) found that the use of Predictive Justice, by Criminal Justice, with the Correctional Offender Management Profiling for Alternative Sanctions (COMPASS)[12], in the United States, gave rise to the occurrence of discrimination against blacks, indigenous people or other minorities, that is, it takes care of evident and verified damage.

When it is stated that the use of AI by the Judiciary can improve parity of treatment, the fight against human prejudice and the absence of discrimination, it means that these are projections based on the use of objectivity and transparency in the use of technology to reduce – it is intended to eliminate – the possibility of discrimination arising from decisions rendered by human judges, which by nature carry their preferences and perceptions.

In any case, at this point it is questioned whether the gains described in Table 5 are capable of improving access to a fair legal order.

[12] In Portuguese: Criminal Correctional Management Profiles for Alternative Sanctions.

Even though these are optimistic projections, due to the lack of research on the results of the use of technology, even because the stage is still early, it is possible to perceive timid advances and significant setbacks in access to the fair legal order, a perspective that is directed to those under jurisdiction.

Predictive Justice, in the criminal field, has the power to improve the efficiency of the prison system – if algorithmic discrimination is eliminated – which will lead to a reduction in the prison population and, consequently, to an increase in the dignity of convicts, something that will contribute to the respect of their fundamental human rights, a facet of access to a fair legal order.

This tool also has the potential to improve procedural speed and, consequently, the analysis of incidents involving convicted prisoners, avoiding illegal and lengthy arrests, a fundamental aspect for the preservation of fundamental human rights.

The use of algorithms to support judicial decision-making, in turn, can assist magistrates in the analysis of simpler cases, contributing to time savings and improving productivity. This is a key factor in reducing unnecessary arrests.

In addition, it is questioned what are the impacts that the risks and losses described in Table 5 can cause to the fair legal order.

The violation of fundamental human rights is a latent concern in the context of the use of AI by the Judiciary because it is an aspect that signals clear harm to access to a fair legal order.

The use of biased and discriminatory algorithms, in this step, is shown to be an aspect to be considered. In this context, the lack of transparency and publicity, several times cited as a "black box" by the authors, is presented as a relevant factor that should be considered by the Judiciary.

Those under jurisdiction have the right to trial by an impartial judge and also to know the criteria that are used in the analysis of their case, something that is questionable and worrisome, in the case of the use of AI, under penalty of violation of due process. When questioning the absence of transparency, it is also possible to observe the possibility of deficiency in the interpretation of the rules, a sensitive issue for the developers of the technology.

In this context, there may be insurgencies about the violation of the separation of powers, as the Judiciary could use the technology freely, without the existence of previous regulatory norms. It seems very clear that the use of AI by the Judiciary falls within its administrative autonomy, but one cannot ignore the need to regulate issues – especially

ethical ones – that may be sensitive to constitutional principles, such as the Natural Judge, something that does not currently exist.

Therefore, the predominance of risks in relation to gains is observed and, among the risks – and losses – the existence of algorithmic bias, lack of transparency (black box), reduction of the rule of law and violations of due process and fundamental rights capable of mitigating access to a fair legal order stand out.

In short, the use of AI by the Judiciary in jurisdictional activities is obscured in the complex scenario of risks, losses and gains, and it is hasty to conclude that, at this moment, there is an improvement in access to the fair legal order. On the contrary. The comparison between risks, losses and gains signals the presence of violation of access to the fair legal order.

Thus, some essays presented structures, recommendations, solutions, models, examples, and reflections with the objective of overcoming the risks and losses and optimizing the gains from the use of AI by the Judiciary.

Bhatt et. al. (2022) list a series of recommendations that can be employed in this context, highlighting the following: (1) legal infrastructure: according to the authors, the challenges emanating from cutting-edge technological devices justify dedicated efforts on the part of the legal apparatus to bring about adequate legal changes to the legal infrastructure, so that the current infrastructure legislation needs to be renewed to make way for the intervention of technologies to help the apparatus legal; (2) regulatory framework: there is an absence of a legislative framework on how the violation of individual rights through AI-driven action can be compensated, so a regulatory framework is needed; (3) legal education: in order for the digitalization, modernization, and virtualization of legal services to be achieved, legal education would need to be renewed to assimilate AI- and robotics-enabled education to overhaul the legal education ecosystem and engage in law education.

Terzidou (2022) presents a set of suggestions for the development of AI in the judicial sphere, highlighting the development of AI technology by computer scientists who are part of the staff of the Courts' administrations, as it would provide direct communication between magistrates and technicians, facilitating experimentation and redesign processes.

Jneid, Saleh and Fakhoury (2019) presented a list of suggestions for the development of a conceptual model for successful E-Justice projects, relying on information systems on success factors and completing it with specificities and values based on the domain of the judicial sector.

Oliveira (2022) states that there is an urgent need for a binding and comprehensive legal instrument that regulates the use of artificial intelligence in the field of Justice.

Asis Pulido (2020) presents a set of suggestions for the safe use of AI by the Judiciary. According to the author, the necessary measures must be taken to guarantee access to computer systems and the Internet for the entire population, through responsible computerization of society. Advances in cyberjustice, according to Asis Pulido (2020), must be accompanied by the reinforcement of citizens' rights to data protection, so that their information is properly encrypted and secure throughout the process. According to the author, it is necessary to ensure the transparency and publicity of the algorithm that makes the machine work, that is, it is required that the operation of the technologies used in the judicial process be known, in order to guarantee the rights recognized in due process.

These proposals are pertinent and relevant and can contribute to optimizing the use of AI by the Judiciary and reducing risks, however, regulation is the most urgent and delicate aspect, as it is necessary to consider the establishment of standards without removing or limiting the potential for future technological advancement and, also, ensuring the protection of human and fundamental rights and the observance of fundamental ethical aspects. A challenge for the legislator.

In the European context, the first step has been taken: the European Commission for the Efficiency of Justice of the Council of Europe (CEPEJ) adopted the "European Charter on the Use of AI in Judicial Systems" at the end of 2018 to mitigate the above-mentioned risks specifically in the justice sector.

In the United States, the New York City Council was the first to pass a law in 2017 on algorithmic transparency in decision-making by providing for the creation of a task force to monitor the fairness and validity of the algorithms used by municipal agencies[13]. In 2019, the New York City Council approved the creation of another rule, a local law to amend the New York City administrative code, regarding reporting on the algorithmic tools used by city agencies[14].

The Algorithmic Accountability Act of 2019[15] was passed by the U.S. Congress in 2019 and provides for a series of measures against algorithmic bias and discrimination, including determinations for developer companies such as mandatory audits. In addition,

[13] Available in https://legistar.council.nyc.gov/LegislationDetail.aspx?ID=3137815&GUID=437A6A6D-62E1-47E2-9C42-461253F9C6D0
[14] Available at https://legistar.council.nyc.gov/LegislationDetail.aspx?ID=4265421&GUID=FBA29B34-9266-4B52-B438-A772D81B1CB5&Options=Advanced&Search=
[15] Available in https://www.congress.gov/bill/116th-congress/house-bill/2231/text

the proposal for a new Algorithmic *Accountability Act of 2022* is already being discussed in the US Senate[16].

Finally, these findings can be compared with the conclusions of Almeida and Pinto's studies (2022) who carried out a systematic review of the literature in which they investigated the relationships between the use of AI, by the Judiciary, and access to justice.

The authors identified gains that they called "successful initiatives" and highlighted: (1) "reduction in the number of time, resources and personnel allocated to those everyday activities, so that human action can be directed to acting on more complex demands"; (2) smart readers; (3) algorithms that can facilitate the user's understanding of texts characteristic of the legal area; (4) impartiality; (5) objectivity; (6) objective predictability; (7) standardization of jurisprudence; (8) speed; (9) improvement of the management of public resources; (10) preservation of constitutional rights. Regarding the recommendations, the authors understood that it is necessary to: specific regulation that can support the use and scope of AI measures; and follow-up management to verify risk factors and difficulties in the use of technology.

The main findings of this systematic review corroborated, in part, the findings described above by Almeida and Pinto (2022), especially those described in (1), (5), (6), (8), (9). Numbers (2), (3) and (7) identify technologies that can be used by the Judiciary, with the use of AI, something that was not identified in this systematic review. And the findings expressed above in letters (4), (5) and (10) were not fully ratified in this investigation, with divergence among the authors of the selected scientific articles.

Regarding the suggestions presented by Almeida and Pinto (2022), it is observed that they are in line with those described by the authors of the essays in this investigation.

Siqueira, Lara and Lima (2021), on the other hand, when conducting a systematic review of the literature on access to justice and AI, grouped the selected essays into four segments, with the aim of systematizing the searches: (1) efficiency and use of applications; (2) focus on the characteristics of the law and the risks and opportunities for the profession; (3) online dispute resolution systems and interconnection with AI; and (4) challenges for the interconnection between AI, law and access to technology.

As can be seen, segments (1), (2) and (3) do not communicate with the proposal of this research and the challenge foreseen in (4) ended up having repercussions in this systematic review as a suggestion and not a challenge.

[16] Available in https://www.congress.gov/bill/117th-congress/house-bill/6580/text

It is recommended that other systematic reviews of the literature be developed on the following topics: AI in the Public Defender's Office; AI in the Public Prosecutor's Office; and AI in Online Dispute Resolution (ODR) models.

FINAL CONSIDERATIONS

The results of this systematic review indicated that there are gains and risks with the use of AI by the Judiciary in jurisdictional activities. However, far more risks than gains were identified, which is justified by the absence of legal regulation and the presence of underlying ethical issues. This provides important evidence on the impacts of this technology on access to jurisdiction and access to the fair legal order.

No substantial and immediate gains were identified for access to the jurisdiction, in the syntheses of the main findings of the investigated trials, and there are prospects for reducing the costs of the process and improving its processing time. This finding was justified to the extent that the appropriate studies are contextualized in the reality of democratic countries whose AI development is predominantly focused on the Administration of Justice, Criminal Justice and the Theory of Judicial Decision.

Evidently, this does not mean that there are no gains in this context, and other studies may later demonstrate the benefits of the technology, for example, with the use of AI for the admissibility of appeals (double degree of jurisdiction).

In relation to the fair legal order, the benefits found were of various orders, but again those directed to the Administration of Justice, Criminal Justice and the Theory of Judicial Decision predominated. In this step, the improvement of the administration of justice, support for the magistrate and procedural speed were highlighted, but the absence of mention of the quality of the judicial decision was surprising, which signals that there is still a long way to go for the Judiciary.

The risks in relation to access to jurisdiction are worrying, especially the possibility of reducing human resources, replaced by machines, and closing forums, something that is not proportional to the increase in the collection of cases identified in recent years.

It was noticed that the risks were concentrated especially in potential stimulants of prejudice and discrimination, in the face of blacks, indigenous people and other minorities. The reduction of the rule of law and the violation of due process were also identified.

Thus, between gains and risks, it is concluded that the use of AI, by the Judiciary, in jurisdictional activities, has the ability to catalyze injustices, especially in Criminal Justice, that violate access to justice. This scenario is in line with the stage of development of smart technologies, which is still incipient and, therefore, evolving.

It is possible to present some suggestions to enhance the gains and minimize the harmful effects of smart technology on access to justice.

Indeed, not all the work of the courts is complex work, so the need for information technology is not the same for all cases. It means that it is possible to employ AI, in aid of the magistrate, in cases of small complexity.

The use of AI tends to provide cost reduction and procedural speed, but it is necessary to be careful that these factors do not result in an exacerbated reduction of the workforce, due to the effect of replacing man by machine. This process can also increase the dehumanization of judicial decisions, catalyzing algorithmic aversion and resistance to the use of AI by citizens.

One cannot lose focus on investment in free legal aid and free justice, which means that the State must be attentive to its budgetary priorities so that it does not employ disproportionate financial efforts in AI and leave these strategies, which are fundamental for access to jurisdiction, in the background.

In the case of predictive Criminal Justice and the application of risk assessment software, it is necessary to improve the development of algorithms, with the effective participation of magistrates, including through courses and training, and to ensure transparency in the process of use, especially by providing access to AI tools and the possibility of questioning biases by parties who consider themselves harmed by the use of technology. reducing the possibility of prejudice and discrimination against black, indigenous and other disadvantaged minorities. It takes care of a fundamental strategy that will help not only to overcome distrust in algorithms, but will provide conditions for continuous testing, refinement and improvement of algorithms. This is an alternative to opening the algorithmic *black box*, including shedding light on it, since it haunts those involved in investigations of this nature so much.

This requires, at first, the adequate and urgent regulation of AI, without limiting its possibilities and mitigating technological development, but with a provision for the prevention of harm, something that proves to be a great challenge for the legislator. In addition, it is necessary to rethink the justice system itself, with specific legislative changes in the rites, especially to ensure access to a fair and appealable decision. Consequently, it is necessary to review the civil liability system to contemplate the illicit conducts practiced by developers and applicators of this technology and by hackers. In addition, one cannot lose sight of the need for investments in security to prevent unauthorized access to technological resources or cyberattacks, something that can compromise the credibility of the entire system.

You cannot fully hand over to machines, autonomously, the judicial decisions that will affect people's lives. It is essential that there is human supervision in the use of AI by the Judiciary, especially in those cases of greater complexity and that involve fundamental rights, such as freedom.

Without respect for fundamental rights and the rule of law, the use of AI by the Judiciary, no matter how fast and cheap it may be, will not ensure access to justice.

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SUSTAINABLE AND EFFICIENT RECONSTRUCTION: THE USE OF WOOD IN THE ACCELERATION OF POST-DISASTER PROCESSES

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ABSTRACT

Natural tragedies are devastating events that require rapid and effective responses to minimize social and economic impacts on affected communities. This article explores the use of timber construction technologies, specifically Cross Laminated Timber (CLT) and Light Wood Frame (LWF), as viable solutions to speed up reconstruction processes. Based on case studies and the analysis of technical, cultural and regulatory challenges, the article proposes strategies to overcome the barriers to the expansion of these technologies in Brazil, with emphasis on the need for a national study that establishes specific cost compositions, financing of industrial plants, public-private partnerships for CLT and LWF in the context of public works.

Keywords: CLT. LWF. Post-disaster reconstruction. Sustainability. Engineered wood.

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INTRODUCTION

In recent years, Brazil and the world have faced a significant increase in the occurrence of natural disasters, resulting from heavy rains. These tragedies have caused large-scale destruction, leaving thousands of fatalities, people homeless, damaging infrastructure, and causing damage to both the public and private sectors. The need for rapid and efficient reconstruction therefore becomes a priority for governments, businesses and affected communities.

Emerging solutions for post-disaster reconstruction include timber construction technologies such as Cross Laminated Timber (CLT) and Light Wood Frame (LWF). These technologies offer not only speed of construction, but also significant benefits in terms of sustainability and reduced environmental impact. However, its large-scale implementation faces technical, cultural, and regulatory challenges that need to be overcome so that they can be adopted in reconstruction projects, especially in public works.

This is not just a discussion about improvements, but a matter of urgency. Exploring wood construction technologies, their benefits and challenges, is essential to propose solutions that promote their expansion in Brazil. This is a blessed country, where any seed that falls on the ground bears fruit, and the exploration of this vocation begins with a detailed national study. Such a study should establish specific cost compositions for CLT and LWF, enabling its inclusion in the National System of Research on Costs and Indices of Civil Construction (SINAPI) and, consequently, its application in public works projects.

THE URGENCY OF QUICK AND SUSTAINABLE SOLUTIONS IN THE POST-TRAGEDY

Natural tragedies are recurrent and devastating events that require quick and efficient responses to minimize social and economic impacts. In post-disaster scenarios, rapid reconstruction is crucial to restore normalcy and ensure the safety of affected communities. Construction technologies such as Cross Laminated Timber (CLT) and Light Wood Frame (LWF) have proven effective, combining speed of assembly, sustainability, and the ability to adapt to the specific needs of the affected areas.

In 2012, in New Zealand, a Christchurch Central Recovery Plan (CCRP) was created after a major earthquake destroyed most of Christchurch city centre. The CCRP aimed to rebuild the city of Christchurch to optimised standards. However, the rebuilding process was not as quick as expected, resulting in significant delays in most projects. Researchers Shitong Tian and Don Amila Sajeevan Samarasinghe realized that CLT technology was entirely aligned with the purposes of CCRP, due to the speed of assembly combined with fire resistance, good environmental performance and high mechanical resistance, that is,

everything that is expected in a good enterprise. *"CLT has positive features such as good environmental performance, high fire resistance, high shear force resistance and rapid assembly, all of which are in line with the objectives of CCRP".* (Tian and Samarasinghe, 2022).

Modularity and adaptability approaches are central to the effectiveness of disaster responses. The CLT panel is a construction material of quick completion, as it is prefabricated with openings and pre-cut electrical and plumbing installations. This means that the completion of a structure is not difficult and does not require highly skilled workers to erect and connect it on site (Divekar apud Tian and Samarasinghe, 2022), consequently, there can be considerable savings in on-site operating costs due to the rapid assembly of components.

The adoption of emerging technologies, such as Building Information Modeling (BIM) and modular construction methods, are necessary to enhance the use of CLT and LWF in post-disaster scenarios. As discussed at the 44th AUBEA Conference (Australasian Universities Building Education Association), integration of these innovations with construction methods such as CLT and LWF not only accelerates the reconstruction process, but also increases the resilience and sustainability of the rebuilt structures, however, and this is perceived across the globe, the high costs associated with the implementation and management of BIM, as well as the lack of expertise in the system, have hindered its adoption (Karia et al, 2021).

Other, very significant challenges still need to be overcome to ensure the effective implementation of these technologies. The logistics of transporting and storing materials, the need for specialized training for the workforce, and cultural and regulatory barriers are some of the obstacles identified, overcoming these barriers requires a coordinated approach that includes education, training, and strategic partnerships between governments, the private sector, universities, and international organizations.

Finally, the sustainability of post-disaster reconstruction solutions must be considered a priority, after all, as has been ventilated in all the news, disasters will increase in magnitude, reconstruction must associate speed with respect for the environment. The use of CLT and LWF not only facilitates rapid construction, but also contributes to reducing the carbon footprint of new constructions, since wood is a renewable and low-carbon material, in fact, "wood sequesters carbon" (DIAS, 2018). This sustainable approach is essential to ensure that rebuilt communities are resilient not only to future disasters, but also to increasing environmental pressures.

CASE STUDIES

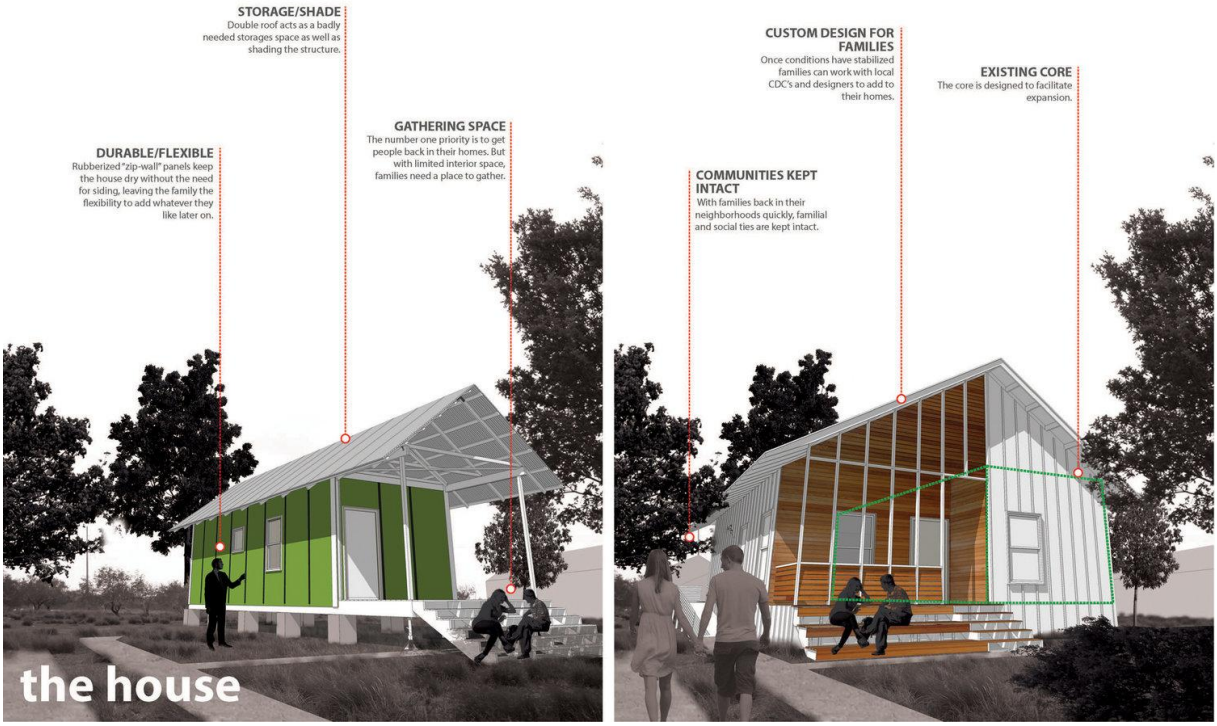
In this chapter, two representative examples of post-disaster housing solutions will be analyzed, which demonstrate the application of sustainable technologies that combine efficiency, speed and low cost. The RAPIDO program, developed in the United States, stands out for the rapid implementation of expandable modular units, offering an efficient solution to serve communities in emergency situations. The Villa Verde project, led by ELEMENTAL in Chile, presents an incremental approach with wooden structures, allowing families to expand their homes according to their needs and resources. Finally, the integration of technologies such as Building Information Modeling (BIM) with wooden construction systems, such as CLT and LWF, will be discussed, highlighting how the use of digital tools can optimize the planning and execution of works in post-disaster reconstruction contexts.

RAPIDO: RAPID TRANSITION TO PERMANENT HOUSING

The RAPIDO (Recovery Accelerated Program for Inhabitable Dwellings Operations) program was developed in the United States after Hurricane Dolly in 2008, to offer fast, scalable and adaptable housing solutions in emergency scenarios. It combines prefabricated central units based on the Light Wood Frame (LWF) system, which can be installed quickly to meet emergency housing needs, and subsequently adapted or extended for permanent use (DUSTIN et al., 2024).

RAPIDO stands out for its efficiency in reducing the time between the disaster and the delivery of an initial housing solution. Housing units are assembled quickly and designed to allow expansion without occupants being displaced. The modularity of the structures facilitates the integration of improvements and extensions in a cost-effective and sustainable way. The program also prioritizes the use of sustainable building materials, contributing to the reduction of the carbon footprint and environmental impact associated with post-disaster reconstruction. Figure 1 illustrates an application of the RAPIDO program, highlighting its main attributes:

Figure 1: Schematic drawing of RAPIDO deployment



Source: RAPIDO

Image Description: The illustration presents two stages of the implementation of the RAPIDO program. On the left, the initial installation of the prefabricated central unit is demonstrated, which uses lightweight and durable panels, providing safe and flexible shelter. The double roof serves as storage space and additional shade. On the right, the expansion of the unit is presented, with the incorporation of additional modules designed according to the needs of the family, keeping the communities intact and promoting sustainable reconstruction.

In addition, the application of RAPIDO has demonstrated its effectiveness in mitigating the impact of disasters on vulnerable communities, offering a replicable model for other contexts. Programs like this could be adapted to meet the housing demand in post-disaster scenarios in Brazil, especially in areas that are difficult to access or lack specialized labor.

ELEMENTAL: INNOVATIVE RECONSTRUCTION IN CHILE

After the 2010 earthquake and tsunami that devastated the city of Constitución, Chile, the architectural firm ELEMENTAL, led by Alejandro Aravena, was invited by the forestry company Arauco to develop a housing plan for the affected workers. The result was

the "Villa Verde" project, an initiative that exemplifies the application of incremental housing solutions in post-disaster contexts (ELEMENTAL, 2012).

Like the RAPIDO project, the project's central concept is based on the construction of two-story "half-houses", delivering to families an initial structure that meets basic housing needs, but can be expanded and customized over time according to the resources and preferences of the residents. This approach allows families to complete their residences according to their means, fostering a sense of ownership and active participation in the reconstruction process.

The modularity and flexibility of the project facilitate the adaptation of the housing units to the specific needs of each family, allowing horizontal and vertical expansions without compromising the structural integrity or aesthetics of the complex. In addition, the use of local materials, such as wood supplied by Arauco, has contributed to sustainability and the regional economy, reducing construction costs and times.

Figure 2: Vila Verde Housing - ELEMENTAL



Source: ELEMENTAL, 2012

The LWF system, as exemplified in the image, stands out for its speed of execution, lightness and efficiency in the use of materials. Its prefabricated structures allow for agile assembly on the construction site, with high precision, resulting in constructions that can be completed in a few weeks. In addition, LWF facilitates expansions and adaptations over time, providing flexibility for future needs.

On the other hand, integration with the CLT could further enhance these advantages. With its robust cross-laminated wood boards, it provides greater structural strength, excellent seismic and thermal performance, in addition to contributing to more sustainable and durable buildings. The combination of LWF for lightweight structure with CLT for slabs would create an optimized hybrid system, further accelerating delivery times and increasing responsiveness in post-disaster scenarios.

The Villa Verde project stands out for its ability to balance constructive efficiency, community participation and sustainability, serving as a model for interventions in emergency situations. The incremental approach taken by ELEMENTAL not only provided immediate shelter to affected families, but also laid the foundation for the development of resilient and cohesive communities capable of growing and adapting to future needs (ELEMENTAL, 2012).

SYSTEM INTEGRATION

Technological advances, such as Building Information Modeling (BIM), enable greater accuracy in the planning and execution of reconstruction projects. Despite challenges such as high upfront costs and lack of training, BIM combined with CLT and LWF presents opportunities to reduce waste, optimize resources, and accelerate the delivery of resilient and sustainable housing solutions.

Studies show that the implementation of BIM can result in a reduction of up to 41% in project delivery time, in addition to increasing the profitability of the professionals involved by up to 35% (SANTIAGO et al, 2021). These gains occur due to BIM's ability to integrate multidisciplinary information into a three-dimensional digital model, facilitating the early identification of incompatibilities and improving communication between work teams. Consequently, there is a reduction in rework and an optimization of the resources employed, accelerating the construction schedule (MEIRELES et al, 2024).

In addition, the use of technologies such as BIM combined with CLT and LWF allows for faster and more sustainable execution in post-disaster contexts, offering solutions that combine speed and construction precision. By automating processes and optimizing assembly logistics, BIM reduces waste and promotes greater efficiency in all stages of construction (FERREIRA et al, 2020).

PROPOSAL FOR APPLICATION TO THE BRAZILIAN CONTEXT

Brazil faces severe landslides and floods annually, especially during the rainy season in mountainous and urban regions. These natural disasters, aggravated by the disorderly

occupation of the land and the lack of adequate infrastructure, generate significant social and economic damage. Given this reality, the expansion of wood construction technologies, such as Light Wood Frame (LWF) and Cross Laminated Timber (CLT), combined with digital tools such as BIM, presents itself as an efficient and sustainable solution for the reconstruction of housing in affected areas.

Light Wood Frame constructions can be implemented quickly, offering safe, low-cost housing in locations that need emergency responses. Its lightness and ease of assembly reduce the impact on the ground and construction time, making it ideal for hard-to-reach regions. In addition, its modularity allows adaptations according to the needs of families, creating flexible and scalable solutions. The use of CLT, in turn, ensures greater structural strength, thermal and acoustic performance, in addition to contributing to resilient buildings in areas vulnerable to disasters.

For areas affected by landslides, prior mapping of risk zones is required, using geotechnical and climate monitoring technologies. The application of CLT and LWF in these regions should prioritize stable terrain, with optimized foundation systems that ensure safety and durability. The rapid assembly of prefabricated structures minimizes the exposure of work teams to additional risks, in addition to speeding up the delivery of housing to homeless families.

In flood-affected regions, housing design should consider raising the level of structures with the use of pilotis or high foundations, ensuring that habitable areas are above the water level. This solution, combined with materials that are resistant to moisture and rot, such as the treatments applied to engineered wood, can extend the useful life of buildings. Additionally, the use of prefabricated CLT panels makes transportation and installation easier, allowing complete housing units to be delivered in a matter of days.

The use of Building Information Modeling (BIM) plays a crucial role in this context, optimizing the planning and execution of projects. Through BIM, it is possible to integrate multidisciplinary information, predict possible failures in the project and ensure the efficient management of resources. The application of this technology combined with CLT and LWF allows a significant reduction in execution time and operating costs, facilitating the reconstruction of entire communities in an organized and sustainable way.

To make these proposals feasible in Brazil, it is essential to promote public policies that encourage the adoption of these technologies. The inclusion of the CLT and LWF in popular housing programs and the updating of national technical standards are fundamental steps. In addition, investments in workforce training, public-private sector

partnerships, and tax incentives for engineered wood industries can accelerate the implementation of these solutions in the country.

Finally, the combination of the proposed technologies not only offers quick and sustainable solutions, but also creates a resilient reconstruction model to address the recurring climate challenges in Brazil. The adoption of these practices is essential to mitigate the impacts of natural tragedies, ensuring safe, durable, and environmentally responsible housing for the affected populations.

CONCLUSION

In view of the current scenario, marked by the increase in the occurrence of natural disasters, such as floods and landslides, the search for quick, efficient, and sustainable solutions for post-disaster reconstruction becomes an urgent priority. Innovative technologies such as Light Wood Frame (LWF) and Cross Laminated Timber (CLT), widely studied and applied in international cases, have proven to be viable alternatives to respond to emergency needs, offering structural safety, construction speed and a reduced environmental impact.

The analysis of examples such as the RAPIDO program, in the United States, and the Villa Verde project, developed by ELEMENTAL in Chile, shows how modular and adaptable solutions can transform the reconstruction of affected communities. Such initiatives highlight the potential of wooden buildings not only to house families in record time, but also to promote resilience and community participation, ensuring safe and long-lasting housing.

In addition, the integration of digital technologies such as Building Information Modeling (BIM) represents a qualitative leap in the management and execution of works, enabling a reduction of up to 41% in delivery time and minimizing rework and waste. This combination of efficient construction methods and technological tools places wood construction as a competitive option, even when compared to conventional methods, especially in contexts where speed and precision are fundamental.

For Brazil, where natural disasters such as floods and landslides affect thousands of families annually, the implementation of these solutions requires joint efforts between the public, private and academic sectors. It is essential to promote public policies that encourage the use of the CLT and LWF, including their regulation in national cost systems and indexes, such as SINAPI. The training of labor, the financing of industrial plants and the encouragement of public-private partnerships are fundamental steps to enable affordable construction on a large scale.

Finally, the use of engineered wood in post-disaster reconstruction goes beyond the delivery of emergency housing. It represents an opportunity to align efficiency, sustainability and innovation, contributing to the reduction of the carbon footprint and offering a resilient reconstruction model for the future. The international experience and technological advances available provide a clear path for Brazil to lead initiatives that combine speed, quality, and respect for the environment in responding to natural tragedies. It is time to turn challenges into opportunities by adopting solutions that can rebuild not only infrastructure, but also the dignity and well-being of affected communities.

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COGNITION AND NORMS: A CONCEPTUAL FRAMEWORK TO ADDRESS DENIALISM AND DISSONANT COMMUNICATION IN SOCIAL DILEMMAS

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ABSTRACT

How to explain denialism, resistance to health measures, and the proliferation of narratives contrary to what was supposed to be common sense? Although a possible answer to this question points to demographic, social and economic differences, the article aims to expose the decisive influence of individuals' mental models and value systems. In preparation for testing these connections, we have introduced a conceptual framework that integrates the Habermasian approach to communication with the psychology of moral development and the Bloomington School of institutional analysis. Results from experiments reported elsewhere support the hypothesis that the ability to resolve social dilemmas communicatively, without coercion, requires social perspectives and cognitive structures that emerge late from the order of individuals' moral development.

Keywords: Social dilemmas. Ethics of discourse. Evaluative memes. IAD framework.

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INTRODUCTION

The positive effect of communication on the governance of *common-pool resources* and the provision of public goods has been demonstrated for a long time in the literature on social dilemmas and collective action (Bowles, 2016; Mak and Rapoport, 2013; Balliet, 2009; Bochet and Putterman, 2008; Sefton *et al.*, 2007; Bicchieri and Lev-On, 2007; Cardenas et al., 2004. Camerer, 2003, Ostrom and Walker, 2003).

The opportunity for these studies was initially related to the prediction failures arising from the canonical model of rational choice in economic theory. Given the basic conflict between individual and collective gains that characterizes those situations, the rational choice model predicts that communication opportunities will have no influence on participants' choices, and are useless to avoid the overexploitation of common resources (CPRs) or the undersupply of public goods (Harsanyi and Selten, 1988).

Habermas was one of the first theorists to identify the epistemological nature of the problem and to bring a cognitivist approach to normative choices to the task of explaining the logic of collective action (Heath, 2001). Through his critique, Habermas reestablishes the internal connection (rational and dialogical) between the moral content of the proposed norms and the justifying foundations used in the argumentation of the agents who interact in the public sphere, seeking to reach agreements to collectively manage matters of common interest.

The most recent developments in the analysis of the conditions and incentives that affect the normative choices of individuals in social dilemmas give increasing attention to cognitive processes, mental models, value systems, and language (Aligica, and Boettke, 2009; Ostrom, 2005; Mantzavinos, *et al*, 2004). However, these developments still operate almost entirely under epistemological assumptions that deny cognitive content to "moral questions" and lead to an exclusively instrumental conception of rationality (Heath, 2001).

The effects of communication opportunities among participants are interpreted in the context of strategic interactions and attributed to the incorporation of information about the current situation of the resource, the consequences of past choices and the reputations of the others involved, for example, to the decision-making process of agents with limited rationality (Simon, 1955). Moral norms and value judgments that affect the choices of subjects are seen as a repertoire of habits, instincts, or moral feelings fixed through adaptive (evolutionary) processes displaced from the arena of present action (Nowak and Highfield, 2011; Ostrom, 2005; Bowles and Gintis, 2002; Boyd and Richerson, 1990, 1992). In other words, according to the conventional approach, communication is seen as a simple mechanism for exchanging signals, and not as an event that, in the words of Marcondes

Filho (2019, p. 11), although rare, "has the ability to promote changes in values, political positions, moral orientations, including a reordering of life in the person".

The difficulties in promoting the behavioral changes necessary to face the Covid-19 pandemic (e.g. wearing a mask, maintaining social distancing, getting vaccinated) have given new significance to the epistemological critique of the communicational phenomenon, especially that which sustains the Habermasian approach to social dilemmas. Denialism and resistance to vaccines, in particular, denote choices that go beyond greater or lesser knowledge of the technicalities involved or access to other relevant information. We argue that these are decisions driven by complex cognitive structures, composed of different social perspectives, concepts of authority and justice, expectations and motivations to act, and whose rationalities are established through argumentations and narratives built within different collectives (Latour, 2020).

From this perspective, we can understand the rarity of the qualitative transformations that mark authentic communication processes, in the view of Marcondes Filho (2011, 2019), as resulting from modes of intentionality and motivational dispositions closed to the new, and to the other.

In the realm of experimental research, the division of labor, proposed by Habermas (1990), between the moral philosophy that underpins his discourse ethics, on the one hand, and developmental psychology, on the other, provides a robust theoretical basis for the formulation of testable hypotheses involving the choices of individuals in social dilemmas, including the problems of adherence to the measures to control the Covid-19 pandemic. In this paper, we develop this argument and present an empirical strategy based on experiments on public goods provision and collective management of common resources (CPRs).

At first, we situate the nature of choices in the face of the health crisis as belonging to the class of collective action problems. Next, we summarize Habermas' epistemological critique, establish the theoretical basis of voluntary adherence to normative commitments in social dilemmas, and gather this basis to the conceptual framework of the Bloomington School. The article concludes with brief considerations on the empirical strategy to test the predictive/explanatory power of the Habermasian approach, in the face of the current crisis.

HEALTH CRISIS: THE NEW "TRAGEDY OF THE COMMONS"

Social dilemmas include a variety of situations in which individual and collective interests conflict. In a social dilemma, the rational choices of individuals generate the paradoxical result that everyone is worse off. Individuals are said to face a "dilemma"

because a better situation for all can be achieved through cooperation for coordinated action[2]. But, given the institutional conditions that configure the dilemma[3], there is no incentive for participants to accept the costs of sustaining this cooperation (Ostrom, 2007).

The archetypal illustration of social dilemmas was made famous by Garret Hardin (1968), in his famous article in *Science*: *The Tragedy of the Commons* . Right at the beginning, the author situates social dilemmas as members of a class of problems for which there is no technical solution, and whose solution requires changes in values and ideas of morality (Hardin, 1968, p. 1243). Ostrom (2005) also notes that the moral nature of choices in social dilemmas demands theories that deal with the formation of intrinsic values – attributed to actions themselves – and the subjective valuation of collective interests, needs and results.

Several authors have recognized that the behavioral alternatives for coping with the Covid-19 pandemic have a structural correspondence with the archetype of the tragedy of the commons, configuring a large-scale social dilemma (Harring *et al.*, 2021; Meyer, 2021; Kovac *et al.*, 2020; Lunn *et al.*, 2020; Chiaravalloti, 2020; Silva, 2020). Limitations on access to public roads and places, for example, are problems related to the governance of common resources, and the use of masks implies the acceptance of an individual cost for the provision of a public good (collective health). Maaravi *et al.* (2021), in particular, investigated how individualistic and collectivist attitudes influenced coronavirus spread rates in different societies. In the authors' study, those attitudes were accessed through the *Hofstede index* of individualism of national culture, that is, in aggregate form.

In this study, we situate these postures within the scope of Habermas' (1990) typology of actions, and in connection with the transformations that mark the development of the moral conscience of individuals, towards the ethics of discourse. This framework leads to testable hypotheses regarding the chances of producing the behavioral changes recommended by science to face the health crisis, through the moral discourse of awareness.

The significance of those tests, however, requires admitting the rationality of moral justifications and the voluntary fulfillment of verbal agreements in collective action dilemmas. The basis for this admission is provided by the Habermasian critique of foundationalism. The acceptance of this critique allows the integration of Habermas' theory

[2] In the case of common resources (CPRs), coordination aims to limit the private appropriation of the resource. In the case of public goods, it aims to increase the supply of the good.
[3] In the case of common resources, the conditions cause the costs of using the resource to be distributed among all users (negative externalities), while the benefits are private. In the case of public goods, the conditions prevent those who do not accept the private costs of offering the good from being excluded from its benefits (positive externality).

into the analytical scheme of the Bloomington School on communication and institutional change in social dilemmas.

HABERMAS AND THE OSTROMS: REMOVING THE EPISTEMOLOGICAL BARRIER TO THE CONSIDERATION OF COMMUNICATIVE ACTION IN STUDIES ON SOCIAL DILEMMAS

As indicated in the Introduction, our methodological proposal for the treatment of social dilemmas requires integrating the Habermasian, communicational, dialogical approach to collective action problems, with the conceptual framework provided by the Bloomington School. Under the leadership of Nobel Laureate Elinor Ostrom[4], the Bloomington School has emerged as one of the most dynamic, recognized, and productive centers of the New Institutional Theory movement (Aligica and Boetkkle, 2009). Well rooted in the intellectual heritage provided by authors such as Locke, Montesquieu, Hume, Adam Smith, Hamilton, Madison, and Tocqueville, the School's prominence is attributed to the success of its unique way of combining multiple theoretical approaches with an uncompromising empiricism. This mode is provided, to a large extent, by the analytical framework called Institutional *Analysis and Development (IAD) framework*.

The *IAD framework* provides the conceptual basis through which the analyst can investigate the predictive power of competing or complementary theories or analytical models, in view of the different contexts in which agents' decisions take place, concretely (Ostrom, Gardner and Walker, 2002). The research conducted by the *IAD framework* explores theoretical limits and complementarities across a broad range of social sciences and humanities, including classical political economy, modern microeconomic theory, transaction cost economics, institutional economics, public choice theories, law, sociology, and political theory. For Baiard (2011), Elinor Ostrom's award had the character of recognition of her "unified vision of the human sciences". However, what the Bloomington School does not do is overcome the epistemological barrier that leads to moral non-cognitivism. In the entire spectrum of analyses guided by the *IAD framework*, moral judgments are seen as an expression of habits, customs or socializing emotions that can effectively influence the decision-making process to the extent that they integrate the preferences of the agents (Bowles and Gintis, 2002), but which cannot be rationally justified.

[4] In 2009, for her analyses of economic governance, Elinor Ostrom shared the Nobel Prize in Economics with Oliver E. Williamson.

Heath (2001) explains that the belief in the impossibility of rational justification of following moral norms (moral non-cognitivism) depends on a specific conception of rationality and justification known as *foundationalism*, and that it seeks to provide an answer to the fundamental problem of epistemology: the problem of infinite regress.

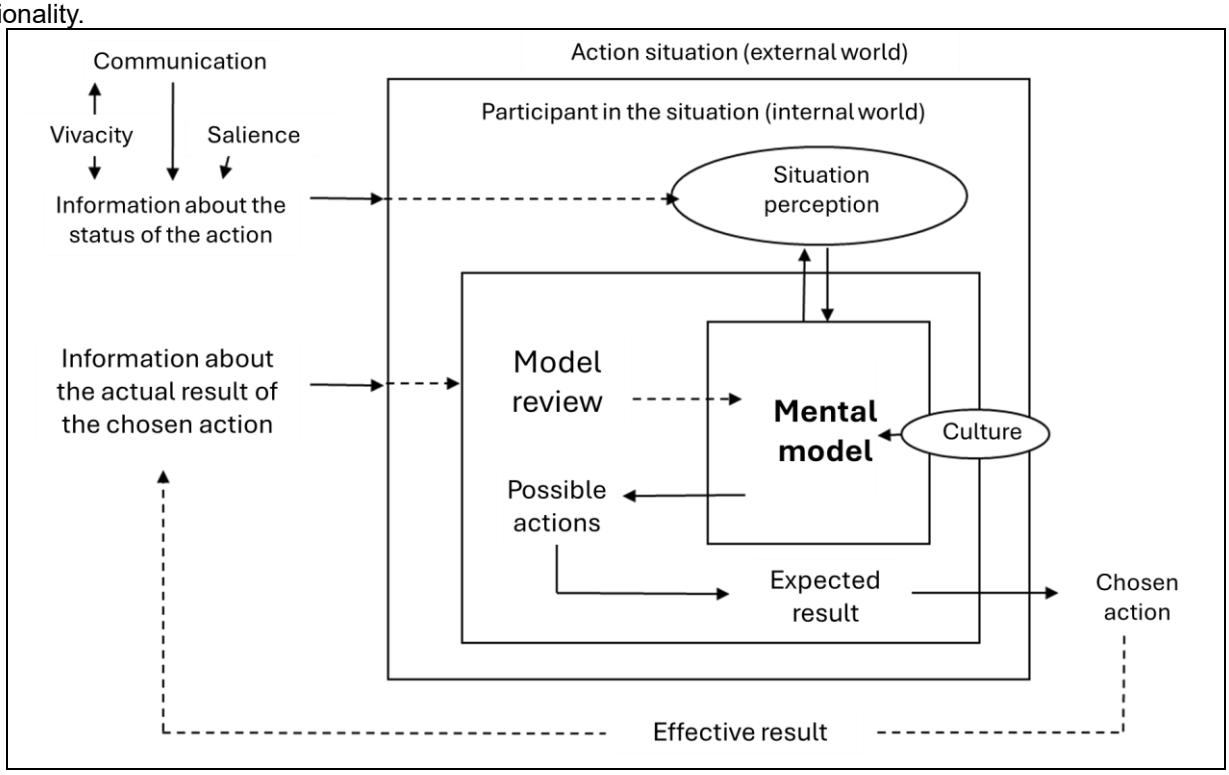
The problem expresses the understanding that, when trying to justify any statement, there are only two ways to interrupt the cycle of infinite regress of arguments: either one uses the conclusion as a premise (circular reasoning) or simply breaks the chain of reasons by means of a statement accepted as self-evident, that is, one that dispenses with any justification.

Foundationalism represents an example of the latter strategy (Heath, 2001, p. 197), arguing that there is a class of fundamental (or foundational) beliefs that are intrinsically justified (self-evident) by virtue of their empirical content (based only on sensory perceptions). Since claims to the validity of moral judgments and normative commitments cannot be based on perceptions of the physical world, the foundationalist view concludes that these judgments are essentially non-cognitive.

The tacit adherence of the Bloomington School to moral non-cognitivism is evident in the way Elinor Ostrom (2005) incorporates the suggestion of Frohlich and Oppenheimer (2001) about the role played by the "liveliness" and "salience" of the signals perceived in a given situation, to introduce the opportunities for communication in the model provided by the new "institutional cognitivism" (Denzau and North, 2001; Mantzavinos *et al*. 2004), which deals with institutional change from the perspective of cognition and learning (Figure 1).

In the scheme of Figure 1, mental models are understood as representations that the agent makes of the situation of the action and as the basis of his expectations regarding the results of the chosen actions. In isolation, agent learning is seen as a process of revision of mental models, according to Skinnerian logic, that is, on the basis of the reinforcement (positive or negative) of expectations. According to this scheme, the beliefs of the agents basically consist of mental models crystallized by repeated expectations that are positively reinforced (Mantzavinos *et al*., 2004).

Figure 1: Effect of communication on the revision scheme of the mental models of agents with limited rationality.



Source: Ostrom (2005), adapted from Denzau and North (2001).

Admitting that "paying attention is costly", Frohlich and Oppenheimer (2001, p. 8) explain that liveliness and salience are attributes that function as a kind of "key" in the displacement of attention from one element to another, within the variety of signs present in the environment of the action. In Figure 1, the most vivid and salient signs concern the effective results of the chosen actions.

Since the epistemological foundation does not admit the possibility of justifying normative commitments, communication between agents is prevented from providing rational support for claims of validity of a given rule of interaction (e.g. social distancing, vaccine passport), in preference to any feasible alternative. The interpretation of the nature of communication has the focus diverted from the normative issue, central to all institutional analysis, to focus on the correct representations of causal chains and feedback circuits (e.g. relationship between social distancing and Covid-19 cases, for example).

It is then admitted that the information exchanged about these causal relationships affects the perception that the agent has of the situation of the action and contributes to the convergence of the participants' mental models. This convergence eventually crystallizes in the form of institutions that, seen from their "internal" side, are nothing more than mental models of shared solutions to recurring problems.

The so-called "cognitive approach" of institutions also does not insist on the rationality of the choices that lead to the rules of interaction, preferring to treat the social

order as an emergent (unintentional) result of the following of conventions, rules or moral norms stabilized in the way described (Mantzavinos *et al*., 2004, p. 77).

However, by placing itself in the field of moral non-cognitivism, this position frustrates the greater purpose of the Bloomington School (Ostrom, V. 1991, p 3), which seeks to provide a positive answer to Alexander Hamilton's question, in the opening paragraph of *The Federalist*, about "whether or not societies are really capable of establishing good government based on reflection and choice, or whether they are forever destined to depend on chance and force for their political constitutions" (Aligica and Boettke 2009, p. 83).

It so happens that foundationalist epistemology has been increasingly discredited, largely due to the so-called linguistic turn[5], with Habermas being one of the first theorists to apply a non-foundationalist conception of rationality and justification to explain the logic of collective action (Heath, 2001. p. 2).

Following Heath's (2001) outline, Habermas's view has two basic components. First, Habermas asserts that non-cognitivist concerns about the truth of moral judgments are only important if we assume that truth indicates some kind of correspondence between sentences and the state of affairs in the world[6]. If we deny that this kind of "objectivity" plays any role in the truth claims associated with beliefs, then our ability to justify beliefs has nothing to do with references to the physical world. In the same way, when the relativist questions the final justification of moral judgments, the argument is only persuasive if we presuppose a monological conception of rational justification, that is, when justification is tacitly treated as a process that refers, essentially, to the relationship between the agent's cognitive states and the objects of representation.

It is noted that these assumptions have the effect of reducing all public practices of justification to a secondary or derivative role. However, if we assume, like Habermas, that justification is always dialogical—a process that involves trying to justify something to someone else, so that justification to others is taken as the primary phenomenon—then there is no a *priori* reason to think that moral questions are any less soluble than empirical or scientific questions.

Despite the revolutionary tone of this epistemological (linguistic) turn, Heath (2001, p. 198) observes that the reason why many theorists have accepted to take this more radical

[5] The so-called linguistic turn is a metaphor, whose contours are not very clear, referring to the failure of logical positivism and the representationalist conception of language in the field of epistemology. For Habermas (1990a), the linguistic turn expresses a change in the epistemological paradigm, which shifts the focus from the "subject" to the "language", questioning universalisms and essences, and emphasizing the linguistic and historical construction of worldviews (Fontes, 2020).
[6] Habermas is referring to the Correspondence Theory.

step is that foundationalism offers no persuasive justification for any type of belief, including empirical ones. In fact, the dialogical conception of justification contributes more to the understanding of the problem, pointed out by Mantzavinos *et al*. (2004, p. 76), about the persistence of mental models that do not seem to correctly interpret the phenomena. In the same way, the dialogical conception provides a rational basis for understanding denialism and the proliferation, in social networks, of conspiracy theories and more dissonant narratives on all subjects, as expressions of the modes of justification characteristic of the different collectives or interest groups in which they are formed.

Regarding our purpose of integrating Habermas' communicative action into the conceptual framework of the Bloomington School, the first thing to note is that Habermas' theory is a typological theory (Heath, 2001, p. 13). Habermas does not reject, nor exclude instrumental rationality, but rather takes as a starting point that agents have access to a set of different patterns of choice or logics of action.

Habermas' basic typology of elementary and social actions is illustrated in Figure 2. Communicative action is an action governed by a specific norm or logic, that is: to achieve mutual understanding, while instrumental action is an action governed by a different standard: that of achieving success or achieving an intended result.

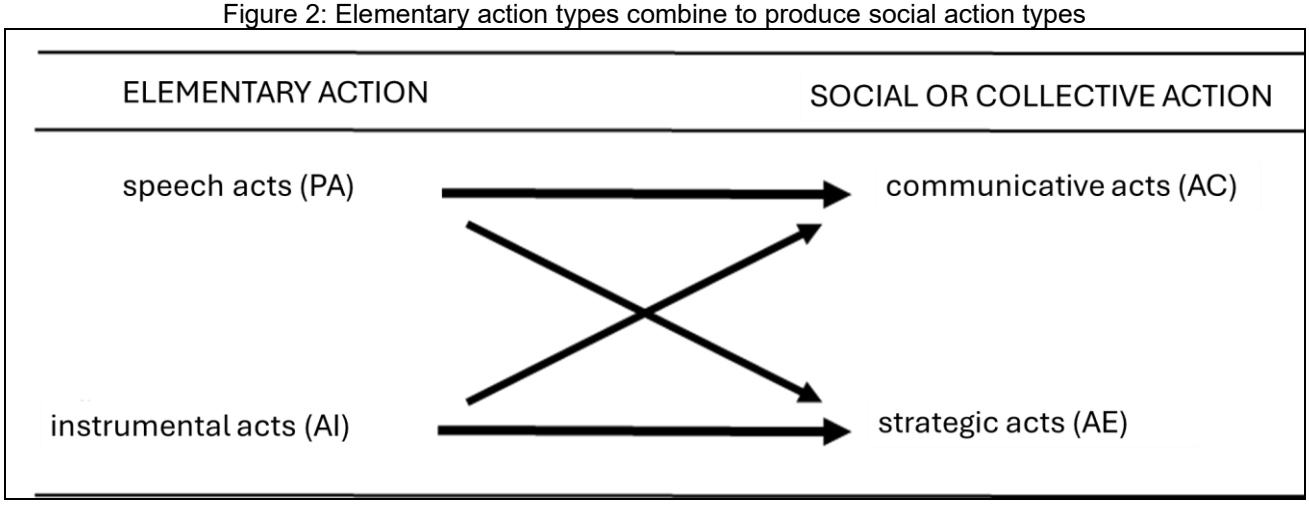
According to Habermas' typology, rational agents engaged in social action always face the problem of the interdependence of expectations, which can be solved based on the resources of instrumental action or speech. When actors are primarily interested in outcomes, social action becomes strategic action, in the standard sense of game theory, in the framework of the Bloomington school. However, when speech is used to coordinate expectations, the form of interaction that Habermas calls *communicative action* is produced (Habermas, 1990b, p. 133).

This basic scheme is indicated by the straight lines in Figure 2. The ascending oblique line indicates that communicative action is not the same as speech. Like strategic action, communicative action also presupposes the basic teleological structure of action, insofar as actors continue to conduct their plans to achieve a certain state of affairs. In Habermas' words, the two types of social action differ in that "for the strategic action model, a structural description of the action directly oriented to the result is enough, while the model of action oriented to understanding must specify the propositions of an agreement to be reached communicatively", in order to coordinate the expectations of the agents in interaction. In other words, when engaged in communicative actions, the actors assume that they are "prepared to harmonize their action plans by internal means, committing themselves to pursue their objectives only on the condition that an agreement – already

exists or one to be negotiated – on the definitions of the situation and the expected results" (Habermas, 1990b, p. 134). The production of this agreement does not mean that the agents have reached a consensus on substantive issues (e.g. value judgments), differently perceived in the common dilemma, but only that they have agreed to comply with the norms of the agreement reached.

It turns out that both common experience and the results of controlled experiments (Ostrom *et al.*, 2003; Meyer 2010) prove that verbal agreements in collective action dilemmas are often disrespected. In Figure 2, this possibility is shown by the descending oblique line. The line indicates that speech acts can also be used in strategic interactions, precisely in order to influence the expectations and actions of other agents in a way that is advantageous to the objectives of the actor in question.

Figure 2: Elementary action types combine to produce social action types



Source: adapted from Heath (2001, p. 25)

It is at this point, when considering the empirical differences regarding the extent to which different collectives or societies depend on explicitly discursive procedures to ensure social integration, that Habermas finds in developmental psychology – notably in the models of Laurence Kohlberg and Robert Selman – an indirect verification of the validity of his historical reconstruction of the development of communicative action[7] (Chart 1).

The objective of this reconstruction is to demonstrate that communicative action requires more complex socio-cognitive capacities than those required for strategic action, and for this reason emerge later in the order of the moral development of individuals. According to Habermas (1990), it is these late structures, in the post-conventional stage, that enable individuals to interact and resolve disputes through argumentation. In this

[7] This reconstruction is based on an interpretation of the studies of Emile Durkheim and George Herbert Mead.

phase, the individual must be able to compare the authority vested in the existing norms in society with that which emanates from his ideals, and resolve the motivational conflict between autonomy and heteronomy through the proposition of solutions based on principles and processes of justification of norms.

Conversely, in the pre-conventional and conventional stages of interaction, compliance with recommended modes of behavior requires following rules or norms presented by external authorities. In the pre-conventional stage, the concepts of authority, motivation, and justice coalesce into a self-centered social perspective. In this phase, adherence to social rules or norms typically occurs in the face of expectations of obtaining individual advantage or avoiding disadvantage resulting from criticism, reprimands, or other credible penalties.

The conventional stage is defined by the ability to support the following of rules in the intimate feeling of responsibility (e.g. com public health). In dilemmas of collective action, this feeling, when it exists, is opposed to inclination, as a motive that emerges from the possibility of obtaining greater or more immediate personal gains. The conformity of choices and actions to rules that contradict this inclination presupposes the internalization of concepts of supra-individual or collective authority, to which the individual adheres out of loyalty or recognition of his legitimacy (Chart 1).

Once the epistemological critique that supports the possibility of rational justification of normative commitments (moral cognitivism) is accepted, Habermas' typology of actions (Figure 1) and its connections to the psychology of social-cognitive development (Exhibit 1) can be coherently integrated into the Bloomington School's approach to making the link between communication, learning, and institutional change (Figure 1). This integration is illustrated in Figure 3.

Chart 1: Connections between Habermas' types of action and Kohlberg's cognitive structures associated with moral judgments

Tipos de ação (Habermas)	ESTRUTURAS COGNITIVAS				
	Estrutura de perspectivas	**Conceitos de autoridade**	**Conceitos de motivação**	**Perspectivas sociais/conceitos de justiça**	**Estágios de julgamento moral (Kohlberg)**
Pré-convencional Interações controladas por autoridade Cooperação baseada no interesse próprio.	Interligação recíproca de perspectivas de ação (Selman – Nível 2)	Autoridade da pessoa de referência: vontade sancionada externamente	Lealdade à pessoa de referência: orientação por recompensa e punição	Perspectiva egocêntrica / Complementaridade entre ordem e obediência Perspectiva egocêntrica / Simetria de compensações	1. Punição e obediência 2. Hedonismo instrumental ingênuo
Convencional Comportamento controlado pelo papel social Interações governadas por normas	Coordenação das perspectivas do participante e do observador (Selman – Nível 3)	Internalização da autoridade da vontade supraindividual: lealdade Internalização da autoridade da vontade impessoal coletiva: legitimidade	Obrigação *versus* inclinação	Perspectiva do grupo primário / Conformidade às regras Perspectiva da coletividade / Conformidade ao sistema de normas existentes	3. Moralidade do bom garoto, boa garota 4. Moralidade da lei e da ordem
Pós-convencional Ação comunicativa (ética do discurso)	Integração das perspectivas do agente e do mundo (Habermas – orientação descentrada do mundo)	Ideais *versus* validade social	Autonomia *versus* heteronomia	Perspectiva dos princípios / Orientação por princípios de justiça Perspectiva dos procedimentos / Orientação pela justificação de normas	5. Moralidade do contrato democrático 6. Moralidade dos princípios individuais

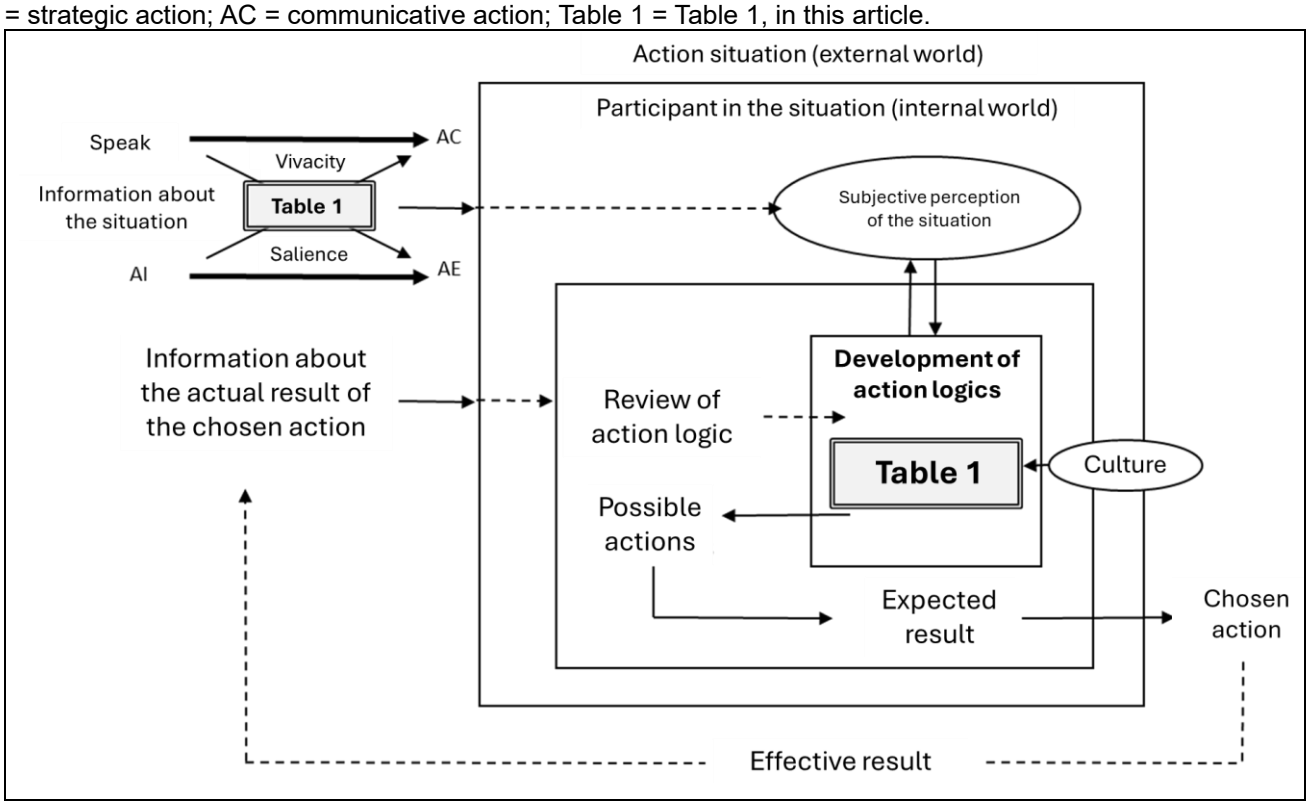
Source: adapted from Habermas (1990b, p. 166).

In Figure 3, the Habermasian typology that relates elementary actions to social actions (Figure 2) is integrated into the Bloomington School scheme for the analysis of communication in social dilemmas (see Figure 1).

This integration maintains all the previous relations related to communicative exchanges through which agents review their mental models of the causal relationships between actions and results. However, by replacing the monological (foundationalist) conception of justification with the dialogical conception, the scheme is expanded to encompass the logic of communicative action (CA), in addition to the logic of strategic action (EA), making room for the rational justification of normative commitments (without the need for coercion).

In the face of communication opportunities, the adoption of one pattern or another of interaction, as well as the perception of what is most lively or salient in the situation of the action, is directed by the internal logic of the transformations of socio-cognitive capacities, vis-à-vis the present situation of each agent (Chart 1).

Figure 3: Integration of Habermas' typology of actions into the Bloomington School's frame of reference for analysis of the relationship between cognition, learning, and institutional change: IA = instrumental action; AE = strategic action; AC = communicative action; Table 1 = Table 1, in this article.



Source: authors' configuration based on Ostrom (2005).

EMPIRICAL STRATEGY AND RESULTS OF PREVIOUS RESEARCH: FINAL CONSIDERATIONS ON THE (IN)COMMENSURABILITY OF NARRATIVES IN THE FACE OF THE HEALTH CRISIS

The effects of communication on social dilemmas have traditionally been investigated through controlled experiments that simulate problems of governance of common resources and provision of public goods. Typically, the results of these studies indicate that, on the one hand, communication opportunities have a visible impact on improving the governance of those interactions, but that, on the other hand, these improvements remain vulnerable to the individualistic attitudes of those who do not honor the commitments made verbally, that is, without coercion (Ostrom *et al*., 2003).

The tacit adherence to the thesis of moral non-cognitivism has hindered the researchers' view of the interest of using models of socio-cognitive development, such as Chart 1, to predict the disparate attitudes of the participants in the face of communication in social dilemmas. In one notable exception, Meyer (2010) reports results that corroborate Habermas' prediction of the capacities required to resolve collective action dilemmas, communicatively. Employing a hierarchical development model of *evaluative memes* (*vMemes*), in which individualistic and collectivist attitudes alternate dialectically, the author

showed that the chances of solving social dilemmas communicatively are positively correlated with post-conventional socio-cognitive structures.

In times of "post-truth" and flat-earthism, the impression is that, as Latour said about the anti-vaccine movement in an interview with *El País*, "facts are useless" (Latour, 2019). But what lurks behind immeasurable mental models is perhaps the epistemological fact that our ability to justify beliefs and values really has nothing to do with references to the physical world, being primarily a dialogical phenomenon, along the lines of Habermas's critique.

Instead of an exacerbated relativism that sustains the incommensurability of narratives, the Habermasian view of an internal logic of transformation of socio-cognitive structures opens the way for the prediction and explanation of the discrepant choices of agents in the face of the same incentives, controlled experimentally. In the context of health crises, this seems to be a promising strategy to advance knowledge and the formulation of communication strategies capable of overcoming the resistance of certain groups to the measures necessary to control the disease, or so many other crises and conflicts that emerge from the apparent incommensurability of values and worldviews.

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TYPOLOGY OF VIOLENCE AND ITS CHARACTERISTICS IN BRAZIL: ETHICAL-LEGAL ASPECTS

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ABSTRACT

The epidemiological profile of violence analyzes data and statistics to understand the distribution and factors that influence violence in a population, considering aspects such as age, gender, location, and socioeconomic status. The most affected groups include young people, especially men, and women, who often face domestic and sexual violence. Violence is more prevalent in densely populated urban areas and in contexts of poverty (self-inflicted, interpersonal, and collective). The typologies of violence include (physical, psychological/moral, sexual, obstetric, financial/economic, resulting from legal intervention, torture, human trafficking, negligence/abandonment and child labor). Understanding this profile is essential to develop effective public policies for prevention and support for victims.

Keywords: Violence. Epidemiological Profile. Brazil. Features. Legislation.

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INTRODUCTION

Violence occurs all over the world and affects people of all ages, gender, race, religion, nationality, education, sexual orientation or social status. However, violence tends to occur among vulnerable groups due to poor living conditions. It exists in everyone's life, whether as a victim or as an aggressor. It is repeated in the structure and subjectivity of different spaces, such as home, school, community, work and institution. Therefore, it is a socially constructed phenomenon that must be deconstructed based on intersectoral and multidimensional actions (BRASIL, 2009).

Thus, the situation of violence is understood as a multifaceted problem, with a high incidence of violent deaths throughout the federative regions of Brazil, affecting several groups, among them are the population of lesbians, gays, bisexuals, trans and transvestites, queers, intersex, asexuals and other existing genders and sexualities, people with disabilities, indigenous people, youth, women and blacks (Cerqueira *et al.*, 2021; BRAZIL, 2016).

Next, it will be discussed about the different types of groups that violence fits according to the World Health Organization, as well as conceptualizing their typologies and their main characteristics. In addition, epidemiological data on violence will be presented and the criminological issue will be conceptualized for a greater understanding of this phenomenon that affects the whole world, especially Brazil, through compulsory notification being an important instrument for use in the spheres of health and justice, especially for Primary Health Care professionals who will face people in their different situations of violence.

CONCEPT OF CRIME AND VIOLENCE

The concept of crime can be studied from a formal, material, or analytical perspective (Rostirolla *et al.*, 2021):

- The **formal norm** treats any infraction of the criminal law as a crime, taking into account every human action prohibited by the criminal law.
- The **material aspect** refers to any action or omission to the detriment of a legitimate interest protected by criminal law. The rule takes into account all damages caused to victims, holders of rights and constitutional guarantees protected by criminal law.
- Analytical **criteria**, as the name suggests, analyze the main elements of a crime without distraction, studying it as a whole. Its constituent elements are typical facts, illegality, guilt and punishment.

According to the conception of the Penal Code regarding crime in Brazil (BRASIL, 1941):

> (...) a criminal offence is considered to be a crime punishable by law with imprisonment or detention, alone or alternately or in a cumulative fine; In misdemeanours, the law punishes criminal offences with simple imprisonment or both, alternately or cumulatively.

The World Health Organization (WHO) defines violence as:

> "The actual or threatened use of physical force or force against oneself, another person or a group or community that causes or may result in suffering, death, psychological harm, developmental disability or deprivation" (WHO, 1996).

The WHO itself distinguishes between different forms of violence, including (COFEN, 2017; Krug *et al*., 2002): physics; psychological/moral; sexual; torture; human trafficking; Economic; negligence; child labour; legal and obstetric intervention.

According to data released by the Institute of Applied Economics (IPEA) in 2019, the epidemiological profile of homicides in Brazil exceeds 45,503 per 100 thousand inhabitants, with 30,825 homicides by firearms, 23,327 juvenile homicides and 3,737 female homicides; 92.2% of deaths were caused by men and 7.8% by women. Regarding race, 67.2% were brown men and 58.9% were brown women. The age is between 20 years, and the level of education of men and women is 80.5% of single men and 71.4% of women. Regarding education, 46.6% of boys (4 to 7 years old) and 41.1% of girls completed elementary school. And the day the crime happened was on weekends, especially on Sundays (IPEA, 2019).

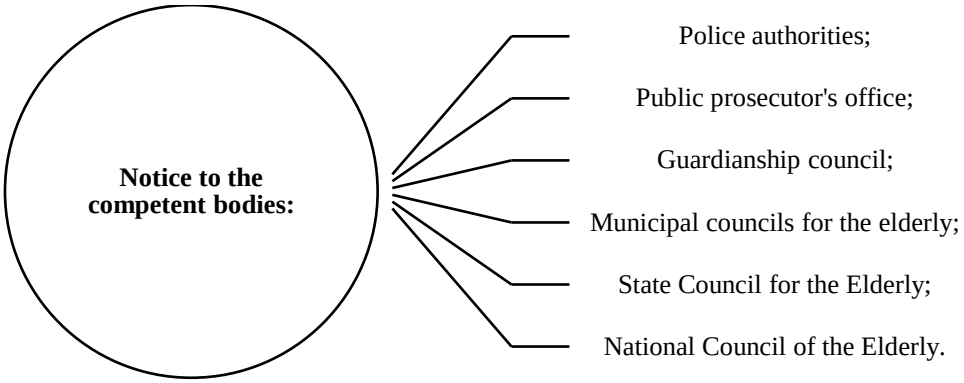
According to the Atlas of Violence in 2021, there was an increase in violent deaths from undetermined causes in Brazil per 100 thousand inhabitants in different federative regions against the population of lesbians, gays, bisexuals, trans and transvestites, queers, intersex, asexuals and other existing genders and sexualities, people with disabilities, indigenous people, youth, women and blacks (Cerqueira *et al*., 2021; BRAZIL, 2016).

In Brazil, external causes occupy the third place in the set of registered deaths. In 2013, due to violence (attack and self-harm), resulting in a total of 67,337 deaths (44.4% of external factor deaths), a year-on-year increase of 2.9% from 2012. According to the composition of mortality from external causes, aggressions (homicides) were responsible for 37.4% of deaths in the same period, listed as the main cause of death from external causes. Suicide (self-mutilation) totaled 10,533 deaths in 2012, 6.9% of all deaths from external causes (BRASIL, 2016).

Until recently, descriptions of the characteristics of cases of violence and accidents in Brazil were limited to information provided by the Mortality Information System (SIM), the SUS Hospital Information System (SIH/SUS) and, occasionally, by the analysis of police reports (BO) and specific studies (BRASIL, 2016).

The referral and counter-referral process should be configured as a network involving health, social assistance, education, guardianship councils, rights, protection and justice councils, as well as governmental and non-governmental organizations and the private sector. It is recommended that this notification be an important tool for the organization of administrative and assistance services and for the full protection of people in situations of violence (BRASIL, 2016).

Brazilian law also determines that notified cases must be reported to the following institutions (BRASIL, 2016; 2006; 1990):



Suspected or confirmed cases of violence are considered to be: domestic/domestic, sexual violence, self-inflicted violence, human trafficking, slave labor, child labor, torture, judicial intervention and homophobic violence against men and women of all ages (BRASIL, 2016).

In cases of extra-family or community violence, only incidents of violence involving children, adolescents, women, the elderly, people with disabilities, indigenous people, and LGBTQIA+ individuals will be reported (BRASIL, 2016).

Therefore, notifications of violence are mandatory for (BRASIL, 2016; 2009; 2006; 2003; 1990):

- **Violence against children:** Men and women, aged 0 to 9 years, regardless of the type or nature of the violence.
- **Violence against youth:** Includes boys and girls aged 10 to 19, regardless of the type or nature of the violence. In cases of violence against children and young people, the case must be reported to the Guardianship Council and/or the competent

authority as determined by article 13 of the Statute of the Child and Adolescent (ECA).

- **Violence against women:** According to Law 10.778/2003 - Women of all ages, regardless of the type or nature of violence.
- **Violence against the elderly:** Men and women aged 60 years or older, regardless of the type or nature of the violence. The law also provides that notified cases must be reported to the following bodies: Police Authority, Ministry of Public Administration, Municipal Council for the Elderly, Council for the Elderly of the State Council and National Council for the Elderly.

In addition, there are other groups that are also mandatory to report violence (BRASIL, 2011; 2013; 2010; 2002):

- **Violence against Indigenous Peoples:** Regardless of gender and age, regardless of the type or nature of the violence. Indigenous populations are vulnerable due to changes in culture and relationships resulting from contact with neighboring societies and asymmetries in power relations between indigenous and non-indigenous peoples.
- **Violence against the LGBTQIA+ population:** Includes gender and all age groups, as this social group is vulnerable to violence and is in line with the National Integrative Health Policy for Lesbians, Gays, Bisexuals, Transvestites, Transgenders, among others.
- **Violence against people with disabilities:** Regardless of gender and all ages, regardless of the type or nature of violence – it is due to the marked asymmetry of power relations between people with and without disabilities.

Thus, crime and violence combine two of the most powerful systems that affect the daily lives of citizens around the world: health and justice. Violent crime and related trauma are of concern to doctors, nurses, lawyers, judges, sociologists, psychologists, social workers and policymakers, lawyers and activists, and criminal justice agencies. Reducing and preventing human violence requires a multidisciplinary and intersectoral approach (Hammer; Moynihan; Pagliar, 2013).

DIFFERENT GROUPS OF VIOLENCE ACCORDING TO THE WHO

The three groups that define the type of violence can be defined as self-inflicted (suicide attempts), interpersonal violence (family and community) and collective violence

(political groups, terrorist organizations, militias), as described below (BRASIL, 2016; Krug *et al*., 2002; WHO, 1996).

SELF-INFLICTED/SELF-INFLICTED VIOLENCE

According to the World Health Organization (WHO, 2019), suicide is a serious global public health problem. Every year, 703,000 people in the world die by suicide. Suicide is one of the leading causes of death in the world, killing more people than malaria, HIV/AIDS, breast cancer, or war and murder. More than one in every hundred deaths (1.3%) in 2019 was due to suicide. Suicide is the fourth leading cause of death among young people aged 15 to 29. Brazil is the seventh country in the Americas with a high incidence among men.

The Ministry of Health (BRASIL, 2017) classifies this type of violence as self-mutilation without suicidal intent (ASIS), while other literature classifies other types, such as suicidal ideation, self-harm (suicide attempt) and suicide (Bahia *et al*., 2017; Moreira; Bastos, 2015; Braga, Dell'Agilio, 2013) as shown below.

- **Self-injury without suicidal intent (ASIS):** It is characterized by self-injurious behavior, including mild and severe self-injury, which can take the form of cuts, scrapes, bites, or even amputation, demonstrating self-injurious behavior. Dealing with mental pain, but without the desire to interrupt life.
- **Automutation:** It is defined as a suicide attempt (TS), which can result in disabling injuries, in addition to basic family illnesses.
- **Suicide:** It arises from a conscious desire to die and a clear and premeditated intention to provoke behaviors when life becomes unbearable. Suicidal ideation, suicide attempt, and suicide are three categories of suicidal behavior.

The notification of interpersonal violence and self-injury is part of a health surveillance operation that has an epidemiological purpose and does not constitute an instrument of condemnation. Notifications of interpersonal and self-injurious violence (suicide attempts and self-injury) must be registered by filling out an interpersonal and self-injurious personal notification form, which is forwarded by the professionals of the notifying unit to the local reference epidemiological surveillance service (Paraná, 2022).

In addition, it is relevant that the professional has knowledge about the risk factors of this type of violence, as well as knowing the characteristics, the way to act and how to refer them to the appropriate services, which is seen soon after (BRASIL, 2001).

Manejo de situações que envolvam intenção suicida:

Risco	Características	Ação	Encaminhamentos
Baixo	Pensamentos como "eu não consigo continuar", "eu gostaria de estar morto", mas não fez planos do ato.	Apoio emocional; trabalhar sentimentos suicidas; identificar situações resolvidas pela pessoa sem recorrer ao suicídio.	Encaminhar p/ profissional de saúde mental ou outro que saiba manejar.
Médio	Pensamentos e planos, mas não para execução imediata.	Idem anterior; trabalhe a ambivalência (entre o viver e o morrer); explore alternativas ao suicídio; faça um contrato de não cometer o ato sem que se comunique com a equipe.	Agende imediatamente consulta com psiquiatra e psicólogo.
Alto	Plano definido, meios para fazê-lo e imediatamente.	Nunca deixar a pessoa sozinha; gentilmente tente remover as pílulas, faca, arma, enfim, os meios que possam contribuir para o intento.	Contate com profissional de saúde mental ou médico e providencie ambulância e hospitalização. Informar a família sobre o risco e reafirmar apoio.

Fonte:https://bvsms.saude.gov.br/bvs/publicacoes/manual_atendimento_vitimas_violencia_saude_publica_DF.pdf

This shows that the rate of self-inflicted/self-inflicted violence has increased depending on the factors that lead people to self-harm. It is important to review how public policies use prevention strategies, such as access to mental health services, to obtain appropriate referrals by health professionals, especially those who work in PHC for proper referrals to specialized services (Brito *et al*., 2021).

INTERPERSONAL/FAMILY VIOLENCE

It is any act or omission that compromises the well-being, physical or mental integrity, as well as the freedom and right to full development of another member of the family. This violence can be perpetrated by family members, both inside and outside the family nucleus, including those who assume a parental role, even if they do not have blood ties, as long as there are power relations over other people (BRASIL, 2016; 2002). It manifests itself between intimate partners and family members, especially in the domestic environment. It is any action or omission that negatively affects the well-being, physical and mental integrity, or freedom and right to full development of another family member.

According to the Ministry of Health (BRASIL, 2016; 2002), domestic violence is a social problem that constantly affects women, children, young people, the elderly, people with disabilities, indigenous people, and the LGBTQIA+ population. One of the difficulties faced by health professionals when dealing with situations of violence is the lack of language and concepts that connect medical knowledge with other fields, such as social and legal.

Health professionals are strategically positioned to detect risks and identify potential victims of domestic violence, through compulsory notification through the differences in the types of violence, which is seen below (BRASIL, 2016; 2002).

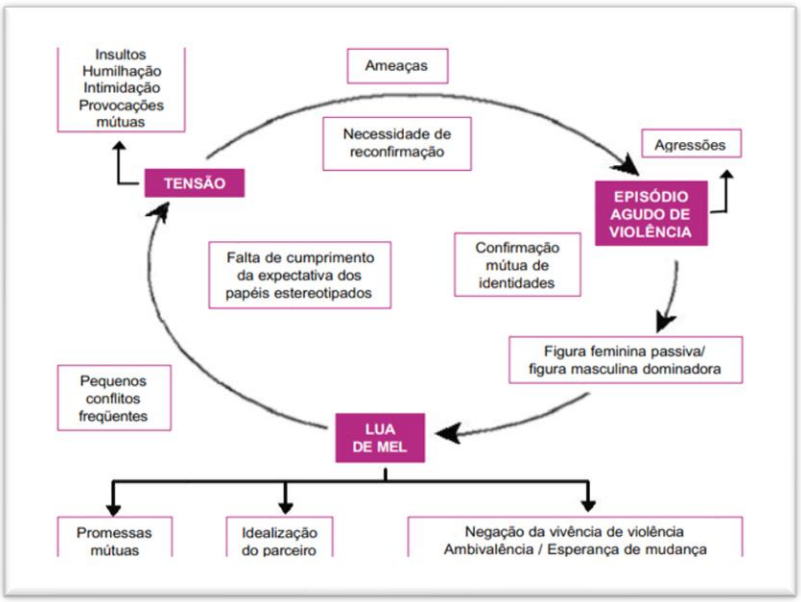


Source: https://bvsms.saude.gov.br/bvs/publicacoes/viva_instrutivo_violencia_interpessoal_autoprovocada_2ed.pdf

The concept of interpersonal/family violence refers not only to the physical space in which violence occurs, but also to the relationships in which violence occurs and is perpetrated. Domestic violence differs from intrafamily violence in that it includes other members of the group who live in the domestic space, but do not perform parental functions. This includes employees, people who live with you occasionally, and family members (BRASIL, 2016; 2002).

Such violence occurs in a situation in which bonds are formed between husband and wife, parents and children, children and parents, siblings, that is, aggressors and victims are people who know each other and maintain affective relationships, even if they are ambivalent. Domestic violence is constructed in a scenario of asymmetrical power relations between generations and genders (Moreira; Sousa, 2012).

Violence in family relationships often reveals the continuation of cycles of violence, that is, adults repeat the violence they experienced in childhood, while children are socialized to use violence in the future as a strategy to deal with their conflicts and difficulties. In this sense, attentive listening to these families in the context of psychosocial treatment allows us to observe the repetition of patterns of interaction between generations (Moreira; Sousa, 2012).



Source: https://bvsms.saude.gov.br/bvs/publicacoes/cd05_19.pdf

The cycle of violence has three distinct phases that vary in intensity and time for the same couple and from couple to couple, and do not necessarily appear in all relationships (BRASIL, 2002).

- **Phase I: (**increased tension): Small but frequent incidents of violence occurred. Women are more likely to deny their anger, blaming each incident on external circumstances. Try to believe that he has some control over the behavior of the abuser.
- **Phase II: (**acute incident of violence): It is characterized by the uncontrollable discharge of the accumulated voltage of the first phase, which lacks predictability and controllability. The difference between the two phases is the seriousness of the couple with the events of the second phase.
- **Phase III:** (appeasement/honeymoon): The abuser knows that he is behaving inappropriately and being overly aggressive and tries to make amends by asking for forgiveness and promising no more violence. He trusts that he will not attack again, that he will control himself and that he thinks the woman has learned her "lesson".

COLLECTIVE VIOLENCE

It is violence that occurs between known and unknown people in a social context. This form of violence manifests itself through aggressions against individuals, compromising their integrity, their life and/or their property, and is the target of prevention and repression actions by public security forces and the judicial system.

This type of violence is understood as violence that occurs in the macrosocial, political, and economic spheres and is characterized by the domination of groups and the State. This category, from a social point of view, includes crime by organized groups, terrorism and mass crime. In the political field, there are wars, processes of annihilation of certain nations and countries by other nations and countries. The classification of collective violence also includes economic attacks between groups and states, often with the intention and interest of domination (BRASIL, 2005).

The World Health Organization (Krug, *et al*., 2002; WHO, 1996) brings the ecological conceptual model of violence, being divided into four factors. The first is a biological and personal factor, the second relational, the third community and the fourth related to social aspects, seen below (BRASIL, 2005).

1. **Physiological and Personal Factors:** Each individual has a certain behavior that focuses on characteristics that increase the likelihood that an individual will become a victim or perpetrator of violence.
2. **Relational factors:** Social interactions, in the context of close peers, colleagues, intimate partners, family members, and their influence on victimization or offense to violence stand out. For young people, it reiterates the importance of friends as facilitators of illegal and criminal activities.
3. **Community factors:** In these community settings, workplaces are named, schools, and communities and as a problem, high unemployment, drug trafficking, weapons, and related factors such as isolation from certain families living in society.
4. **Social factors:** Cultural norms that justify violence as a means of conflict resolution; attitudes that consider an alternative (suicide) as a right of individual choice; machismo and adult culture; patterns that reinforce police misconduct and norms that support political conflict.

Thus, understanding violence as a social phenomenon in its various manifestations requires an in-depth analysis of the specificities of the society that produced them, with regard to social formations. Brazil has been registering alarming indicators of injuries and homicides due to accidents as a result of violence, whose impact has had repercussions on urgent/urgent services, becoming a public health issue (Escorsim, 2014).

In this context, the increase in violence makes it necessary to mobilize public policies to articulate networks and services for prevention, care, protection and rehabilitation of its victims, which currently constitute a vast network of challenges to overcome (Escorsim, 2014).

DISTINGUISHING THE DIFFERENCES IN THE TYPOLOGIES OF VIOLENCE

Physical violence

It is the deliberate and unintentional use of force to injure, inflict pain, and suffering, with or without visible marks on the body. It can manifest as slapping, pinching, kicking, twisting, pushing, throwing objects, strangulation, burning, piercing, dismemberment, etc. It can occur with a gunshot wound or a stab wound (ABEFORENSE, 2017; BRAZIL, 2016; 2008; 2006).

This type of violence can occur in different groups, whether children and adolescents, or adults and the elderly. It is essential to pay attention to the indicators, behavioral changes and characteristics of those who are long-standing, such as those who end up being victims. This means that health facilities at all levels need to be aware of the situation and implement prevention and care plans, especially for families living in environments of social and personal risk (BRASIL, 2008; 2002).

The nurse is an integral part of the multidisciplinary team that works with these victims of violence, the professional who spends the most time with the clients and, most of the time, is the first person to assist these individuals. Professionals should suspect abuse when they cannot explain injuries, bruises, frequent falls and other signs of physical violence (ABEFORENSE, 2017).

The indicators of physical violence, against children and adolescents, women and the elderly will be presented below (ABEFORENSE, 2017; BRAZIL, 2008; BRAISL, 2002).

1. Indicadores de Violência contra Criança e Adolescente

INDICADORES	COMPORTAMENTO DA CRIANÇA E DO ADOLESCENTE	CARACTERÍSTICAS DA FAMÍLIA
VIOLÊNCIA FÍSICA		
Presença de lesões físicas, como queimaduras, hematomas, feridas e fraturas, que não se adéquam à causa alegada. Ocultação de lesões antigas e não explicadas.	Muito agressivo ou apático; hiperativo ou depressivo; temeroso; tendências autodestrutivas e ao isolamento; baixa auto-estima; tristeza; medo dos pais; alega agressão dos pais; relato de causas pouco viáveis às lesões; fugas de casa; problema de aprendizado; faltas freqüentes à escola.	Muitas vezes oculta as lesões da criança, justificando-as de forma não convincente ou contraditória; descreve a criança como má e desobediente; abusa de álcool ou drogas; possui expectativas irreais acerca da criança; defende uma disciplina severa; tem antecedentes de maus-tratos na família.

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Source: https://bvsms.saude.gov.br/bvs/publicacoes/manual_atendimento_vitimas_violencia_saude_publica_DF.pdf

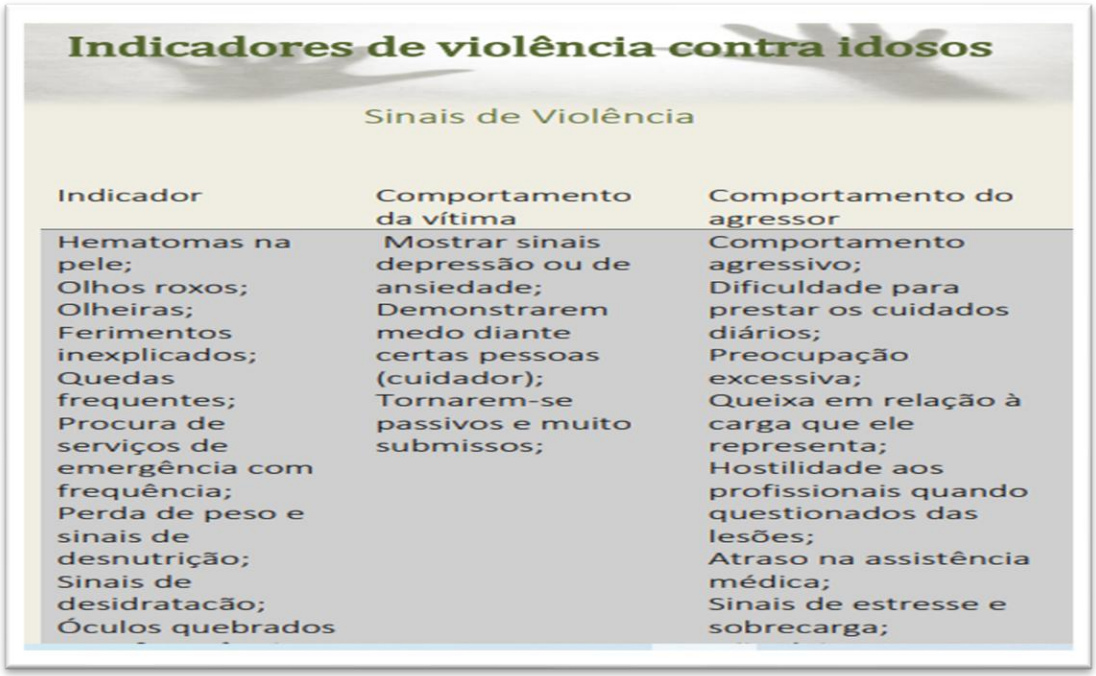


Indicadores de violência contra mulher

Violência Física

Indicador	Comportamento da vítima	Comportamento do agressor
Presença de lesões físicas, como queimaduras, hematomas, feridas e fraturas, que não se adéquam à causa alegada. Ocultação de lesões antigas e não explicadas.	Usa roupas excessivamente compostas; Evita sair de casa, e/ou, quando saí, evita falar com vizinhos e familiares; Não faz contato visual; Se explica em demasia.	Agressivo com os profissionais de saúde; Impõe sua presença a força; Postura intimidadora; Ciúmes/raiva por parte do agressor.

Source: http://www.abeforense.org.br/wp-content/uploads/2017/11/Cartilha-de-Orienta%C3%A7%C3%B5es-da-Enfermagem-Forense-ABEFORENSE.pdf



Indicadores de violência contra idosos

Sinais de Violência

Indicador	Comportamento da vítima	Comportamento do agressor
Hematomas na pele; Olhos roxos; Olheiras; Ferimentos inexplicados; Quedas frequentes; Procura de serviços de emergência com frequência; Perda de peso e sinais de desnutrição; Sinais de desidratacão; Óculos quebrados	Mostrar sinais depressão ou de ansiedade; Demonstrarem medo diante certas pessoas (cuidador); Tornarem-se passivos e muito submissos;	Comportamento agressivo; Dificuldade para prestar os cuidados diários; Preocupação excessiva; Queixa em relação à carga que ele representa; Hostilidade aos profissionais quando questionados das lesões; Atraso na assistência médica; Sinais de estresse e sobrecarga;

Source: http://www.abeforense.org.br/wp-content/uploads/2017/11/Cartilha-de-Orienta%C3%A7%C3%B5es-da-Enfermagem-Forense-ABEFORENSE.pdf

In cases of physical violence, it is important to pay attention to what is being observed if there are discrepancies between the report of the event and the injuries that are observed. In addition, attention should be paid to physiological changes such as chronic pain, neurological, gastrointestinal, cardiovascular, urinary tract and respiratory changes (ABEFORESEN, 2017)

Physical Injuries

- oasis fraturas;
- signs on the skin, such as abrasions, ecchymosis (black, red, bluish, yellowish);
- burns (first, second or third degree);
- head trauma and;
- intra-abdominal organ injuries.

Psychological/Moral Violence

There are several manifestations of rejection, devaluation, discrimination, disrespect, excessive demands and humiliating punishments. These actions compromise or harm the self-esteem, identity, and integral development of the individual. In terms of psychological violence against children and adolescents, it refers to the depreciation, threat and rejection of children by adults, with the development of destructive or self-destructive behaviors in children as a result of the devaluation suffered by children, exhibiting its main characteristics (BRASIL, 2008).

1. Indicadores de Violência contra Criança e Adolescente

INDICADORES	COMPORTAMENTO DA CRIANÇA E DO ADOLESCENTE	CARACTERÍSTICAS DA FAMÍLIA
VIOLÊNCIA PSICOLÓGICA		
Problemas de saúde, como obesidade, afecção da pele, distúrbios do sono e dificuldades na fala; comportamentos infantis; enurese noturna.	Comportamentos extremos de timidez ou agressividade, destrutividade e autodestrutividade; problemas do sono; isolamento; baixo conceito de si próprio; abatimento profundo; tristeza; idéia e tentativa de suicídio; insegurança.	Tem expectativas irreais sobre a criança; rejeita; aterroriza; ignora; desqualifica; exige em demasia; corrompe; isola; descreve a criança como má, diferente das demais.

Source: https://bvsms.saude.gov.br/bvs/publicacoes/manual_atendimento_vitimas_violencia_saude_publica_DF.pdf

With regard to psychological violence against women, the Maria da Penha Law - Law No. 11,340, of August 7, 2006, emphasizes that psychological violence is understood as any conduct that causes emotional damage and decreased self-esteem or that harms and threatens them; Embarrassment; disturbs their full development or that aims to degrade or control their actions, behaviors, beliefs and decisions, through (BRASIL, 2006):

- Humiliation;
- Handling;

- Isolation;
- Constant vigilance;
- Persecution;
- Insult;
- Blackmail;
- Ridicule;
- Exploitation and limitation of the right to come and go.

In relation to psychological violence against the elderly, the Law of the Elderly (Law 10.741, of 2003) defines in its article 19, paragraph 1, that violence against the elderly is:

> "any action or omission, in a public or private place, that causes death, physical or psychological injury or suffering".

The experience of coping with psychological violence against the elderly, by itself, shows that the violence that exists in the relationships with family members is attributable to (Wanderbroocke *et al.*, 2020):

- Lack of understanding/patience in the face of their limitations;
- Curtailment of autonomy;
- Failure to recognize their potential;
- Capacity for new learning;
- Repetition of abusive family patterns.

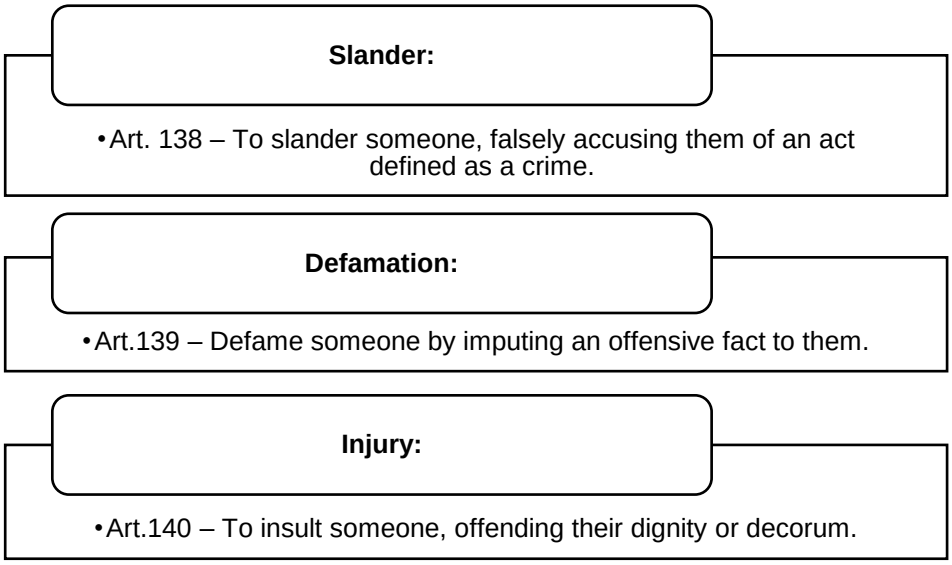
Thus, psychological violence perpetrated by family members against elderly people exposes the subtleties of the problem, both because it is a form of violence capable of causing harm even when it is recognized that the aggressor's family member has a thin line between what is considered care and what is considered aggression (Wanderbroocke *et al.*, 2020).

In moral harassment, violence occurs in a work environment based on power relations between employers and employees or vice versa. Thus, moral violence refers to all acts designed to defame, slander, or damage an individual's honor or reputation.

According to the Brazilian Penal Code, moral violence is dealt with in Article 146 (BRASIL, 2017):

> "Repeatedly offending the dignity of someone causing physical or mental damage or suffering, in the exercise of employment, position or function."

The Maria da Penha Law punishes crimes of moral violence against women committed in the domestic or family environment. The Brazilian Penal Code (Law No. 11,340/2006), which is regulated in articles 138, 139 and 140 on the following crimes:



Bullying is another example of physical/psychological violence, which manifests itself in the school environment or not, such as cyberbullying that will be mentioned below (ABEFORENSE, 2017; BRAZIL, 2016; 2006; 2008; 2002).

Law No. 13,185, of November 6, 2015, considers bullying as (BRASIL, 2015):

> "Any act of physical or psychological violence, intentional and repetitive that occurs without evident motivation, practiced by an individual or group, against one or more people, with the aim of intimidating or assaulting them, causing pain and anguish to the victim, in a relationship of power imbalance between the parties involved."

According to Article 2 of the aforementioned law on the Program to Combat Systematic Intimidation (Bullying), the characteristics of this type of violence will be described below (BRASIL, 2015):

- Physical attacks;
- Personal insults;
- Systematic comments and pejorative nicknames;
- Threats by any means;
- Derogatory graffiti;
- Prejudiced expressions;
- Conscious and premeditated social isolation;
- Jokes.

In addition, bullying can be classified through actions of various types of violence such as physical, verbal, moral, sexual, social, psychological and material, seen in the diagram below (BRASIL, 2015):

- Verbal: insulting, cursing and pejoratively nicknamed;
- Moral: defaming, slandering, spreading rumors;
- Sexual: harassing, inducing and/or abusing;
- Social: ignoring, isolating and excluding;
- Psychological: to stalk, frighten, terrorize, intimidate, dominate, manipulate, blackmail and make hell;
- Physical: punching, kicking, hitting;
- Material: stealing, robbing, destroying other people's belongings;

There is another type of bullying called cyberbullying, carried out through digital technologies, using the internet to degrade, incite violence, tamper with photos and personal data as a way to generate psychosocial embarrassment (ALMEIDA, 2019; BRAZIL, 2015).

Cyberbullying is an act of moral harassment committed through electronic communication. It would be an aggressive and deliberate act, by a group or individual, repeated over time against a victim who cannot easily defend himself (ALMEIDA, 2019).

The classification of this type of violence is all forms of (BRASIL, 2015):

> "disparaging, sending intrusive messages of intimacy, sending or tampering with photos and personal data that result in suffering or with the intention of creating means of psychological and social embarrassment."

Sexual violence

It is any act by which a person takes advantage of a position of power and uses force, coercion, intimidation, or psychological influence, whether through weapons or drugs, to compel another person regardless of gender and age to have, witness, or participate in any form of sexual violence. Interact with or exploit sexual activity in any way for gain, revenge or other purposes (ABEFORENSE, 2017; BRAZIL, 2016; 2008; 2006).

This type of violence includes rape, abuse, sexual harassment, forced marital sex, non-consensual sexual play, forced pornography, child pornography, pedophilia, voyeurism, manipulation, oral, anal or genital penetration, with a penis or object in a forced way (ABEFORENSE, 2017; BRAZIL, 2016; 2008; 2006).

In addition, it includes coercive/embarrassing exposure to sexual acts, exhibitionism, masturbation, sexually explicit language, sexual interactions of any kind, and pornographic

material. They also describe the prevention of the use of any contraceptive method or forced marriage, pregnancy, abortion, prostitution, through coercion, blackmail, bribery or complicity; or restriction or removal of the autonomy of any person and the exercise of their sexual and reproductive rights (ABEFORENSE, 2017; BRAZIL, 2016; 2008; 2006).

The following are presented about sexual harassment, rape, child pornography and sexual exploitation (BRASIL, 2016):

- **Sexual harassment:** It is the insistence, questioning, proposals, demands or any other form of coercive methods of a sexual nature, improper, regardless of gender or sexual orientation. It is the act of embarrassing someone, through gestures, language or the use of violence, taking advantage of relationships of trust, lineage, hierarchy, authority or employment or service relationships with the aim of obtaining sexual advantage.
- **Rape:** Forcing a person, by force or serious threat, to have sexual relations or to perform or permit other sexual acts with him. This concept includes carnal intercourse (insertion of a penis or other object into the anus, vagina or mouth), regardless of the sexual orientation or gender of the person/victim.
- **Child pornography:** Refers to the exhibition, production, sale, supply, dissemination and/or publication of photographs or images of explicit or sexually explicit sex involving a child or adolescent through any means of communication (image exposure).
- **Child sexual exploitation:** Commercial and commercial exploitation of people, regardless of age, sex or gender identity, whether characterized by the practice of sexual acts (prostitution); nudity and live relations (striptease, pornographic performances) or through (magazines, films, photographs, videos or websites).
- **Adult sexual exploitation:** In the case of adults, sexual exploitation is considered if the victim's consent is not obtained in these circumstances, or is obtained through force, deception, intimidation or any other form of coercion. Therefore, anyone who obtains sexual services directly or through an intermediary (direct agency, inducement, facilitation) is considered a sexual exploiter through payment or reward of any kind.

In view of sexual violence against children and adolescents, attention should be paid to the indicators, the victim's behavior and family characteristics, as shown in the table below (BRAISL, 2008):

1. Indicadores de Violência contra Criança e Adolescente

INDICADORES	COMPORTAMENTO DA CRIANÇA E DO ADOLESCENTE	CARACTERÍSTICAS DA FAMÍLIA
VIOLÊNCIA SEXUAL		
Infecções urinárias; dor ou inchaço nas áreas genitais ou anais; lesões e sangramento; secreções vaginais ou penianas; doenças sexualmente transmissíveis; dificuldade de caminhar; baixo controle dos esfíncteres; enfermidades psicossomáticas.	Comportamento sexual inadequado para a idade; não confia em adultos; fugas de casa; regressão a estado de desenvolvimento anterior; brincadeiras sexuais agressivas; comportamento promíscuo; vergonha excessiva e alegações de abusos; idéias e tentativa de suicídio; autoflagelação.	Oculta freqüentemente o abuso; é muito possessiva, negando à criança contatos sociais normais; acusa a criança de promiscuidade, sedução sexual e de ter atividade sexual fora de casa; crê que o contato sexual é forma de amor familiar; alega outro agressor para proteger membro da família.

Source: https://bvsms.saude.gov.br/bvs/publicacoes/manual_atendimento_vitimas_violencia_saude_publica_DF.pdf

According to the Pan American Health Organization and the World Health Organization (PAHO/WHO, 2023), children who grow up in violent homes can develop a series of behavioral and emotional disorders. These disorders may also be related to violence or exposure to violent behaviors later in life. Partner violence is also associated with higher mortality and morbidity (such as diarrheal diseases and malnutrition) among children under five.

With regard to the characteristics of sexual violence against women, the focus is on the information recorded in the mandatory notification form to feed the data collected on violence by health professionals, which shows that this type of violence occurs at all ages and has serious consequences, including death (Delziovo *et al*., 2017).

Most victims of sexual violence are women, who are adolescents, young people and adults. Adolescents experience violence committed by a single aggressor at home, at night, with vaginal penetration, recurrence of major aggressions, and consequently pregnancy. For adolescents aged 10 to 14 and 15 to 19 years, the proportion of offenders was unknown (32.9% and 33.1%, respectively). Adults were assaulted by a single aggressor during the night and early morning at home, on a public road, with vaginal penetration in more than half of the reported violence, plus bodily injuries and suicide attempts (Delziovo *et al*., 2017).

The risk factors associated with the increased risk of perpetrating violence are (PAHO/WHO, 2023):

- Low education;
- Child maltreatment or exposure to violence in the family;
- Harmful use of alcohol;

- Violent attitudes;
- Gender inequality.

The factors associated with an increased risk of becoming a victim of sexual violence are as follows (PAHO/WHO, 2023):

- Low level of education;
- Exposure to violence between parents;
- Child abuse;
- An attitude that allows violence;
- Gender inequality.

In addition, factors associated with sexual and partner violence occur at the individual, family, community, and social levels. Some of them are related to "being a perpetrator of violence", others to the suffering caused by violence or both

Risk factors for partner violence and sexual violence include (PAHO/WHO, 2023):

- Low education (perpetrators and victims of sexual violence);
- Exposure to child abuse (perpetrator and victim);
- Experiences of domestic violence (perpetrator and victim);
- Antisocial Personality Disorder (Author);
- Harmful use of alcohol (perpetrators and victims);
- Have multiple partners;
- Acceptance of attitudes of violence (perpetrator and victim).

In relation to sexual violence against the elderly, this is a veiled phenomenon, which deteriorates their integrity, generating inconveniences for life, causing poor health and distancing from family and social life, subjecting the victim to silence in exchange for the permanence of coexistence and individual guarantees (Gomes *et al*., 2020).

In Brazil, sexual violence against the elderly occurs predominantly in the white female population, with up to 4 years of schooling, especially at home, with unknown people as the most present aggressors (Vieira; Toledo, 2022).

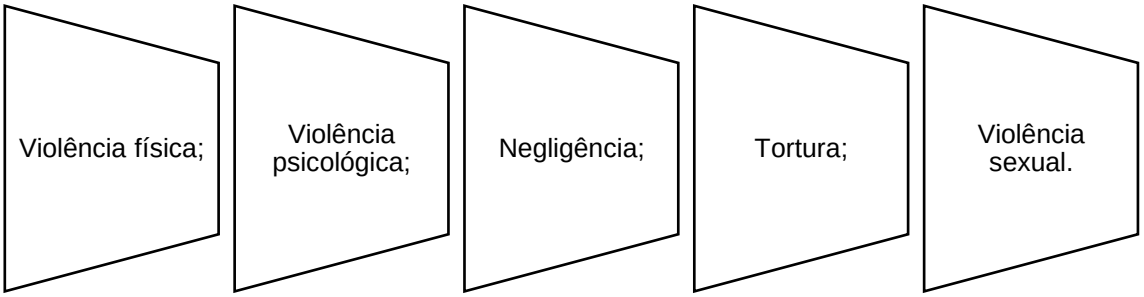
The characterization of the profile of elderly people who suffered violence based on the records made by the compulsory notification form emphasizes that the main types of violence they suffer are physical and sexual violence. The victims of physical violence were male (use of body force and beatings) and sexual violence were female, in which these

types of violence occurred in the homes of these elderly people and were perpetrated by family members (Hohendorff *et al*., 2018; Rodrigues; Armond; Gorios, 2015).

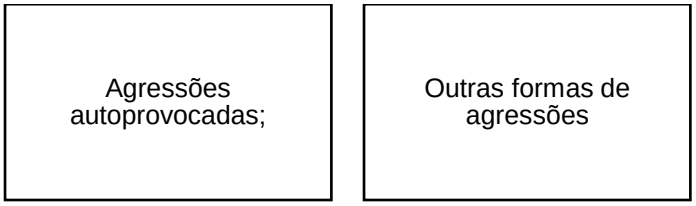
The Statute of the Elderly states in Article 4 that no elderly person should be the object of any type of (BRASIL, 2003):

> "(...) negligence, discrimination, violence, cruelty or oppression, and any attack on their rights, by action or omission, will be punished in accordance with the law."

Females have the highest risk of being victims of violence (Hohendorff *et al*., 2018):



Males, on the other hand, are more likely to be victims of violence (Hohendorff *et al*., 2018):



Obstetric violence

It is characterized as gender violence because it occurs to women at all stages of pregnancy and puerperium, including abortion, and can be divided into moral, physical, psychological, and patrimonial violence (Marques, 2020).

According to the booklet on obstetric violence of the Anna Nery School of Nursing of the Federal University of Rio de Janeiro (EE-UFRJ, 2021), which states that such violence affects pregnant women, postpartum women and postpartum women, the actions carried out can be characterized by two different environments, relationships (inside and outside the family) and institutions, as described below (Batista; Gates; Giotto, 2019).

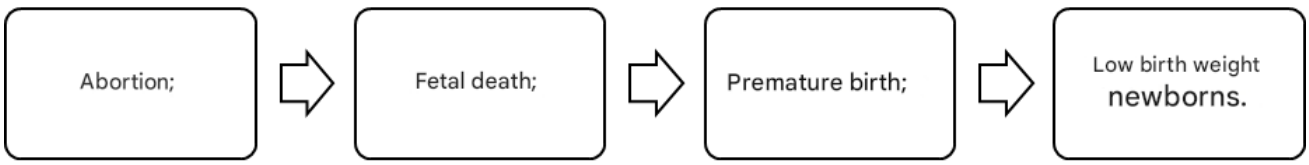
Interpersonal obstetric violence:

- **Intrafamilial:** perpetrated by close partners, family members and family members with different biopsychosocial damages.
- **Extra-familial:** perpetrated by people, known and unknown, whose actions aim to compromise their integrity and that of the baby.
- **Institutional:** appropriation of women's bodies, being perpetrated by health professionals, where there is substance abuse, exclusion of rights, inhumane treatment of their bodies and sexuality;

Disrespect and abuse during childbirth in health facilities include (EE-UFRJ, 2021; Bowser; Hill, 2010):

- Lack of confidentiality, failure to obtain informed consent before performing procedures;
- Refuse to take painkillers;
- Neglected care during childbirth that leads to preventable complications;
- Prevent a woman from being accompanied by a person of her choice;
- Using jokes, mean and rude comments to belittle, demean and offend women in any way;
- Performing unnecessary medical procedures without instructions, such as: Kristeller's maneuver, episiotomy, husband's stitch, intestinal lavage.

According to the Pan American Health Organization and the World Health Organization (PAHO/WHO, 2023), violence committed by the partner during pregnancy increases the likelihood of:



These forms of violence can lead to (PAHO/WHO, 2023):

- Depression;
- Post-traumatic stress;
- Other anxiety disorders;
- Sleep difficulties;

- Eating disorders;
- Suicide attempts.

In Brazil, there are laws that favor women's reproductive rights and sexuality during the pregnancy-puerperal cycle (BRASIL, 2007; 2005).

- Law No. 11,108, of April 7, 2005 - permission of a companion during labor and immediate postpartum;
- Law No. 11,634, of December 27, 2007 - the right of the pregnant woman to know and be linked to the maternity hospital where she will receive care.

Thus, obstetric violence occurs in diverse and complex forms through institutional, physical, sexual and psychological violence, which consists of the appropriation of the woman's body and reproductive processes by health professionals, is externalized through violent treatment, medical abuse and the pathologization of the natural process that leads to the loss of autonomy of women in childbirth and the ability to freely self-determine (Oliveira; Albuquerque, 2018).

Financial/economic violence

It means acts that imply damage, loss, reduction, destruction or retention of belongings, personal documents, work tools, objects and valuables of the recipient/victim. It includes the improper or illegal exploitation, or unauthorized use of their financial and patrimonial resources (ABEFORENSE, 2017; BRAZIL, 2008; 2006).

This type of violence occurs mainly in the family environment, especially among the elderly, women and the disabled, and is also called patrimonial violence (ABEFORENSE, 2017; BRAZIL, 2008; 2006).

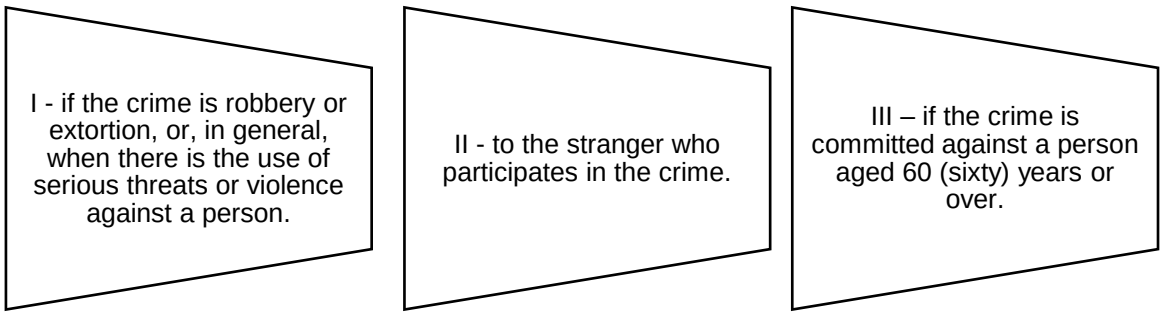
With regard to women who are related to financial/economic and patrimonial violence, the Maria da Penha Law (Law No. 11,340, of August 7, 2006) defines this type of violence seen in Article 7 in item IV of the types of domestic and family violence against women (BRASIL, 2006):

> “(...) understood as any conduct that constitutes retention, subtraction, partial or total destruction of their objects, work instruments, personal documents, goods, values and rights or economic resources, including those intended to satisfy their needs."

The victims and perpetrators of this type of violence are mostly married women, whose average age is 36 years old, white and brown skin color, incomplete elementary school and domestic work. The aggression comes mainly from the husband and son and is

motivated by jealousy, alcoholism and vulnerability. Domestic violence, both individual and combined, occurs mainly in the lives of women, especially the elderly, associated with the loss of material and emotional goods (Pereira *et al*., 2013).

In addition, the Maria da Penha Law (BRASIL, 2006) corresponds to other crimes against property provided for in the Brazilian penal code and must be treated accordingly (Delgado, 2015). If the woman is the target of violence during a separation, divorce, distribution of goods or food or by theft, destruction, kidnapping or imprisonment of the spouse, former spouse, the crime provided for in Article 183 (BRASIL, 1940) is provided for by law:



In relation to the elderly, the Law of the Elderly (Law 10.71/2003) establishes that crimes against economic, financial and patrimonial violence are related according to Art. 102 (BRASIL, 2003):

> "[...] Appropriating or diverting assets, earnings, pension or any other income of the elderly, giving them an application different from that of their purpose."

For the elderly who suffer economic/financial and patrimonial violence, it is highlighted that this type of violence occurs more in single elderly men, compared to other forms of violence. This typology occurs in public places and in the homes themselves, and the main aggressors are women who are not part of the family cycle (Santos *et al*., 2019).

Violence resulting from legal intervention

It refers to the intervention of public officials, whether they are representatives of the state, the police or other law enforcement officials in the exercise of their duties. This type of violence can occur with the use of firearms, explosives, gas, blunt objects, pushes, punches, and can result in injuries, aggression, embarrassment and death (BRASIL, 2016).

According to the International Classification of Diseases (ICD-11) published by the World Health Organization (WHO) on external causes of morbidity and mortality. The ICD-11 defines injuries as those resulting from acute exposure to physical agents, such as

mechanical energy, heat, electricity, chemicals, and ionizing radiation that interact with the body in quantities or speeds exceeding the limit of human tolerance (WHO, 2023).

In some cases (such as drowning and frostbite), injuries are caused by a sudden lack of vital substances, such as oxygen or heat. In addition, the ICD-11 classifies injuries according to intentional causes and by who caused them (WHO, 2023):

As for legal intervention, the ICD-10 states that it includes firearms, explosives, gas, sharp and piercing objects, legal coercion and other specified and unspecified means (WHO, 2000).

The commonly used categories on external causes will be described below (WHO, 2023):

- Unintentional (i.e., accidental);
- Intentional (i.e., deliberate);
- Interpersonal (e.g., assault and homicide);
- Self-harm (e.g., drug and alcohol abuse, self-harm, suicide);
- Legal intervention (e.g., action by police or other law enforcement personnel);
- War, civil insurrection and riots (e.g. demonstrations and riots);
- Undetermined intent.

Brazil has legislation (Law No. 13,869 of 2019) that provides for crimes of abuse of power committed by public persons, public servants or not, who, in the exercise of their functions or under the pretext of exercising them, abuse the power assigned to them according to Articles 1 and 2 (BRASIL, 2019), described below:

I - public servants and military personnel or persons equivalent to them;	II - members of the Legislative Branch;	III - members of the Executive Branch;
IV- members of the Judiciary;	V - members of the Public Prosecutor's Office;	VI - members of the courts or audit boards.

The Penal Code itself raises issues related to urban violence in different situations of legal intervention, such as situations of vandalism according to Art.163 (BRASIL, 1940):

> (...) Vandalism is a crime and the perpetrator of the offense is subject to arrest and a fine, for damage to public property (Union, State, Municipality, companies and services). The penalty ranges from six months to three years of detention, in addition to the aggravating factors.

The Atlas of Violence introduces the category "Violent Deaths of Undetermined Cause", which is used for violent deaths from external causes in which it was not possible to determine the underlying cause or reason for death. whether resulting from self-inflicted injury (suicide), accident (including in traffic) or attack by third parties or legal intervention (murders) (Cerqueira *et al*., 2021).

Police violence against individuals and groups is a constant in contemporary society. But its form varies according to the degree of tolerance, whether state or popular, so police activity is more monitored in some places than in others. Thus, if in some cities the addiction of a person belonging to a discriminated ethnicity or social group is enough to generate a public debate, in others these categories or more serious facts do not arouse interest in the media or the population (Machado; Noronha, 2002).

Thus, violence is a way to solve the problems of crime, the population does not seem to deny this method. For residents of urban areas where crime is common and effective policing is absent, violent actions by the police or death squads are planned to combat insecurity and disseminate this type of violence by the same wave is perpetuated (Machado; Noronha, 2002).

Torture

It is the act of restraining a person by force or serious threat in order to obtain information, statement or confession from the victim or third parties, causing him or her physical or psychological suffering, resulting in a criminal act or omission, due to racial or religious discrimination, among others (BRASIL, 2016).

According to Law 9.455/97, it defines the crime of torture (BRASIL, 1997):

I. Embarrassing someone with the use of violence or serious threat, causing them physical or mental suffering:
   a. for the purpose of obtaining information, statement or confession from the victim or a third person;
   b. to provoke action or omission of a criminal nature;
   c. due to racial or religious discrimination;

II. Subjecting someone, under their custody, power or authority, with the use of violence or serious threat, to intense physical or mental suffering, as a way of applying personal punishment or a preventive measure.

The problem of torture in Brazil is multifaceted, with institutional violence leading to the accountability of agents involved in this perpetration, poor social perceptions of public security, and significant underreporting of these acts. These factors disproportionately affect some social classes, especially young, black, poor people who live in peripheral areas (BRASIL, 2020).

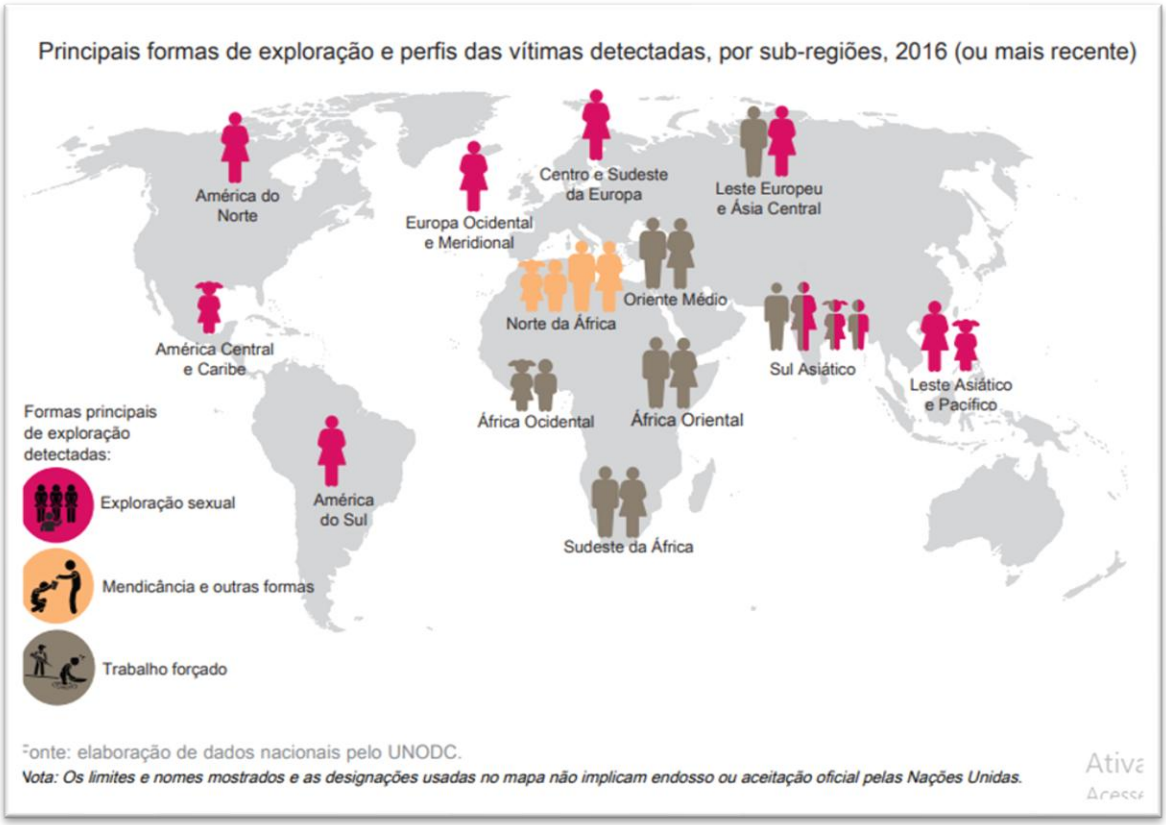
According to the Final Report of the Permanent National Campaign to Combat Torture and Impunity, there are four types of Torture, which are described below (BRASIL, 2000):

- **Torture-Evidence:** as a purpose to obtain a confession from the victim;
- **Incarceral torture:** cases of contempt of the victim before the police authority, causing barbaric aggressions;
- **Collective torture:** practiced by a group of at least 10 people (rebellions and escape attempts);
- **Discriminatory torture:** in cases of social exclusion, linked to the practice of torture in various situations of violence.

Despite the typification in the legal system, many judges still reduce torture to physical harm, abuse of power, illegal humiliation, etc. This disrespect for the law allowed the practice of torture to continue, especially by police officers who see impunity as authorizing the regular practice. The crime of torture is a cultural heritage of Brazilian society, and effective respect for the dignity of the human person depends primarily on law enforcement agents (Dias, 2013).

Trafficking in persons

It includes recruitment, transportation, transfer, placement of persons, use of threats, abduction, fraud, deception, abuse of authority, use of force or other forms of coercion, or prostitution in a situation of vulnerability, or unpaid work, including domestic work, slave labor or servitude, servile marriage, or for the removal and sale of their organs, with or without the use of physical force. It can take place within the same country, or between different continents (UNODC, 2023; BRAZIL, 2016).



Source: https://www.unodc.org/documents/lpo-brazil/Topics_TIP/Publicacoes/TiP_PT.pdf

Brazil is among the countries with the highest rates of human trafficking, with 92.36% of the processes in which all Brazilian victims were taken abroad or at least tried to be sent, mainly to the European continent for the purpose of prostitution. Spain is the country with the highest number of Brazilian victims, being the target of 82 cases (56.9%). The victims of international trafficking in persons for the purpose of sexual exploitation are women (96.36%) over 18 years of age (BRASIL, 2022; UNODC, 2018).

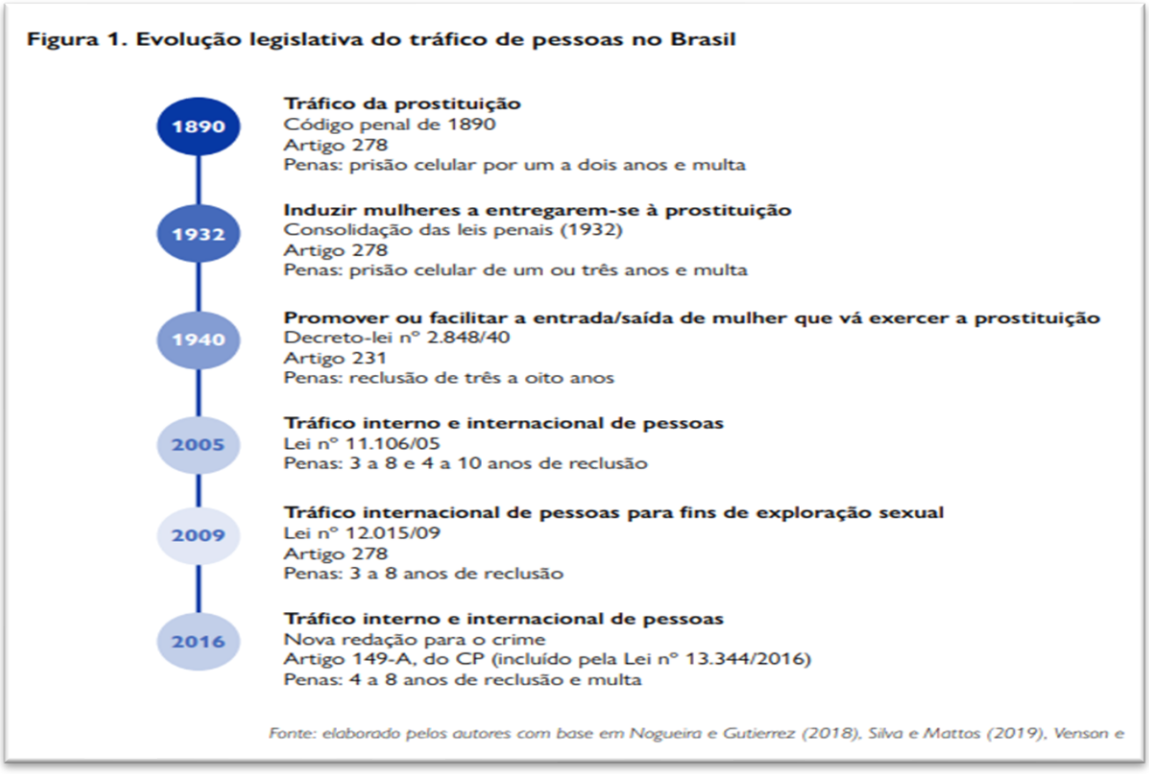
The majority of victims detected worldwide are trafficked for sexual exploitation, although this pattern is not uniform across regions. Trafficking of women – both women and girls – for these purposes is common in the regions where victims are most often found in the Americas, Europe, Asia and the Pacific, as shown in the following figure (UNODC, 2018).

According to the United Nations Office on Drugs and Crime (UNODC) in Brazil, there are three elements that make up trafficking in persons, which are described below (UNODC, 2023):

- **The act (what is done):** recruitment, transportation, transfer, housing or reception of people

- **The means (how it is done):** threat or use of force, coercion, kidnapping, fraud, deception, abuse of power or vulnerability, or payment or benefit in exchange for control of the victim's life.
- **Purpose (why it is done):** For the purpose of exploitation, including prostitution, sexual exploitation, forced labor, slavery, organ removal, and similar practices. To ascertain whether a particular situation constitutes human trafficking, consider the definition of trafficking in the Protocol on Trafficking in Persons and the elements of the crime as defined by relevant national laws.

There are laws that aim to punish this type of crimes related to trafficking in persons and smuggling of migrants, as seen in the figure below on the legal evolution regarding human trafficking (BRASIL, 2022; 2016; 2004a; 2004b).



Source: https://brazil.iom.int/sites/g/files/tmzbdl1496/files/documents/tr%C3%A1fico-pessoas-web.pdf

In addition, UNODC states that in trafficking consent occurs first, exploitation second, and transnational character third, as mentioned below (UNODC, 2023):

- **Consent:** it is irrelevant for the action to be characterized as trafficking or exploitation of human beings.
- **Exploitation:** exploitation of the victim by traffickers, to obtain some benefit or profit.
- **Transnational character:** occur both internationally and within the country itself.

After the description seen above, there is the typification of human trafficking, being for the purposes of labor and sexual exploitation, begging and organ harvesting according to the Brazilian penal code and the prevention and repression of internal and international trafficking in persons (BRASIL, 2016; 2009; 1997; 1940):

Labor exploitation:	•Art, 149. 171. Forced labor or services, slavery.
Sexual exploitation:	•Art. 149. 228. Inducing or attracting someone to prostitution or another form of sexual exploitation or illegal addiction.
Organ extraction:	•Art. 15, 149 and 171. Practices similar to slavery, servitude or the removal and purchase of organs.

According to Veras, Souza and Souza (2021), the profile of the victims is more often associated with young, single, unemployed women living in distant cities or in the countryside. Recognizing the profile of victims of human trafficking is very complex because almost no one highlights the characteristics of the victims due to the existing underreporting rates.

In this context, it is important to emphasize that the issue is quite complex due to the fact that the victims may present psychological problems due to the act perpetrated, making it still a very difficult investigation for the identification of the criminals through the public prosecutor's office and federal public security (Veras; Souza; Souza, 2021).

Neglect/abandonment

It means any omission in which the physical, emotional and social development needs of the recipient/victim and basic care are not met, for example, deprivation of medications, lack of necessary medical care, among others (ABEFORENSE, 2017; BRAZIL, 2016; 2008).

Abandonment is an extreme form of neglect and the most common type of violence against children and the elderly (ABEFORENSE, 2017; BRAZIL, 2016; 2008).

With regard to the neglect/abandonment of children and adolescents, it can be considered in several situations, for example (BRASIL, 2008):

- Leave vaccines in arrears;
- Do not take it to the doctor;

- The child is not enrolled or does not go to school;
- Unkempt and dirty appearance;
- Young children alone at home;
- Foreseeable domestic accidents (falls from bed, crib, etc.)

Among the most common types of violence and triggers of aggression, negligence is the result of the lack of preparation of mothers and fathers and the lack of basic care in childhood. Abuse by them or by their guardians is extremely common (BRASIL, 2008).

The Statute of the Child and Adolescent (ECA) (Federal Law No. 8,069/1990), safeguards the citizenship of the child by the principle of full protection. The law makes it mandatory to report suspected or confirmed cases of abuse of children or adolescents (BRASIL, 1990).

Therefore, it is important to know about the indicators of this type of violence, as well as the behavioral and family characteristics of child neglect, as seen below (BRASIL, 2008):

1. Indicadores de Violência contra Criança e Adolescente

INDICADORES	COMPORTAMENTO DA CRIANÇA E DO ADOLESCENTE	CARACTERÍSTICAS DA FAMÍLIA
NEGLIGÊNCIA		
Padrão de crescimento deficiente; fadiga constante e pouca atenção; problemas físicos e necessidades não atendidas; vestimenta inadequada ao clima.	Comportamentos extremos de hiper ou hipoatividade; contínuas faltas ou atrasos à escola ou ao médico; comportamentos infantis ou depressivos. Dificuldade na aprendizagem.	É apática e passiva, não se importando muito com a situação da criança; tem baixa auto-estima e severo desleixo com higiene; é despreocupada em resolver as necessidades de atenção da criança.

Fonte: Assis, S. G. *Crescer sem violência:* um desafio para educadores. Rio de Janeiro: Fiocruz/ENSP/CLAVES, 1994, p. 24.

Source: https://bvsms.saude.gov.br/bvs/publicacoes/manual_atendimento_vitimas_violencia_saude_publica_DF.pdf

Therefore, negligence can manifest itself by a variety of factors that are not necessarily related to poverty and the voluntary abandonment of those responsible, but to their psychological, material and emotional impotence. In many cases, this culture of violence is passed on from generation to generation, as the victims have emotional consequences that will be reflected in the way they raise their children (Rodrigues; Mendes, 2018).

Regarding neglect/abandonment against the elderly, it can be considered in several situations, such as (BRASIL, 2008):

- Denying adequate care and supervision (especially in cases of people with physical or mental disabilities);
- Let the elderly go hungry;
- Not giving the medications you need;
- Do not take the scheduled appointments;
- Do not provide other physical care;
- Behaviours of an older person that threaten their own health or safety.

Violence due to negligence/abandonment is more common in the elderly aged 80 years or older than in the younger ones (60 to 69 years), 45% in the black elderly than brown, 42.% more common in those with a partner and the prevalence (3.24 times higher) among the elderly with some type of disability/incapacity (Pampolim; Leite, 2020).

The elderly who apparently suffer the most violence are mainly women, single/widowed, aged 75 years or older, with low education, with any neurological, rheumatic or psychiatric disease (BRASIL, 2008).

Violence against the elderly is complex due to several aspects that interfere in its emergence, such as cultural, social, historical, family and demographic aspects, where population aging brings the abuse of the elderly, due to its naturally biopsychosocial character, a situation of investigation and urgent solutions (Sousa *et al*., 2010).

Therefore, it is essential to be aware of the signs of violence, especially its indicators, the victim's behavior and that of those who perpetuate such crime, as seen below (ABEFORENSE, 2017):

Indicador	Comportamento da vítima	Comportamento do agressor
Descuido nas vestimentas; Falta de higiene; Úlceras por pressão em muitos lugares do corpo; Sinais de sonolência excessiva por uso de sedativos; Alterações de comportamento repentinas pelo idoso, principalmente perante estranhos; Doenças facilmente controláveis, mas que não melhoram por falta de tratamento adequado;	Baixa autoestima; Se culpa da violência sofrida; Antes de falar, olha para o cuidador; Muda de comportamento na frente do cuidador;	Contesta perguntas dirigidas ao idoso; Obstaculiza o cuidado; Apresenta descontrole emocional; Não demonstra sentir-se satisfeito com a vida; Demonstra ser controlador;
Uso incorreto de medicacões; Quedas frequentes; Procura por cuidados médicos constantes; Repetidas ausências às consultas agendadas; Explicações improváveis sua ou de seus familiares para determinadas lesões e traumas.	Baixa autoestima; Se culpa da violência sofrida; Antes de falar, olha para o cuidador; Muda de comportamento na frente do cuidador; História controversas entre o idoso e o cuidador; Solidão; Exagerado respeito pelo cuidador	Tenta convencer o profissional que o idoso é "louco" ou que está "caducando"; Culpabiliza o idoso; Apresenta "gênio forte" Sente-se cansado.

Source: http://www.abeforense.org.br/wp-content/uploads/2017/11/Cartilha-de-Orienta%C3%A7%C3%B5es-da-Enfermagem-Forense-ABEFORENSE.pdf

Child labor

It is the set of behaviors and activities performed by children that prevent them from fully enjoying childhood and adolescence. It refers to any type of activity, paid or unpaid, of a mandatory, regular, routine nature, which puts their physical, mental, social and moral

well-being at risk, restricting their growth conditions for a healthy life and safe development (BRASIL, 2016; 2008).

The exploitation of child labor is not restricted to Brazil. The International Labour Organization estimates that there are approximately 250 million child labourers worldwide. At least 120 million children aged 5 to 14 work full-time. The rest combine work with study and other non-economic activities (ILO, 2001).

According to the International Labor Organization (ILO, 2000), the worst forms of child labor include:

A. All forms of slavery or practices analogous to slavery, such as the sale and trafficking of children, debt bondage, servitude, forced or compulsory labour, including forced or compulsory recruitment of children for use in armed conflict;
B. Use, demand, and provide children for the purposes of prostitution, pornography, or sexual performance;
C. The use, recruitment and supply of children for illicit activities, in particular the production and trafficking of narcotic drugs as defined in relevant international treaties;
D. Work which, by its nature or the circumstances in which it is carried out, is likely to adversely affect the health, safety and morals of children.

In view of the above picture, the ILO states that this type of work represents a threat and danger to these children, not least the consequences that it can have on their lives, as (ILO, 2001):

A. Exposure to physical, emotional or sexual abuse;
B. Acting underground and underwater, at dangerous heights or in confined environments;
C. Using dangerous machinery, equipment, tools or transporting heavy objects;
D. working in an unhealthy environment or being exposed to dangerous substances, agents or processes, or exposure to temperatures or levels of noise and vibration that are harmful to health;
E. Acting in difficult conditions, such as long hours, at night or that prevent the daily return to your home.

Thus, all these types of exposures and conditions that end up violating children's human rights of the Statute of the Child and Adolescent (ECA) are exposed to various degrees of violence situations (BRASIL, 1990).

ASYNCHRONOUS ACTIVITY

In this chapter, he contextualized the various typologies of violence, their definitions and essential characteristics. As healthcare professionals, it is crucial that you consider not only the clinical aspects, but also the social and emotional contexts. The analysis of the case study by Amar and Sekula (2015) leads to reflect on the impact of violence on the experience of people in situations of violence. This reflection is essential to improve communication and welcoming skills, allowing for more conscious and responsible action in scenarios where violence influences the health and well-being of individuals.

CASE STUDY REFLECTION: ELDER ABUSE

"Patient, female, 82 years old, presenting with shoulder pain after a fall. She walks with the help of supervision and is accompanied by her daughter. The patient said she lived alone, but her daughter helped her with some daily activities. From her appearance, she looked fragile. His clothes are not clean and dirt can be seen under his nails, making it understood that it was due to a fall at home. During the physical evaluation, the patient remained relatively still, without making eye contact or speaking. On clinical/physical evaluation, she had some areas of redness and bruising on her upper extremities and trunk. When asked about the bruises, the daughter repeated that her mother was a little unstable and prone to falls. The daughter also said that her mother is well taken care of and has never fallen before. She also takes care of her family, including three children, and works as a full-time teacher."

"This scenario describes a possible case of abuse. Although after a fall at home, the patient's appearance is expected. In this case, the daughter seemed to be taking care of her mother and the Nursing did not find anything unusual. The elderly patient's poor health may have been the cause of her fall, but it may also be related to chronic neglect, leading to malnutrition and dehydration."

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FAMILY INTEGRATION IMPACT ON THE LEARNING OF SEVENTH GRADE STUDENTS[1]

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ABSTRACT

The objective of the research work was to analyze family integration and its impact on the learning of students in the seventh year of elementary school, the methodology was framed from the inductive-deductive, analytical, synthetic, historical-logical methods with a descriptive, qualitative-quantitative approach, the techniques used were student surveys, interview with the tutor teacher and interview with the director, it was tabulated in the SPCS 29 and a level of reliability of the instrument according to Cronbach's Alpha at 0.83 was obtained. One of the most relevant conclusions was that there is a considerable percentage of children who are affected by the lack of integration in their homes and it is concluded that the integration of students into their family nucleus is always reflected in their school performance, behavior, grades, mode of socialization and psychological behavior in group and family behaviors. What was evidenced is that the impact of family integration and its incidence on the learning of elementary school students are key to the harmonious development in meaningful learning and in the integral development of each student.

Keywords: Integration. Family. Education. Learning. Harmonious development.

[1] Contribution of the Montubian tradition to the socio-cultural, economic, agricultural, livestock, food, hospitality and tourism development of the Sucre - San Vicente community and the Bolivar canton.

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INTRODUCTION

Family integration influence on children must have in their family environment are the fundamental basis for their academic performance and learning, since a child who has a good relationship with his or her family environment is a stimulated child, a child who has a favorable family reception will always have more academic performance. The family integration that they must have in their environment is very important; Thus, as an example, a child who is going through processes of separation from the family nucleus or losses, needs more attention and greater welcome from the educational environment.

This research work will be carried out at the Eidan Abel Erique Cercado Educational Unit in the 2023-2024 school year of "San Vicente canton, which is located in the north center of the province of Manabí, its extension of 715 km² (33 km² urban area and 682 km² rural area)" (San Vicente, 2023), the San Vicente canton has made many advances in the educational field, such as

The authors say that "the National University of Education UNAE, in the Support Center in San Vicente Manabí, becomes a new conception for the formation of citizens committed to society, based on conceptual axes of a pedagogical model that proposes challenges in education, based on processes of relationship with respect to legal, conceptual, psychological, sociological that focus on the human being and on its integral development" (Jácome & Ros. 2019, p.2)"

It was carried out in a structured research through field observation, interviews and surveys and several problems were identified in this sense, it is general knowledge that the Educational Units are not alien to this problem, which according to scientific studies affects educational performance.

From the point of view (Briones. 2021) "students who have regular and low grades. They are presented incorrectly in family relationships, discipline style, communication, and socio-affective formation of parents, inappropriately influencing students' school performance. (P.5)

That is why the impact of family integration on the learning and school performance of students in the seventh grade of the Eidan Abel Erique Cercado Educational Unit is defined as a central problem. The objective of this research work is to analyze the impact of family integration and its incidence on the learning of students in the seventh grade of the Eidan Abel Erique Cercado Educational Unit, San Vicente 2023.

For Lahoz. (2010). It indicates that the family environment is the set of relationships that are established between family members who share the same space. Each family lives and participates in these relationships in a particular way, hence each one develops its own

peculiarities that differentiate it from other families. The family environment, whatever the family is like, has very important educational and affective functions, since it is based on the premise that parents have a great influence on the behavior of their children and that this behavior is learned within the family.

This differentiates this from other families that have a positive and constructive family environment that favors the adequate and happy development of the child, and on the other hand, other families do not live interpersonal relationships correctly in a loving way, which causes the child not to acquire the best role model from his parents or to have important affective deficiencies (Luzvike, 2018, p.17).

In addition, to be able to analyze the theoretical approaches on family integration and learning in order to diagnose the current situation on family integration in children through a field study and thus determine the impact of the family situation on the educational performance of the students under study

In this way, it is necessary to study the behavior of children around their school performance, most children have difficulties at home which have an impact on their school performance, therefore it is important to know what is the situation of family union of students in their homes?, recognizing in the first instance what is the educational performance of students in their learning process? Then, it is transferred to a deeper level by knowing what relationship exists between students with family integration/disintegration and optimal/deficient educational performance?

> "The key era that redefined the family-school construct was 1980, when the way in which the family participates or can participate in school was emphasized. There was a shift to a more dynamic one of shared responsibilities, with an emphasis on the partnership between the family and the school." (Waidelich, 20219, p.13)

This work is part of the research line relevant methods were used to carry it out such as the correlational descriptive method, methods in the theoretical, analytical-synthetic order, methods in the practical order, so it is of vital importance to analyze them in the appropriate way.

The current research was carried out with the purpose of knowing the current situation of the repercussions that integration with the family has on the academic development of the children of the aforementioned Educational Unit, this study serves as a basis for educational entities to take this study as a reference to learn about adverse situations that are occurring and that deserve attention.

As a priority aspect, this research seeks to provide alternative solutions within the scope of the relevant authorities and the educational community, especially parents and

teachers, which allows to strengthen and strengthen the family ties of children and eradicate any type of negative impact on the motivation, communication, performance and general development of the students.

The beneficiaries of the current research work are: mainly, the children who are the subjects of the research, since knowing the problem helps to find solutions for their well-being; second, teachers because knowing the causes that lead children to act in a way will allow them to help them improve this problem and the learning environment; third, the directors of the institution, through this investigation and obtaining the results that it yields, helps them to know the causes and thus be able to use the appropriate techniques and tools to seek feasible solutions with the relevant entities such as the Department of Student Counseling (DECE); fourth, parents, since this research helps them to know the repercussions that family integration has on the lives of their children and academic performance, allowing them to contribute to becoming aware of this problem.

> Based on the LOEI in Article 13, it establishes that promoting an adequate learning environment at home or organizing places dedicated to teaching, recreation and leisure, is considered as a formal system that obliges the consanguineous role to maintain a good use of rest, adequate orientations, spaces for learning at all times framed with the respective actions that the schooling of the students has (Organic Law of Intercultural Education of Ecuador. (2011, p.24)

It is of vital importance what the LOEI states, that harmonious places must be fostered that enable the student a safe learning climate where he can be the protagonist of his learning and give reason for what he learns in the various social, educational, and family scenarios. Only in this way will family and school integration make their training a productive entity of what they know and do, experienced what they learn.

A home for children should be a safe place, of peace and tranquility, where there are values instilled by the example of their parents, with the school being the first to form them as integral human beings. When this does not happen, and children grow up in conflictive families where the environment in which they develop is not correct, they acquire these aggressive and inappropriate behaviors at school, reflecting what their family life is like, and that they do not contribute positively to their educational training process. (Silva, 2023, p.18)

Today it is difficult to find references that convince children, because the values of integrity, respect and honesty have been lost, because experiences are adverse to words, that is, there is no congruence with what is said and done, therefore there is a dichotomy of the word and the praxis, therefore, in the face of this ambiguity, children lose sight of what true holistic education is.

In this sense, it is general knowledge that the Educational Units are not oblivious to this problem, which according to scientific studies affects educational performance, in this regard it is known that "students who have regular and low grades. They are presented incorrectly in family relationships, discipline style, communication, and socio-affective formation of parents, inappropriately influencing students' school performance," (Briones, 2021, p.5)

Good family relationships should be the basis of every child and developing in a good family environment should be a priority, since the future of the child will depend on this, and it will be reflected in the activities of daily life both in school and social environments.

> The family role reflects an important role in the education of students, since it transmits values, principles and emotions, which allow the student to develop in the educational environment, the objective of the inquiry was to analyze the influence of parents in the teaching-learning process in the formation of their children, considering that it is a necessary issue for the educational community. therefore, the research was carried out based on a qualitative approach using the inductive-deductive method, decomposing the problem from the particular to the general, using bibliographic analysis to support the experiences in teaching. In addition, among the most relevant results, there was evidence of a limited impact that the home has on school life, through multiple factors such as time, level of preparation or available resources, whether economic or material, which hinder and cause the inadequate intervention of parents in education. (Karina, 2020, p.2)

It is of utmost importance to know the contribution of this study since it serves as a basis for more research to be carried out in educational institutions regarding the topic investigated, which will serve future young people, in order to know the causes and possible solutions to this problem.

METHODOLOGY

The methods used in the research were: quantitative and qualitative descriptive, deductive, historical inductive, analytical – synthetic historical – logical the type of research was descriptive the techniques used were student surveys, interview with the tutor teacher and interview with the director

Interview: it was applied to the directors and tutors of the school to know how much they know about the issue of family integration and the repercussions they have on their environment are of vital importance to know how to strengthen family ties that are closely related to performance and on cases already identified. The survey was applied to the 7th grade students to know the behavior of the children within the educational environment.

Survey: then a survey is applied to the students of the 7th. year of basic education, since they are the last levels of basic secondary education, to know what are the

repercussions that their family environment has on their educational performance and learning. Research instrument: questionnaire. The information obtained from this survey will be tabulated in SPSS 27.V to 27 to obtain its reliability, statistical tables and graphs.

Population was the Basic School of the Eidan Abel Erique Cercado Educational Unit, San Vicente 2023. From which a sample of 30 children from the 7th. year of Basic General Education of the aforementioned institution.

RESULTS

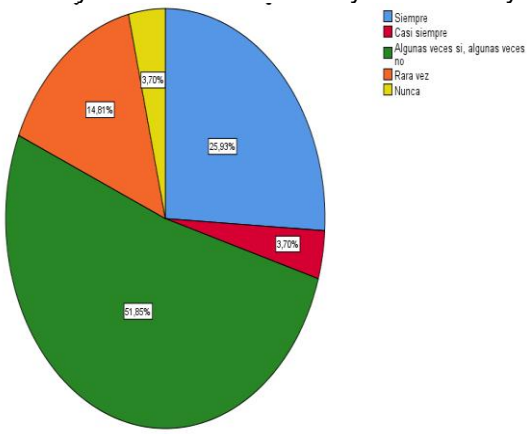
Table 1 - *Instrument reliability*

Cronbach's alpha	N of elements
,835	7

Background: Children and directors of the Eidan Abel Enrique Cercado Educational Unit, San Vicente.
Source: the authors.

The reliability analysis through Crombach's Alpha shows a statistic of 0.825 which is good, therefore, the research instrument is reliable allowing to measure what was intended in the survey. The data obtained were tabulated in the SPSS statistic, which shows that it is good, therefore, this indicates that the instrument used (the questionnaire) was carried out correctly and the research through the questions was well formulated.

Figure 1 - Do you do your homework with any member of your family?

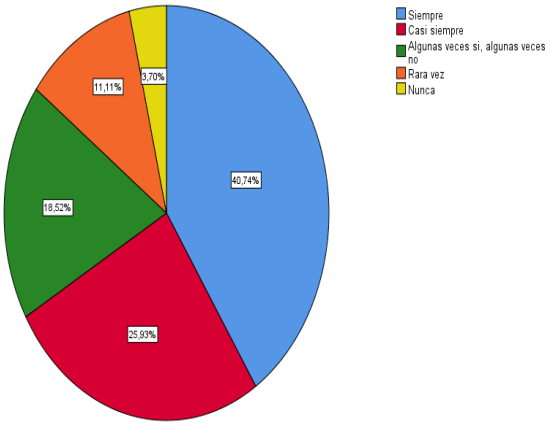


Sources: Children from the Eidan Abel Enrique Cercado Educational Unit, San Vicente. Source: the authors

The results showed that 25.93% of the students do have accompaniment in the performance of their duties; Likewise, 3.70% state that they almost always support them in carrying out extra-class activities. In contrast, there are 51.85% of students who sometimes help them and sometimes do not, which reflects a little guidance and commitment from parents; Also, 14.81% of them mentioned that they rarely have tutoring from their parents in homework; and finally, 3.70% said that they are never guided by their parents and perform only their homework. This showed that most

students are not guided by their parents in carrying out their homework or in reviewing them, leaving all academic responsibility to teachers.

Figure 2 - When there are problems at home, do you feel like doing homework or work in the educational field?

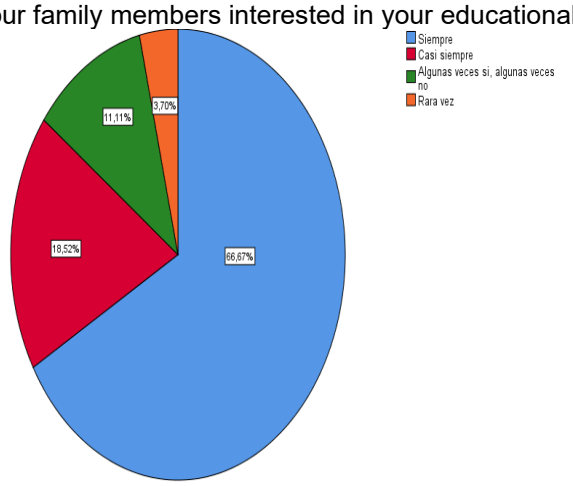


Sources: Children from the Eidan Abel Enrique Cercado Educational Unit, San Vicente. Winemaking: Own

It was evidenced that 40.74% always have the intention of doing their homework and a percentage of 25.93% allege that they almost always have the intention of doing the work sent by their teacher, this is a higher percentage of students who do not have affectations with carrying out their activities normally when there are inconveniences within the family nucleus, however, 18.52% show that it affects them sometimes yes and sometimes not when there are inconveniences at home, also 11.11% rarely feel like doing their homework due to the conflicts they live within their home, and finally 3.70% maintain that they never want to do the assigned tasks due to the inconveniences and their low mood after a member of their family nucleus has conflicts between them. they.

What showed that most of the students do not have impairments is their school performance, however there is a percentage that does have impairments and this is reflected in their academic performance and grades.

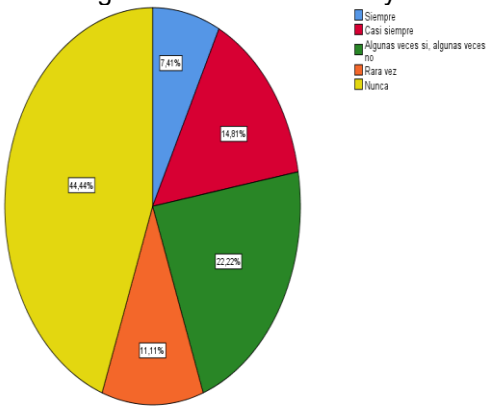
Figure 3 - Are your family members interested in your educational activities?



Sources: Children from the Eidan Abel Enrique Cercado Educational Unit, San Vicente. Source: the authors

It was found in 66.67% that they always have a member of the family nucleus who helps them to carry out educational activities, 18.52% maintain that almost always someone guides them in the tasks assigned to the home, this is a higher percentage in which parents show interest and commitment to their children, a lower percentage of 11.11% allege that sometimes yes and sometimes not a family member helps them to carry out the tasks assigned to them. school work and 3.70% say that they rarely help them in their educational tasks reflecting a minimum and interest in their represented. This shows that most students are motivated by their parents in their school activities, and there is also a small group that lacks this motivation and stimulation.

Figure 4 - Do you think that arguments at home affect your school performance?

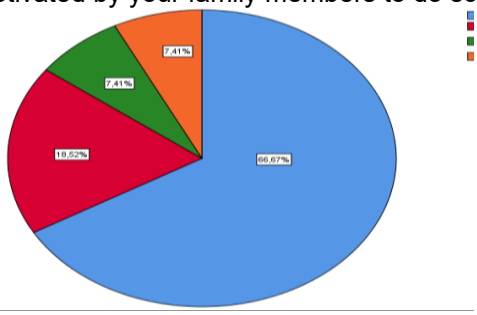


Sources: Children from the Eidan Abel Enrique Cercado Educational Unit, San Vicente. Source: the Authos

According to the results, it shows that a smaller percentage of 7.41% that it always affects them when there are arguments within the family nucleus, likewise 14.81% refer that it almost always affects them when there are this type of inconveniences, in contrast to these answers 22.22% say that sometimes they are

affected by arguments within the home in their school performance, also 11.11% are rarely affected, and a higher percentage of 44.44% are never affected in their school performance by discussions within the family nucleus. This concludes that most students are not affected when there are discussions at home in their academic performance.

Figure 5 - Are you motivated by your family members to do school activities?



Sources: Children from the Eidan Abel Enrique Cercado Educational Unit, San Vicente. Source: the authors

66.67% stated that they are always motivated by members of their family, likewise 18.52% are almost always motivated by their families to carry out their educational activities, in contrast to this a percentage of 7.41% maintain that sometimes yes and sometimes not their family members motivate them to carry out their assigned activities for the house, and finally, 7.41% rarely receive this type of motivation from members of the family nucleus.

This shows that most students are guided and motivated by their parents in carrying out their homework or in reviewing them, and a smaller percentage do not do so, leaving all the academic responsibility to the students themselves.

SYSTEMATIZATION OF THE RESULTS OF THE INTERVIEW WITH THE TEACHER-TUTOR-DIRECTORS

How do you consider the situation of family unity of students in their homes?

Analysis:

The teacher of the seventh year of basic education emphasizes the relationships that parents have with children, which are mostly dysfunctional homes in which only one member of the nuclear family (mother or father) takes care of the needs and activities of the children, inside and outside the educational area.

How important do you think family integration should be in the children's learning process?

Analysis:

The teacher maintains that it is a factor of great relevance and importance since the child's self-esteem and in many cases their behavior depend on it, and this in turn has an impact on school activities and their performance.

What type of workshops do you carry out as a teacher of the institution to promote family-student-school integration?

The teacher states that in the institution workshops are held such as the one on educating in the family, but most of the parents who attend these activities of the workshops are the parents who are always present in the academic activities of their children and these are the children who have a good academic performance and good behavior, But children who have learning and behavior problems are children who are always alone, that is, their parents do not let them pick them up from school or attend the activities of the workshops, and this makes their learning process very difficult.

Do you consider that the integration that children have in their homes with their families has an impact on their school performance?

The teacher states that children who have low academic performance are children who have homes in which they only live with mom and dad and they in turn have other partners and do not worry at all about their children, their educational activities or their school progress.

Do you consider that the children are living in a favorable environment to be able to have a good educational performance?

The teacher expresses her concern and helplessness to know that there are children who do not have enough care or affection from the members that make up their family nucleus and this does not allow them to grow in the academic field, since they are children with low self-esteem and most of the time they are sad. or they manifest their situation in a negative and aggressive way with the classmates around them.

RESULT OF INTERVIEW WITH DIRECTOR OF THE INSTITUTION

What is the situation of family unity of students in their homes?

The director of the institution alleges that the largest percentage of students in the 7th year of basic education live in dysfunctional homes and have many problems in the field of learning and behavior.

What is the educational performance of students in their learning process?

The director of the institution affirms that most students have problems in their academic performance and this affects their learning.

What is the relationship between students with family integration/disintegration and optimal/poor educational performance?

The director maintains that students who have a good integration with their family members and at the same time feel motivated reflect optimal performance in school activities and excellent academic performance, quite the opposite of those who live in situations of abandonment and dysfunctional homes that present low academic performance and unfavorable behavior.

How important do you think family integration should be in the children's learning process?

The highest authority of the educational institution refers that the integration that students have with their homes is of vital importance since this will allow them to be calm and feel motivated in their academic progress since a student who feels the support of his family is a happy student and therefore will be a student who has a good school performance.

What type of workshops do you carry out as the highest authority of the institution to promote family-student-school integration?

The director refers to the programs they have within the educational area of the institution, where there are workshops that are taught and it is about children having more confidence in saying their emotions, in which they also work with playful workshops where children can share the activities with their parents.

DISCUSSION

After having compared the results of several research, the following results were found that helped to deepen the research, so it was possible to verify that, (Jiménez et al., 2023, p. 1) in the article importance of parents in the teaching-learning process of students in Ecuador, they say that parents play an important role in the education of infants and are an indispensable complement to formal institutional education. However, there are problems in the accompaniment, which, if not treated in time, could be negative and detrimental to the development of the child. The results showed that there is not an optimal level of family integration in all the homes of the students subject to the research, despite this situation most of the students carry out and fulfill their school tasks. but there is a smaller part of the students, but no less important, that has affected their school performance.

Within the formative context, values enter, as they say (Villacis et al, 2023.p.2) with the research work on People, Ethnicity and Culture: An approach to the multicultural environment of Ecuador, in which they emphasize that the values of multiculturalism, as a cultural process, is a challenge for the new generations based on their autonomy and identity from the reality of each ethnic group, respecting their cultural, social, and religious expressions. Values are the basis of the formation in students, they are what allow the child to acquire an evaluative academic training where what he knows and does leads him to grow in being as a person, only in this way will new leaders be formed to help the good life .

UNESCO (2023, p.1) states that education is one of the most powerful tools to lift marginalized children and adults out of poverty, as well as a catalyst to guarantee other fundamental human rights. It is the most sustainable investment. The right to quality education is inextricably linked to the Declaration of Human Rights and many other international normative instruments, which are the result of the joint work of UNESCO and the United Nations. Therefore, family integration is the basis of the emotional stability of children and adolescents so that they can perform adequately in any area of their lives, in particular school education, in this sense the United Nations (UN) in particular its dependent body Union for Scientific and Cultural Affairs (UNESCO) determines that one of the universal rights of children, girls and adolescents is the right to education that must be guaranteed by their parents as the main responsible, determining that primary education is compulsory and free, in this regard they ratify that: With which it is established that parents are primarily responsible for the educational development of their children and therefore have the obligation to promote the appropriate conditions, and their emotional stability for the well-being of children.

In the work of (Villacis et al., 2020, p.298) entitled Learning styles in students of the Eloy Alfaro Lay University of Manabí, Ecuador, they state that In this sense, the preparation and updating of the teacher in the field of didactics plays a fundamental role, since it will allow them to discover their own learning style, they will become aware of their cognitive processes, it will broaden its conceptual, methodological and mainly didactic horizons, thereby supporting its students in order to achieve the training of integral and successful professionals. In this regard, comprehensive training is an important element to take into account in the learning style, as it is a continuous, permanent and participatory process, which seeks to harmoniously and coherently develop each and every one of the dimensions of the human being: ethical, spiritual, cognitive, effective, communicative, aesthetic, corporal and socio-political, in order to achieve the full realization of the person as an active part of society. Throughout their educational and training performance, teachers have implemented tactics and techniques to be able to develop the appropriate way to reach the student and ensure that he, in turn, develops under his own learning parameters and in accordance with other fundamental factors, being people who are an active part of society, providing knowledge and positive actions.

CONCLUSIONS

The results showed that most of the students does not have effects on their school performance, however, there is a percentage that do have effects and this is reflected in their academic performance and grades. which can be concluded that it is necessary to work together with parents with new pedagogical tools, technologies and contents that help both school performance and the integration of families, that is, as a school for parents and children, counteracting the most affected part such as the students who are the ones who receive the most problems discussions at home in their school performance.

Another of the most preponderant elements was that a not so high percentage of students are not guided and motivated by their parents in the performance of their tasks, leaving all the academic responsibility to the students themselves without any type of accompaniment. which exacerbates learning by creating a strong family disintegration gap, which does not help to create spaces for dialogue both with families and in school classrooms.

According to the results of the interview with the tutor teacher of the seventh year of basic education, it was possible to confirm that the parents with the children, who are mostly dysfunctional homes in which only one member of the family nucleus (mother or father) takes care of the needs and activities of the children, inside and outside the

educational area, are reflected in their academic performance, in their behavior and their grades. And in his aggressive behavior that does not help a comprehensive formation

The director refers to the programs they have within the educational area of the institution, where there are workshops that are taught and it is about children having more confidence in saying their emotions, in which they also work with playful workshops where children can share the activities with their parents, this in turn increases their self-esteem and is reflected favorably in their educational activities. Therefore, it is necessary to analyze the curricular content and the training of parents.

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"SMART CITY" & BRIGHT AND OPAQUE TERRITORIES IN SALVADOR

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ABSTRACT

This study sought to analyze, in light of Milton Santos' contributions, how technologies can contribute to the knowledge of the geographic dynamics of the city of Salvador-BA and its Opaque Territories, targets for investment through the construction of public policies based on the use of Information and Communication Technologies - ICTs. It also sought to reflect on how these technologies can contribute to the territorialization of cities that decide to enter the transformation process toward the condition of a "Smart City".

Keywords: Information and Communication Technologies - ICTs. Luminous and Opaque Territories. Territorialization. Construction of Public Policies. Framework. Smart City. Ranking of Smart Cities. Right to the City. Culture.

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INTRODUCTION

What idea of the world would be constructed by a person who had always lived in the same city, after taking a trip to a megalopolis where he would discover the existence of an infinity of new things? What existing concepts would be able to explain, as closely as possible to reality, this life experience? This is one of the challenges of Literature in the process of forming civilizations, to translate and transmit such experiences that directly reflect on the constituted forms of culture, influencing new customs, new forms of organization, and finally, through technology[3], new ways of life. It is in this context that concepts existing in a given civilization acquire substance through a historical formulation, which Williams characterizes as historical consciousness, which can be observed through the following definition of the concept of Literature:

> Literature can be understood as a situation of reading, being able to read, and having read until reaching the stage of an ideological concept of "full, central and immediate human experience". Literature develops together with the arts and philosophy until the emergence of Literature, or national Literature, which brings all the possibility of cultural transfer, of values, and the language of a people, a nation. (WILLIAMS, 1979 p.16)

The construction of this historical consciousness can be evidenced in the constitution of Literature pointed out by GOMES (1999), increasingly global and less local, as it is the result of a cultural process that involves global interactions between subjects who come and go to cities, constructing a panorama of narratives (often the result of empirical observations) in their life experiences. The city's inhabitant/user can be considered the main agent that traverses this panorama of narratives and discourses that ultimately shape a "new" or digital city. Digital in the sense of portraying the personal impressions of each agent, as if each one, when interacting with the city and its centers, left their empirical and personal impressions there, thus constituting what I will call "Digital Cities". The Digital City is the result of the construction of narratives about the city, these narratives are a consequence of technological development that has intensified the circulation of information, people, and capital in the territory (in the cities), they constitute discourses about the "ideal city". The notion of "Smart Cities" emerges as a new panorama of discourses that at a given moment claims to be aware of these narratives, but what we have observed is that the use of Information and Communication Technologies - ICTs existing in the territory is not being employed to understand this "Digital City". When we propose to bring the "digital city" (the result of technological development) into the field of

[3] Technology in its historical and cultural dimension in its relationship with the city, with industry and with the prospect of citizenship.

discussion on the notion of "Smart Cities", highlighting the existence of discursive disputes, we work with the perspective of Citizenship as a factor that allows these "cities/discourses" to recognize each other, and it is in this sense that we approach ICTs, as fundamental tools for understanding the dynamics of space, contributing to the formulation and review/reaffirmation of public policies.

According to GOMES (1999), Literature has become deterritorialized due to this new dynamic of global interactions, and cities have gained a greater force of interest, "the city is the City and no longer belongs to the country, no one knows where it begins and where it ends because it loses its metropolis[4], ceases to be a theme and becomes a problem" (GOMES, 1999). This can be observed in narratives about the urban phenomenon of megalopolises and in the manifestations of artistic movements that discuss the city, such as exhibitions, and in other discussion themes that enable knowledge of narratives about the city, such as those of UN-HABITAT.

The entire possibility of transferring culture (values, language of a people or a nation) is strongly intensified with this new dynamic of migration. Many people go to cities and return bringing with them questions and answers. Many forces oppose the culture of here and the culture of there. This dynamism is a consequence of technological advances, involving means of transport, information, and communication, which substantially intensified global interactions and an entire flow of culture, Arjun Appadurai (1994) describes in an enlightening way when he observes that cities/metropolises are in constant interaction and that in this process the forces of these cities are influenced by each other, where the result of this process is the constant emergence of indigenized forces. This new territorial dynamic that we have just observed through the lens of Literature is strongly characterized by an ever-increasing speed of circulation of information, people, goods, and capital, and inaugurates a new way of being and existing in the territory resulting from an n a period of intense technological transformations, exemplifying what Milton Santos (1996) called the technical-scientific-informational environment, consisting of informational objects that unite technique and science under the action of a globalized market, and ultimately, being the geographical representation of Globalization.

> In this period, technical objects tend to be both technical and informational, since, thanks to the extreme intentionality of their production and location, they already emerge as information; and, in fact, the main energy of their functioning is also information. Today, when we refer to the geographical manifestations resulting from new advances, we are no longer talking about a technical environment. We are faced with the production of something new, which we are calling the technical-scientific-informational environment. SANTOS (1996, p. 159)

[4] The term indicates a definition of measurement. When applied to the city, it refers to the ability to identify the expansion of its cultural boundaries and the growth of its geopolitical importance.

The basis for the construction of public policies based on the use of ICTs, necessary to introduce the notion of a “Smart City” in a city, is the technical-scientific-informational means when perceived through the identification of Luminous and Opaque Territories. Likewise, the Framework[5] is the basis of the corporate architecture used to build ICT models aimed at evaluating and directing management efforts and investments in “Smart City”, and may even, according to its configuration, directly influence the constitution of these Luminous and Opaque Territories.

BRIGHT AND OPAQUE TERRITORIES IN SALVADOR-BA

According to Milton Santos (1996), the density of information and knowledge of the territory constitutes a criterion of spatial selectivity for making investments and setting up companies, while areas that do not have this advantage have a lower potential for attracting investments and concentrating investments through the setting up of companies with lower competitive potential “And within the "known" areas themselves, companies will distinguish themselves by their greater or lesser capacity to use information” SANTOS (2006, p. 163). Based on this spatial selectivity on the part of companies and capital, as pointed out by Milton Santos, territorial portions endowed with information “compete advantageously with those that do not have it” (SANTOS, 1996, p. 194, apud ETGES, 2014).

Territories that accumulate technical and informational densities and consequently the capacity to attract investments are called Luminous Territories, while territories lacking these characteristics are called Opaque Territories.

> In general, it can be said that portions of the territory thus equipped offer greater possibilities of success than other areas equally endowed from a natural point of view, but that do not have these knowledge resources. Imagining two regions with the same physical potentialities, the one better equipped scientifically will be able to offer a better relationship between investment and product, thanks to the just-in-time use of material and human resources. In a region lacking the means to know in advance the movements of nature, the mobilization of the same technical, scientific, financial, and organizational resources will obtain a comparatively more mediocre response. SANTOS (2006, p. 162)

Geographic space and all its dynamics exist independently of the subject's observation; however, for territorial development, the lack of observation of this dynamic and the density of information and knowledge present in the territory makes it impossible to identify both the potential for development and attraction of economic activities, capital, technologies and organization, and the lack of these characteristics. Under these

[5] According to Fayad and Schmidt (1997), a framework is a set of classes that collaborate to fulfill a responsibility for a domain of an application subsystem. We have dedicated a specific section in this article to better exemplify the concept.

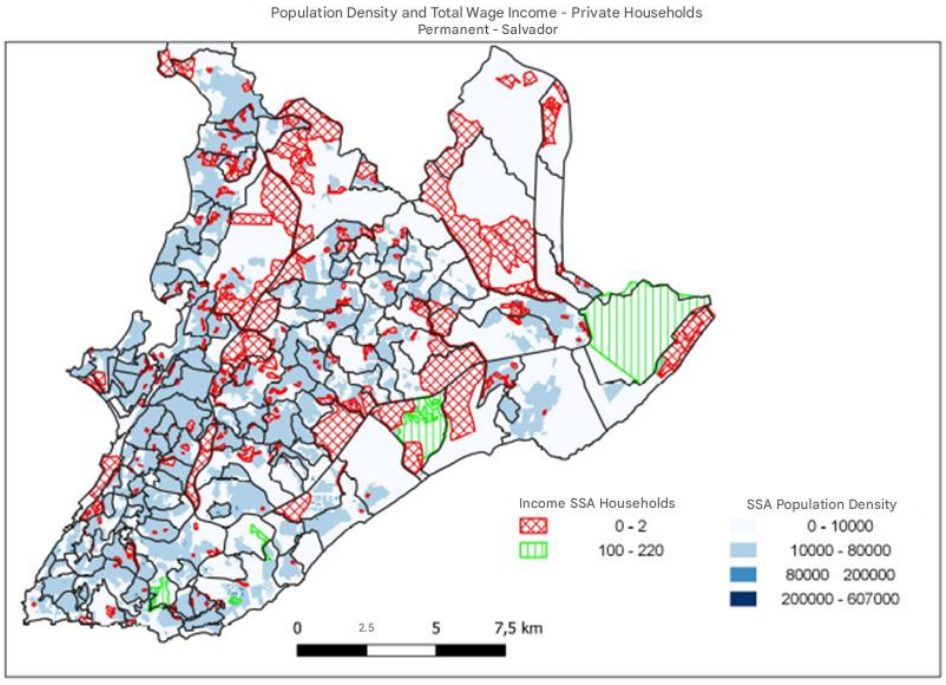
conditions, territorial development becomes an empirical activity whose consequences are unpredictable.

The dynamism provoked by the countless and incessant technological revolutions has led to the emergence of technologies responsible for significant transformations in the representation of space, making it possible to project a certain light on space, deepening the observation of certain densities of information and knowledge of the territory in a space-time that is increasingly closer to the moment in which the facts are realized in our daily lives when we are and exist in cities. These observations of the reality of the territory, increasingly closer to the present day through geographic representations and references, are fundamental tools for the planning and management processes of cities.

As an example of this important change, we highlight a set of three maps of the city of Salvador - BA and its neighborhoods, a geographic representation of the space characterized by areas classified according to population density and income of permanent households, important geographic indicators for identifying Luminous and Opaque Territories.

For the analysis we intend to carry out, we identified in Salvador the low-density and low-income, marked in red on Map 1, as areas made up of opaque territories that are subject to investment through the construction and application of public policies based on the use of ICTs. Such policies would be directed toward understanding the dynamics of these territories, expanding the investment capacity, and attracting and developing existing economic activities.

Map 1 - Very High and Low Income & Population Density - 2010



Source: IBGE, 2010 - Prepared by: Luis Claudio Rios

Map 1 shows a concentration of the highest and lowest incomes in the city of Salvador/Ba in pockets made up of low population density areas and consequently extremely disproportionate potential for consumption and generation of tax revenues, fees, and tributes.

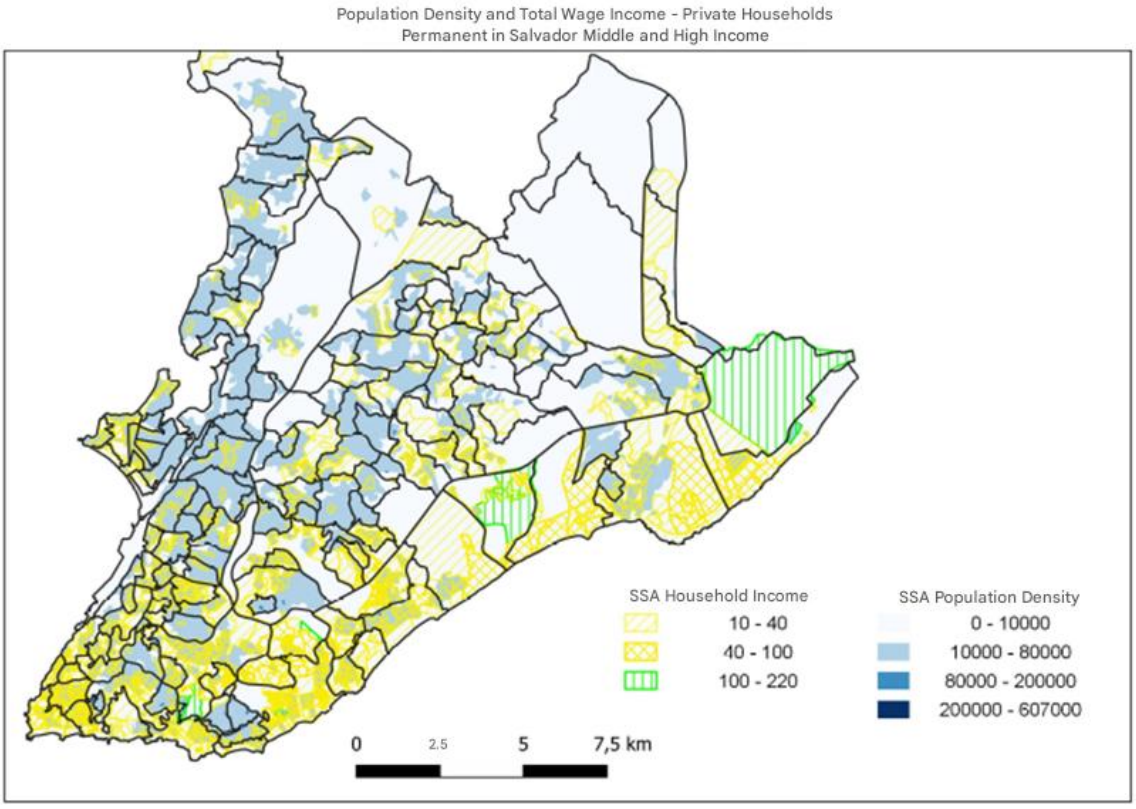
Representing this reality is extremely important for territorial planning. Firms that can understand the dynamics of the territory, basically consisting of the way of being and living in the city, are those that make the most use of Geotechnologies with databases created through the use of ICTs.

The areas marked with green lines concentrate the households with the highest income in the city, and the areas in red constitute the areas with the lowest income households. In blue, we see the population density and its urban agglomerations. Income represents, through informational means, all the consumption potential that exerts a force of attraction and direction of investments. Firms tend to set up or trade products and services in the areas of the city according to the way individuals act. Thus, a neighborhood that predominantly concentrates on high income will be the object of desire for firms seeking high profits, and the neighborhood that has a concentration of lower income will be exploited by less powerful firms, with a low potential for identifying informational objects, and ultimately, low competitive potential.

> It is possible to imagine that such spatial and socioeconomic selectivity leads to rapid changes in the territorial division of labor, with the most technically and financially gifted firms tending to seek a location where the potential profit will be greater, leaving the rest of the territory, even with similar natural potentialities, to less powerful firms. SANTOS (2006, p. 163)

It is based on this reflection that we refer to the Luminosity of the city and its territorial portions, characterized by knowledge of the dynamics of cultural transformations that in themselves encompass all the demands for attracting capital and/or public policies. Opacity can be considered as the lack of all these dynamics to which this article refers. Therefore, in this first map, we have contrasts certainly highlighted by urbanization processes that occur depending on the scope of the vision of companies and government over the territory.

Map 2 - Upper-middle and very high income & population density - 2010

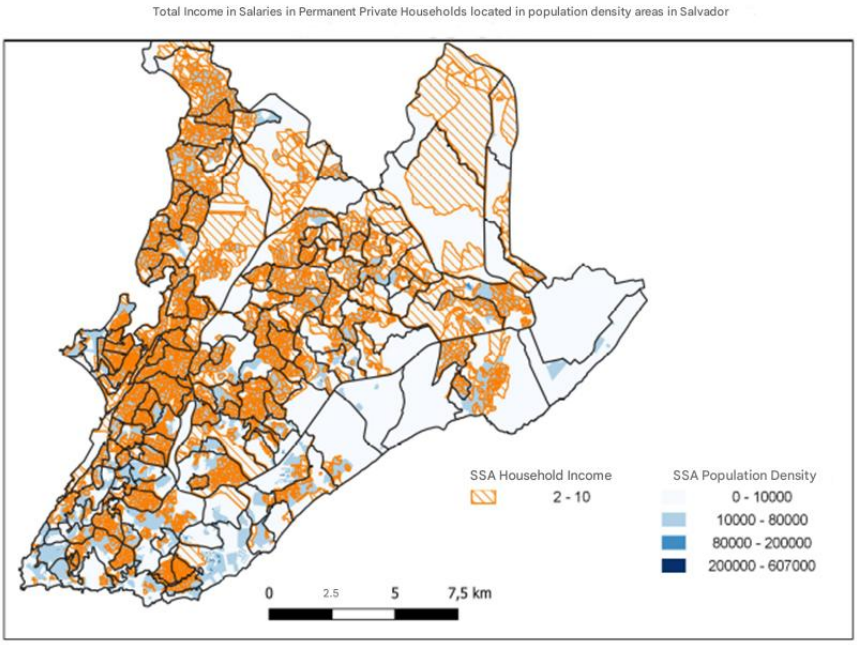


Source: IBGE, 2010 - Prepared by: Luis Claudio Rios

Analyzing Map 2, we observe that there is a concentration of upper-middle and very high-income households close to or in peripheral areas of pockets made up of medium and high-population density zones. This movement reinforces the concentration not only of consumption potential but also of tax collection, fees, and duties on the east coast and in the southeast region of the city of Salvador/Ba.

The use of Geotechnologies allows us to identify trends in the dynamics of geographic space when we have sources and databases that can be associated to construct information and geographic representations according to the criteria and interests of the observer, be it government or private initiative. Below, Map 3 shows how the concentration of households with an average of 2 to 10 salaries occurs predominantly in areas of high population density, where there are more people per household and a per capita income considerably lower than the income on the East Coast and Southeast region of the city, consisting of households with an income between 11 and 220 salaries in a density of no more than 10,000 people per census sector compared to, on average, 80,000 people per census sector in densely populated areas.

Map 3 - Middle and High Income & Population Density - 2010



Source: IBGE, 2010 - Prepared by: Luis Claudio Rios

Another important movement that we can observe is the constant concentration of demand for urban services in certain areas, a determining factor for the planning and execution of public services. Those with the greatest consumption potential are found in low-density population areas and, therefore, they constitute territorial portions with low demand for public services. These areas are less influenced by the factors of concentration and variation in demand for these services, compared to other areas with high urban density. This is a determining factor for the city's urban planning. How can municipal coffers be balanced in the face of the growing urbanization process that requires the expansion of the service network through public services? Where is this expansion headed and what is the response time needed for the citizenship perspective in public policies to continue to be put into practice, regardless of their territorial dynamics? So far, we have explored the potential of technologies that allow us to look at space at a given moment, seeing what the dynamics of the technical-scientific-informational environment were at the time the data were collected. The analysis of the geographic representations that we have just made through a set of maps presented in this study refers to a territorial dynamic observed through IBGE data from 2010, data that has not yet been updated. We have been looking at an old photo for almost 10 years and planning the territory, in some aspects, looking at this “yellowed photograph”. Something needs to be done so that this voracious dynamic of transformations in space-time can compose the development plans of the city and regions. In this sense, large corporations and technology companies have shown us the path towards shedding light on territories, identifying and exploring their potential, and

unfortunately disregarding the portions that lack the public policies necessary to achieve the initial conditions for development, in a movement that occurs in a space without borders for a capitalism without borders. What “Data Center” or “Supercomputer” will be made available to citizens, and consequently to the city, to address serious urban problems? What will provide us with more up-to-date, and why not say digital, pictures?

According to Milton Santos, this action of large companies “over the states” demonstrates the triumph of markets over government policies. In this context, market control has been appropriated by companies that have cutting-edge technologies.

> In this respect, business governs more than governments (E. Laszlo, 1992) and, with the globalization of technology and the economy, states appear as servants of multinational corporations (R. Petrella, 1989). Under these conditions, Warf (1989, p. 265) and C. A. Michalet (1993, p. 19) point out, that the state would no longer be necessary to manage international transformations. SANTOS (2006, p.164)

On the other hand, there is a movement in favor of the city and a more sustainable way of life. However, the conflicting relationship mentioned above persists in discussions and attempts to conceptualize what a “Smart City” would be, even though it is not a subject. The most recent movement of technological innovations aimed at the development of cities and their territories involves the adoption of ICTs that were developed in a business environment and that, because of this, often bring in their constitution, a business perspective devoid of a citizenship perspective. This is the point of obstacle to the development of the territory and management of cities in terms of the construction of plans and public policies based on the use of ICTs that we will address from this moment on, taking as a basis for observation the influence of an organizational architecture that composes both technological solutions and city ranking models every time the notion of “Smart City” is evoked to hierarchize the quality of municipal management. Now, if the city has lost its metropolis and gained cultural and geopolitical importance that goes beyond hierarchical relations with states, regions, and countries, we must think of a way to hierarchize such cities under the subordination of certain hegemonic power centers. We will analyze this movement through Frameworks.

SMART CITY & FRAMEWORKS

Companies, governments, and the academic community come to the narratives[6] of Cities in order to reinforce already established[7] ties that make it possible to mitigate the negative impacts of the urban phenomenon. In this context, the perspective of a notion of a smart city or "Smart City" emerges.

In 1999, GOMES observed the emergence of a deterritorialized Literature that was more global than local and, in a certain way, what we will call the emancipation of cities to a scale of importance that goes beyond the scales of the region and/or country in which it is "inserted", Arun Mahizhan published in an article entitled Smart Cities – The Singapore Case what can be considered as one of the first records of a notion of a smart city:

> The challenge of converting ignorant or skeptical spectators to new technologies is already great. But an even greater challenge is to put IT at the service of humanity instead of using it to subvert or destroy people's values and ways of life. As with nuclear energy, IT can be a force for good or evil. The smart community must be smart enough to make the right choice (MAHIZHNAN A.1999, p.18)

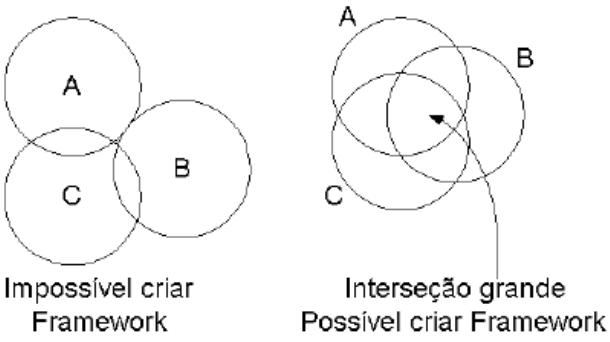
This conception of the notion of a Smart City is directly related to the existence of a smart community, in this sense, intelligence is found in people who have discernment in establishing the use of technology as a cultural process and product, another striking feature is the orientation to put Information and Communication Technologies - ICTs at the service of humanity. The same technology that can mitigate the negative impacts of urban phenomena can also destroy existing values and ways of life[8] in the city, or change them in a harmful way.

At a time when there was a question of the existence of awareness around the construction of relationships between ICTs as a basis for the construction of plans and projects for the execution of urban operations and the construction of public policies, the concept of Framework appeared to be a viable alternative to the production and development of these technologies applied to organizations, as we can see below: "A Framework is a set of classes that collaborate to perform a responsibility for a domain of an application subsystem". (FAYAD AND SCHMIDT, 1997, p.32)

In a software production process, the construction of the lines of programming code for a given process, common to the various subsystems, can be replaced by predefined forms of data and information processing to optimize development times and costs, in

[6] In 1996, the UN sponsored a meeting in Istanbul, Turkey, to discuss the problem of large cities around the world, "Habitat 2"
[7] 1987 - United Nations General Assembly, Our Common Future - Emergence of the concept of sustainability: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."
[8] Culture as "a whole way of life" (WILLIAMS, 1979).

addition to contributing to a standard for executing information processing. A Framework captures the functionality common to various applications. However, such applications must have something reasonably large in common, they must belong to the same problem domain. The figure below depicts this relationship in which an intersection between functions and processes is the main requirement for its application:



(FAYAD AND SCHMIDT, 1999)

This was the most common use of the framework concept inserted in the ICT development processes of technology companies as a tool that had as its main focus the reuse of programming code structures. When these technologies began to approach cities in their transformation processes towards a “smart city”, the framework, although it was already part of a very comprehensive dimension of business or enterprise planning and management known as Corporate Architecture[9], still maintained a limited role. It did not dictate the guidelines for urban planning nor did it define the paths that should be followed and the decisions that should be made by the municipal manager. This corporate culture we refer to, of a Corporate Architecture, reaches its point of maturity with the creation of the TOGAF framework[10], responsible for initiating, through an iterative process, a revolution in city management, or, as we prefer to call it, a process of cultural induction that

[9] Enterprise architecture (AO 1945: arquitectura empresarial), or corporate architecture (AO 1945: arquitectura corporativa), is the practice of applying a comprehensive and rigorous method to describe: a structure for an organizational process, present or future; Information Systems; Human Resources; Organizational Subunits, etc. all in order to align with an organization's primary goals and strategic directions. - all to align with an organization's core objectives and strategic directions.[1] Enterprise Architecture is considered a significant practice within the US Federal Government, as a means of addressing persistent disadvantages in IT investments. It can be understood as the organizing logic of business processes and Information Technology resources that reflects the integration and standardization requirements of a company's operating model. In this context, the work of the corporate architect can be compared to that of the urban planner. An urban planner is concerned with the general planning aspects of a city, while architects and engineers design and plan the buildings, respecting the defined urban project. In the same way, a corporate architect draws up the architecture of the organization, ordering its general elements (concepts, processes, systems, etc.) and then checking that the projects related to each element comply with the corporate architecture. Source: https://pt.wikipedia.org/wiki/Arquitetura_empresarial

[10] The Open Group Architecture Framework - Developed by the Open Group in 1995, in 2016 80% of Global 50 companies and 60% of Fortune 500 companies used the framework, which is free for organizations to use internally, but not for commercial purposes.

territorializes, reflecting at certain times aspects already known from a colonization process, and at other times, the natural and historical movement of technology as a tool for identifying and exploring luminous territories in cities, in some cases defining the territorial portions for investments by the public sphere as well. It is at this moment that the “corporate perspective” overrides the development plans and projects represented by public policies.

This reflection raises an important question when we observe the induction of a Corporate Culture in municipal management: How can we guarantee the promotion of the Right to the City when this corporate perspective becomes predominant as a prerequisite for making investments in the city and its urban centers, a financial return in the form of increased tax collection and/or generation of additional revenues from tourism and the exploitation of urban services? Which areas of the city, in conditions of lack of assistance, will have the “luminosity” necessary to attract these investments? These issues need to occupy more space in discussions not only among municipal managers but among all those who think about the city from the most diverse perspectives, beyond the notion of a “Smart City”[11].

CULTURE IN THE FRAMEWORK

A second notion of “Smart City” was developed by the technology company IBM ten years after Mahizhnan warned about the potential use of ICTs to subvert or destroy people’s values and ways of life. In 2009, the technology company IBM made the following statement:

> Becoming a “smarter city” is a journey, however, not an overnight transformation. Cities must prepare for change that will be revolutionary, rather than evolutionary, as they implement next-generation systems that work in entirely new ways. City governments must decide which activities are essential and, therefore, what they should shed, retain or expand. Not only that, cities must “build the team” – integrating their administrations and working with other levels of government, especially at the national level, as well as the private and non-profit sectors. Cities must also take into account the interrelationships between the systems on which they are based, as well as the interactions between the challenges they face (IBM, 2009, Apud Anderle, 2017, p.65).

For IBM (2009, apud ANDERLE, 2017), technology no longer seems to be the result of a cultural process of the territory in which it will be inserted, but rather the determining factor for a city to become intelligent. In this context, a Smart City does not exist without the corporate culture of IBM or other technology firms, and the intelligence that previously

[11] Lefebvre, when discussing the Right to the City, reports the same problem when he points out that there are systematized ideas or ideas in the process of being systematized that end up imprisoning human thought, preventing it from seeking new possibilities, new horizons.

emanated from a smart community (people and governments that experience the urban problems of the city), decisive for the adoption and development of new ICTs compatible with the territorial specificities of a city, is replaced by another that now arrives in the same city embedded in packages of technological solutions that put on the table of municipal administrators and managers decision-making models that encourage them to act according to pre-defined criteria that determine greater financial results for the city government, which, through the construction of new forms of articulation, begins to be administered through a corporate perspective, where the perspective of citizenship is not considered. The notions of “Smart City” developed by Mahizhnan A. (1999) and by IBM (2009, apud Anderle, 2017) certainly produced antagonistic discourses but associated with the notion of smart cities, which in turn, may have exerted an important influence on the construction of public policies based on the use and development of ICTs. This is where the process of inducing culture and territorialization comes in because if the frameworks determine the management models and strategic guidelines of a city hall, shaping its areas and sectors through new strategic guidelines, even if this process seeks synergy with the territorial specificities of the city and its urban centers, what comes after this, in the form of Smart Cities Ranking Models, means that the municipal management, often affected by the benefits of technology that improves the conditions of operation and execution of public services and gives an air of modernity to certain urban centers, is once again persuaded to continue adopting this business culture that dictates new guidelines so that the city hall remains in the ranking. This is the dynamic that we observe in the process of “evolution” of a city towards the condition of a Smart City from the perspective of a business culture, which disregards the participation of “cultural studies” in the process of building these alliances. If there is pressure from above that shapes institutions, influencing the processes of creating public policies, there is also resistance or re-existence that exerts opposing pressure from the lower classes. This always conflicting relationship between the culture that contributes to the city, endorsed by the Smart Cities ranking models, and the local culture that is always changing despite “re-existing”, is the driving force behind the dynamics of urban and social development in the times in which we live. From this perspective, both the culture from outside and the local culture shape the management structures of a city, influencing the creation of public policies through a fierce dispute over territory. In his work, Rogério Haesbaert addresses the dynamics of social relations inherent and intertwined in geographic space (redefined as space-time and time-space), pointing to this space not only as a fixed scale but as a stage and transforming agent for the formation of territorializations, deterritorializations, and re-deterritorializations.

> Here, not only space but, above all, territory matters – territory in a more concrete, practical sense and also, often, shaped "from the bottom up", based on the resistance of subaltern groups. This requires that we speak, before a spatial turn, of a territorial turn (HAESBAERT, 2021, p.59)

The relationship between experience or way of life and citizenship is present in many cultural movements in such a way that we need to look at the dynamics of the urban phenomenon that exists in cities, bringing a new approach not in search of an ideal or utopia, but of a resilience characterized by the constant capacity to construct solutions to resolve urban problems and conflicts. From this resilience, the city begins to be seen as the product of a certain historical context and no longer as an ideal model to be conceived by urban planners".

Understanding this historical context is fundamental to understanding the city "as a process and no longer as a rigid phenomenon". The conception of the real city is fundamental to identifying scales that allow us to perceive how the existing discourses around a notion of Smart Cities can be distant from urban reality to the point of not being able to produce solutions for the crises evidenced in the urban phenomenon.

The city as a process goes against the ideal and utopian forms of cities existing in the Smart Cities ranking models imported by city governments as technological solutions. Here we make a distinction between intelligence and technology. We often care about the latter, but we lack, due to certain feelings, the former, which is so necessary to discern the best use of ICTs that have great potential to support the construction of public policies. Kohlsdorf reaffirms the importance of using intelligence in city management when he states:

The city has become an entity observed in the light of reasoning that seeks to define problems within it and propose solutions for them, composing a movement to control urban processes. This characteristic has led urban planning to establish itself as an institution closely associated with public power and committed to it. (KOHLSDORF, 1985, p.34).

The city of today is real and irreversible, a product of cultural transformations that bring in its understanding of the historical substance pertinent to its definition, the same relationship of historicity brought by Williams (1979)[12] to Society, Economy, and Culture. Finally, the city comprises territories that produce a culture that is far from being imprisoned in imported computational and quantum models constructed under a generalist territorial perspective that is incapable of qualifying and quantifying the disputes and conflicts that exist in a territory, which in turn require more conscious management from the public manager, reflecting the following concern pointed out by Saquet:

[12] Marxism and Literature.

> Another concern is to support the development of a territorial approach that simultaneously considers the articulations/interactions that exist between the social dimensions of the territory in unity with each other and with nature external to man, the historical process, and the multi-scale nature of territorial dynamics. (SAQUET, 2013, p.13).

To understand the dimension of this conflicting relationship between cultures that clash and change in these disputes around these notions of Smart Cities, it is necessary to resort to the relationships observed by Haesbaert in his Decolonial Turn when he observes: It is important to emphasize that what is being referred to here as the (multi)territorial turn in Latin America demands the recognition of at least two major approaches: one more “top-down”, based on the numerous so-called territorial state policies and the broad business strategies of land exploitation (whether via “agribusiness” or via neo-extractivism of “natural resources”), and another more “bottom-up” in the forms of resistance – or rather, of r-existence – that configure struggles for territory based on the organization of subaltern groups. (HAESBAERT, 2021, p.60)

The power relations involving disputes over territory so well characterized by the (multi)territorial/de(s)colonial turn in Latin America allow us to see these relations of(s)colonies in the city and reflect on the fact that the discursive disputes around a notion of Smart Cities rest on the relations of (re)existence of urban centers, such as sacrificial, degraded and gentrified territories that seek in the Right to the City the construction of public policies that meet their needs and interests.

By establishing a cross-section of these territorial disputes involving these notions of Smart City, we hope to provide conceptual bases so that municipal managers and technicians involved in the processes of transforming cities into “smart cities” open the doors of their offices so that urban awareness or urban reality can come to occupy space in the processes of constructing public policies based on ICTs that identify and monitor the dynamics of the luminous and opaque territories that constitute the city in a space-time that is increasingly closer to reality, allowing the creation of ecosystems favorable to innovations in the urban and regional planning and development. In this sense, we emphasize the great importance of technologies and ICTs for understanding the dynamics of space, which should not be dissociated from a contribution of cultural studies for understanding the conflict relations existing in space in the form of disputes over territory.

Until this happens, we will continue to observe processes of territorialization constituted by a colonizing sense and the degradation of urban centers such as sacrificial territories.

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PEDAGOGICAL RESOURCES IN STORYTELLING FOR AUTISTIC CHILDREN IN EARLY CHILDHOOD EDUCATION

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ABSTRACT

This article presents the preliminary results of an ongoing research within the scope of the Graduate Program of the Professional Master's Degree in Inclusive Education. The study aims to investigate the influence of the use of pedagogical resources in storytelling as a strategy to promote the development of skills in autistic children in early childhood education, with emphasis on orality, reading, writing and social interaction. The research seeks to identify the most recurrent pedagogical resources in storytelling for autistic children, taking into account their specific needs and characteristics, and to analyze how this practice can favor understanding and interactions in the educational environment. The problem that guides the study is: how can pedagogical resources be used in storytelling to contribute to the learning of autistic children in early childhood education? The methodological approach is qualitative, exploratory and bibliographic (Gil, 2008), with thematic analysis by Bardin (2011). The research involved a survey in databases such as the Digital Library of Theses and Dissertations and the Portal of the Coordination for the Improvement of Higher Education Personnel, in the period from 2013 to 2023. The results show the scarcity of scientific production on the subject, but highlight authors such as Silva (2022), Lima (2018), Queiroz (2017) and Battistello et al. (2020), who reinforce the importance of storytelling with pedagogical resources as an inclusive strategy that enhances child development.

Keywords: Autistic Child. Pedagogical Resources. Storytelling. Early Childhood Education.

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INTRODUCTION

This article presents the results of the ongoing research within the scope of the Graduate Program of the Professional Master's Degree in Inclusive Education (PROFEI) with the objective of investigating the influence of the use of pedagogical resources in storytelling as a strategy to promote the development of autistic children's skills in early childhood education, with a focus on orality, reading, writing and social interaction. Consequently, it was sought to identify the most recurrent pedagogical resources in storytelling for autistic children, considering their specific needs and characteristics in the context of early childhood education, in addition to verifying how storytelling can contribute to the interactions and understanding of autistic children in learning relationships in this educational environment. It is important to emphasize that the theme of this study is aligned with the perspective of inclusive education, based on the commitment to educational human rights, which aim to guarantee all children equal opportunities to access education (Rodrigues, 2021; Nozu and Preussler, 2021; Castro *et al*., 2024).

For this study, the following problem was raised: how can pedagogical resources be used in storytelling practices and contribute to the learning of autistic children in early childhood education? Thus, the relevance of research on the theme is considered today, in order to contribute to future investigations, based on daily pedagogical practices in early childhood education.

The methodological development is guided by the qualitative approach, through exploratory and bibliographic research (Gil, 2008). The survey of academic productions took place in the databases of the Digital Library of Theses and Dissertations (BDTD) and in the Portal of the Coordination for the Improvement of Higher Education Personnel (Capes), with a time frame between 2013 and 2023. The selected materials were submitted to thematic analysis by Bardin (2011). With this, it was found that, although the survey of scientific productions was scarce, when referring to the use of pedagogical resources as a storytelling strategy for autistic children, even so, some studies stand out, such as Silva (2022), Lima (2018), Queiroz (2017) and Battistello *et al.* (2020), authors who dialogue and corroborate the discussion centered on storytelling for autistic children.

THEORETICAL FRAMEWORK

CONSIDERATIONS ON AUTISM SPECTRUM DISORDER IN EARLY CHILDHOOD EDUCATION

The number of children diagnosed with Autism Spectrum Disorder (ASD) has grown in the context of early childhood education, just as any child has specificities in their abilities

and challenges, as highlighted by Rogers *et al.* (2015). According to the Brazilian Society of Pediatrics (2019), the first signs of atypical development include language delay, absence of eye contact, and difficulty in social interaction (Castro, 2023). Impairment in communication and language development is variable, ranging from the absence of speech to a hyperformal expression (Wing, 1998).

In this scenario, it is considered relevant to know the needs of children with ASD in order to plan pedagogical practices that value their abilities and favor their own development (Camargo; Bosa, 2012). Storytelling can be a pedagogical strategy capable of attracting children's attention, stimulating orality, imagination and social interaction (Abramovich, 1997). For the author,

> [...] Listening to stories can stimulate drawing, music, going out, staying, thinking, dramating, imagining, playing, seeing the book, writing, wanting to listen again. After all, everything can be born from a text!". The child, when listening to stories, experiences all these emotions. After all, listening to stories is the beginning, to become a reader, an inventor, a creator (Abramovich, 1997, p. 125).

However, activities that awaken the imagination and social interactions can be challenging for autistic children due to the situations that may arise in these personal relationships and in "make-believe" (Chiote, 2013; Rogers *et al.*, 2015). Thus, the use of pedagogical resources, such as toys, puppets and sensory objects, helps the child to interact, engage in the narrative and develop cognitive and social skills, as long as they are planned with intentionality in early childhood education.

THE USE OF PEDAGOGICAL RESOURCES IN STORYTELLING IN EARLY CHILDHOOD EDUCATION

Storytelling, enriched with pedagogical resources, can make educational processes more attractive and promote the engagement of autistic children. Resources such as books, toys, puppets, music and tactile objects work as concrete stimuli that arouse attention and favor the imagination, as highlighted by Busatto (2012) and Perrow (2013).

The use of objects during activities can increase the focus and engagement of children with ASD, creating opportunities for interaction and communication (Rogers *et al.*, 2015). These authors reinforce the importance of experiencing "make-believe" experiences in learning interactions with autistic children, considering that this process occurs naturally in the formation of typical children. Thus, autistic children will require greater attention in this teaching and learning process, since their brain may be intended for the development of abstract thinking.

In this sense, they suggest activities with toys, animals, objects, which gradually instigate the imagination, as being a long-term activity that can take one or two years to complete, but that can start immediately. In this context, stories can be excellent motivations for make-believe, bringing the imitation of characters, playfulness and symbolic play.

The telling of a story can trigger many learning possibilities and affects human formation itself, especially in the psychological, intellectual, emotional and even spiritual dimensions (Busatto, 2012). It can even be used to arouse children's interest in a certain topic, a playful way to promote the teaching and learning of knowledge that becomes valuable in the daily life of early childhood education.

The author also describes the importance of using objects to tell stories, which can be from matchboxes, toothpicks, cloths, or a simple handkerchief indicating a wind blowing, time passing, a flower blooming, in short, something that will play with the imagination. For Vygotsky (2005), imagination is an absolutely necessary condition for almost every brain function of the human being.

Musical stories, for example, have significant potential to motivate and stimulate the participation of autistic and non-autistic children, by combining sensory and playful elements (Louro, 2021). Consequently, it creates opportunities for interaction and participation among children, with listening, trying to follow the melody, gestures, dramatizing the characters, etc. In addition, contact with children's books strengthens the child's relationship with literature and also helps in their language and communication development (Abramovich, 1997).

Rogers *et al.* (2015) also reinforce the importance of teaching "make-believe" to autistic children, which from the age of two happens naturally in typical children, unlike those with ASD who need to be taught, he explains that in autism, there are parts of the brain that are important for abstract thinking, such as the frontal lobe, which develops more slowly and are not so well interconnected with other parts of the brain, so they end up having difficulties with "make-believe" and later with abstract thinking.

In this sense, the author suggests activities with toys, animals, objects, which gradually instigate the imagination, as being a long-term activity that can take one or two years to complete, but which can start immediately. Strategies such as role-playing, the use of simple accessories, and the exploration of "make-believe" allow children to experience new concrete and interactive experiences, expanding their cognitive, social, and emotional skills (Rogers *et al.,* 2015; Vygotski, 1997).

Many authors affirm the importance of music and what it can exert, it has always had an enigmatic relationship with autism, as surprising musical abilities are not uncommon in these people (Louro, 2021). For this, it must be presented from an early age in early childhood education, with lullabies, sung games, musical stories, among others (Perrow, 2013). Thus, musical stories, as a pedagogical resource, have the power to delight children, making classes more attractive and pleasurable.

Another important resource is the children's book. Rogers *et al.* (2015) reiterate that during activities with books, parents can sit a doll or the stuffed animal next to them, show images and say their names to their child and then to the stuffed toy. By interacting with the images of the books, the toys, it provides the opportunity to exchange glances and communication in this affective relationship between the child and his parents. This daily contact with books, in addition to narrative listening, children establish a relationship with symbols, images, codes, letters, words, which become important for their own development, especially that of the autistic child.

For Abramovich (1997) there are many ways to read, to live with literature closely, adults need to provide this contact to children, for all the wonder that is the journey through the world of letters. In this way, there are many resources that can be used in storytelling with the participation of autistic children, as long as they are in the field of their interest. It is configured as a sound instrument, visual resources, books, toys or objects, whose focus provides pleasure.

In this sense, preliminary studies demonstrate that storytelling, combined with the use of pedagogical resources, can be an inclusive and promising practice in early childhood education, especially when in this educational process the involvement with autistic children is supported by intentional planning, based on the needs and specificities presented by the children.

METHODOLOGY

The methodological path chosen to follow the present study is qualitative and exploratory in nature, based on bibliographic research (Gil, 2008). The development of research that aims to extract meanings and intentionalities that reside in social relations, particularly in the educational spaces of basic education. We consider this context as one of the most important *locus* that directly affects human formation, as well as "providing greater familiarity with the problem presented" (Gil, 2008, p. 41).

The data collection of the exploratory phase with academic productions took place in the following databases: Digital Library of Theses and Dissertations and Capes Portal,

using the time frame of the last 10 years, 2013-2023. The analysis procedure was carried out through thematic analysis, considering the following descriptors: autistic child, storytelling, pedagogical resources.

The inclusion and exclusion criteria of the analyzed articles were based on the title of the papers, with analysis of the abstracts, leaving open the year of publication for the last 10 years, from 2013 to 2023. The "thematic analysis" of Bardin (2011) sought to analyze the information presented in them, regarding the link with the theme of the study, thus excluding studies published before 2013, and others in which the subject exposed did not match the theme, requiring conversation with the study proposal. Thus, bibliographic references were used that contributed to infer knowledge about the theme studied.

RESULTS AND DISCUSSIONS

Based on the analysis of research carried out in the area of storytelling for autistic children, it can be seen that resources can be a significant alternative to work with children who have autism. However, few studies have been conducted specifically addressing this topic. The following table presents some results of these researches, with a survey of academic productions with the following descriptors: autistic child, storytelling, pedagogical resources. The time frame between 2013 and 2023 is delimited. Initially, a total of four articles, three master's dissertations and two doctoral theses were obtained.

The final refinement initially considered the title, the summary, the abstract, analyzing which materials would be closer to the theme of the intended study, selecting for full reading the texts that most dialogue with the research proposal, filtering for a scientific article, two master's dissertations and two doctoral theses.

Table 1. Search results by descriptors

Year	Title	Author(s)	Kind
2020	Storytelling for autistic children	Viviane Cristina de Mattos Battistello, Ana Teresinha Elicker, Lovani Volmer, Rosemari Lorenz Martins	Article
2022	Dialogic reading: effects of an oral reading program in children with and without autism	Stefhanny Nascimento Lobo e Silva	Thesis
2019	Telling and retelling stories in science teaching-learning from the perspective of Inclusion	Helen do Socorro Rodrigues Dias	Dissertation
2017	Dialogic reading: effects on the development of verbal behavior in children with Autism Spectrum Disorder (ASD)	Lara Rodrigues Queiroz	Dissertation
2018	Promotion of Interest in Children with Autism from an Assistive Educational Platform with Electronic Puppet	Roceli Pereira Lima	Thesis

Source: Prepared by the authors

In the research carried out by Silva (2022) with the Reading and Communication Program for Children with Autism (Proleca), which consists of a set of storytelling techniques and practices in order to favor the engagement of children with autism in the reading task. Evidence was found of situations experienced in the family, which made use of playful strategies to tell stories, where autistic children were concentrated for longer in the performance of their tasks. It was also observed in the children's behavior a directed attention to the activities performed. In addition, the children began to retell the stories after the reading sessions.

In the studies by Battistello *et al.* (2020) the moments of shared reading with children with mild autism used the Recall program (*Reading to Engage Children with Autism in Language and Learning*) (Whalon; Delano; Hanline, 2015). Initially, parents and teachers began to use question words for the naming of nouns and verbs during storytelling. In the next moment, the strategy was to make a card with a set of three images, taken from the ARASAAC Portal (Centro Aragonés de la Comunicación Augmentiva y Alternativa). For each question, assuming only one correct answer to be pointed out by the child. Next, a resource was presented that can be an alternative to work reading with children with ASD, which allows the mediator to carry out interventions throughout the storytelling to expand the child's understanding. Different moments that, in some way, involve the children's attention.

Queiroz (2017) in his studies highlights that one of the contexts conducive to developing verbal behavior and quality in interaction in children with ASD is the pleasant storytelling environment. Dialogic reading allows the child to have a participatory posture in front of storytelling, which is stimulated through participation strategies in the formulation of questions and answers. Autistic children understand and see the world in a peculiar way, and storytelling can help them understand this world, drawing their attention and bringing them closer to the imaginary world (Oliveira *et al.*, 2017).

Lima (2018) used the resource of Information and Communication Technology in Education, Engineering and Affective Computing models, developed, in the light of Socio-Historical Theory, an Assistive Educational Platform capable of enabling the promotion of the affective state of interest in children with Autism Spectrum Disorder (ASD). The educational activity was developed through children's storytelling and the use of a technological resource, a robotic device, of mediating action, called Electronic Puppet, being used to mediate the children's story. This resource is specially designed for this investigation. The results were positive with regard to joint attention, and in the affective state of interest of the autistic children, however, they were elementary school children,

which is not the age group of the focus of this research, but shows a possibility of resource to tell stories.

The studies by Dias (2019) used pedagogical resources for storytelling for people with disabilities, which included autistic children, all between six and nine years old. Various materials were used for the narrative of the stories. One of these resources were signs with the scenarios on the magnetic board and, as the story was told, the characters and objects were nailed to the boards. Thus, the story was being materialized by the teacher and students. The results of the research show that the use of storytelling and retelling of stories with resources enhances the dialogical interaction between the subjects, favoring the teaching-learning process. "Everyone was very committed to retelling the stories, especially for being able to handle the resource, each student told it in their own way and within their possibilities" (Dias, 2019, p. 83).

In this sense, the use of pedagogical resources for storytelling can constitute a significant path for autistic children in relation to interaction and communication, through the mediation of the adult in the proposed activity. Storytelling allows the mediator to intervene during the telling, which favors both the understanding of the world and the child's own development. Pereira, Gonçalves and Custódio (2024, p. 3) point out that "[...] Storytelling carries with it a great creative power that can be captured by those who listen to it. It is a reconnection with ancestry, with history that is not written, but belongs to the world." However, this process can later encourage them to read, write, create new forms of communication and express themselves. According to Vygotsky (1997), having a disability does not imply less development, but rather a development that occurs in a different way.

CONCLUSION

By analyzing the influence of the use of pedagogical resources in storytelling as a strategy to promote the development of skills in autistic children in early childhood education, with emphasis on orality, reading, writing and social interaction, we found that the integration of pedagogical resources to oral narrative contributes positively to the promotion of essential skills in these children, stimulating communication, imagination and social interaction. The use of concrete objects, adapted books, toys, and other visual materials enriches the storytelling experience, providing children with a more accessible, dynamic, and inclusive environment.

It is noteworthy that storytelling with the use of pedagogical resources also favors linguistic development, as well as strengthens autonomy and the ability to interact in different contexts. This strategy, when planned and developed in a way that is sensitive to

the specificities of autistic children, enables curricular adjustments that respect individualities and stimulate integral development.

In the academic sphere, the study expands the discussion on inclusive education, highlighting the need for more research on innovative pedagogical practices that can benefit the learning process of autistic children. The scarcity of research identified in the initial survey reinforces the importance of deepening the debate on inclusive methodologies, enabling new approaches and guidelines that can guide teacher training and pedagogical intervention in early childhood education.

From a social point of view, the results contribute to a more equitable education, highlighting storytelling as an accessible practice that strengthens the bond between educators and children, in addition to promoting more welcoming and inclusive environments. The appropriate use of pedagogical resources can be an important ally to reduce barriers to access to knowledge, expanding the possibilities of development and socialization of autistic children.

Even in progress, the research has some limitations, such as the restriction to theoretical studies and the absence of practical interventions that could offer a more in-depth analysis of the results. In addition, the scarcity of specific literature on the use of pedagogical resources in storytelling with autistic children reinforces the continuity of research, in order to delve into more robust and consistent empirical data.

Finally, it is understood that storytelling, combined with the use of pedagogical resources, represents a promising strategy for inclusive education, with great potential to positively impact the development of autistic children in early childhood education. In addition, this practice contributes to the construction of a more inclusive and conscious society, capable of recognizing and respecting the singularities of each child, autistic or not, valuing their potential and their way of interacting with the world.

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DE&I (DIVERSITY, EQUITY, AND INCLUSION): A STUDY ON LABOR PRODUCTIVITY AND ITS STRUCTURAL DIFFICULTIES

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ABSTRACT

Through the analysis of stakeholder perceptions, this study explored the productivity in organizations of people who fit into a diversity, equity, and inclusion (DE&I) universe. The methodology used was qualitative, with semi-structured interview techniques, based on a script with pre-elaborated questions. To understand personal data, the study of Lawrence Bardin's arguments was defined. The observation of labor productivity and the difficulties encountered in a DE&I environment reinforce the need for a change in personnel policies for diversity, equity, and inclusion in organizations. Since indigenous peoples, women, blacks, black women, the elderly, adolescents, LGBTQIA+ people and a diversity of

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functional or neurodivergent PWDs, are as productive as any other human being, despite all the setbacks reported in the interviews.

Keywords: Diversity. Equity. Inclusion. Productivity.

INTRODUCTION

The acronym DE&I describes a set of core principles: Diversity, Equity, and Inclusion. These principles represent an organization's efforts to create a more welcoming and representative environment for people from underrepresented groups. In practical terms, this may involve seeking a more diverse senior management team made up of people from different backgrounds and experiences, or implementing mentorship programs aimed at young professionals belonging to minority groups.

The adoption of DE&I practices in companies tends to be motivated by two broad sets of reasons. The first is ethics: promoting equal and respectful treatment and taking a stand against any type of discrimination and prejudice is a fundamental role for everyone, individuals and institutions. And, in an unequal country like Brazil, talking about social responsibility is, necessarily, talking about DE&I. The second set of reasons focuses on the business itself. DE&I, in this scenario, becomes a fundamental management instrument and there is already a consensus around the perspective that perceives DE&I practices as a competitive advantage.

This study is structured in three parts, in addition to the introduction and conclusion. In the first section, we aim to contextualize DE&I and productivity. The second will address methodology as a qualitative approach. And the third will analyze and discuss the categories found in the data collected through semi-structured interviews on the perception of the actors.

LITERATURE REVIEW

Nature is known to be the greatest force in our universe, but learning to deal with it is important for humans. To do this, we identify below what the nature of DE&I is, in addition to productivity.

DIVERSITY

Diversity means variety, plurality, difference. It is a feminine noun that characterizes everything diverse, that which has multiplicity. It is the meeting of everything that has multiple aspects and that differ from each other, e.g.: cultural diversity, biological diversity, ethnic, linguistic, religious diversity, etc. (WOJCIECHOWSKA, 2025).

According to Xiao, 2024, cultural diversity is the multiple elements that particularly represent different cultures, such as language, traditions, religion, customs, family organization, politics, among others, that bring together the characteristics of a human group in a given territory.

According to Chowdhury and Brooks, 2024, in the United Kingdom, for example, the Equality Act of 2010 prohibits discrimination on the basis of gender and sexual identity. However, many lesbian, gay, bisexual, transgender, non-binary and non-traditional (LGBTQIA+) people working in the UK construction industry experience hostility in the workplace.

LGBTQIA+ is an acronym that represents various identities, including lesbian, gay, bisexual, transgender, queer, intersex, and asexual. The "+" symbol encompasses other sexual and gender orientations, representing plurality. (CHOWDHURY; BROOKS, 2024).

According to Wojciechowska, 2025, ethnic diversity is the union of several peoples in the same society. Ethnicity is a group of individuals who have affinities in origin, history, language, religion, and culture, regardless of the country in which they are located. Brazil is a country with great ethnic diversity, its population is made up of the miscegenation of several peoples who together formed a new cultural identity.

The visibility of high-level LGBT+ employees and the leadership of LGBT+ and non-LGBT+ senior management are important for inclusion in organizations and support for junior LGBT+ employees (CHOWDHURY; BROOKS, 2024).

EQUITY

Equity is a fundamental concept in the field of social justice and has been discussed and debated throughout history. It is a principle that seeks to guarantee equal opportunities and fair treatment for all individuals, regardless of their personal characteristics, such as gender, race, religion or social origin (NEESON, 2024).

According to Darmais, 2024, to better understand the meaning of equity, it is important to differentiate it from equality. While equality seeks to treat everyone equally, equity recognizes that people have different needs and circumstances and therefore need different treatment to achieve justice.

Equity seeks to correct existing inequalities in society, promoting inclusion and social justice. She recognizes that some people may need more resources or support to achieve the same opportunities as others. Therefore, equity is not only about offering the same opportunities to everyone, but about ensuring that everyone has the same chance of success (ALAJMI, 2024).

According to Neeson, 2024, a practical example of equity is the implementation of quota policies in universities or in the labor market. These policies aim to correct historical inequalities and ensure that marginalized groups have access to the same opportunities as

others. In this way, equity seeks to promote inclusion and diversity, contributing to a fairer and more egalitarian society.

The importance of equity goes beyond social justice. Studies have shown that more equitable societies are more stable and prosperous. When everyone has the same opportunities, the potential for human development is maximized, resulting in a healthier and more productive society (DARMAIS, 2024).

According to Alajmi, 2024, in addition, equity is also fundamental to building a healthy democracy. In a society where some groups have more power and privilege than others, democracy can be compromised as the voices and needs of marginalized groups are often overlooked. Equity, therefore, is an essential principle to guarantee the equal participation of all citizens in political and social decision-making.

However, achieving equity is not an easy task. It requires deliberate actions and policies to correct existing inequalities and ensure that everyone has the same opportunities. This may involve the implementation of affirmative action policies, social inclusion programs, and education to raise awareness of existing inequalities (DARMAIS, 2024).

Neeson, 2024, states that it is also important that equity is considered in all areas of society, from government to companies and educational institutions. Everyone has a role to play in promoting equity and creating an environment where everyone can thrive.

Equity is a fundamental principle for social justice and the construction of a more egalitarian society. She recognizes that people have different needs and circumstances and seeks to ensure that everyone has an equal opportunity to succeed. In addition, equity is important for the stability and prosperity of a society, as well as for building a healthy democracy. Therefore, it is essential that equity is promoted and considered in all areas of society (ALAJMI, 2024).

INCLUSION

Inclusion is the act of including and adding, that is, adding things or people to groups and nuclei of which they were not previously a part. Socially, inclusion represents an act of equality between the different individuals who inhabit a given society. Thus, this action allows everyone to have the right to integrate and participate in the various dimensions of their environment, without suffering any type of discrimination and prejudice (KAASINEN, 2025).

Kaasinen, 2025, states that social inclusion is made up of a set of actions, many of them protected by laws, that guarantee the equal participation of all members of a society.

Social inclusion provides for the integration of all individuals, regardless of their physical condition, education, gender, sexual orientation, ethnicity, among other aspects.

School inclusion consists of the idea that all citizens should have the right to access the education system. This must occur without segregation and discrimination, whether by gender, religion, ethnicity, social class, physical and psychological conditions, etc. (ADEL, 2024).

According to Adel, 2024, digital inclusion represents the provision, on equal terms, for all citizens of the opportunity to have access to information and communication technologies (ICTs). In short, digital inclusion consists of the democratization of technology, where regardless of social class, ethnicity, religion and economic power, the individual can enjoy the advantages of technological tools.

PRODUCTIVITY

Productivity is related to the quantity and quality of the tasks performed in a given period and the resources used during this production process. However, we must not confuse production, which is the simple fact of producing something, with productivity, which has to do with increasing that production. Being productive means having control over time management to optimize the performance of routine work tasks and deliver more with less effort (PASCUAL, 2024).

Foncubierta-Rodríguez, 2024, states that in other words, it is knowing how to prioritize tasks in order of urgency and not in order of complexity. In other words, the concept of productivity is directly linked to high performance at work. This means having the ability to create a good plan to carry out the greatest number of activities, in less time and with fewer resources, respecting and even anticipating deadlines.

But be careful: productivity is not mass production, nor is it working non-stop and exceeding the working day. On the contrary, it is knowing how to manage the time you have available in the best way. First, productivity ensures greater efficiency in performing tasks. Thus, demands are delivered with quality, in greater quantity and in less time, which has a direct impact on the achievement of goals and better results for the organization (FONCUBIERTA-RODRÍGUEZ, 2024).

In addition, being productive implies reducing the use of other productive resources, which avoids losses and raises awareness in the organization. Undoubtedly, all this also means that the costs of carrying out the work are minimised (FONCUBIERTA-RODRÍGUEZ, 2024).

Pascual, 2024, states that, as a result, high productivity becomes a competitive differentiator and positions the company in a prominent place in the market, ensuring the attraction of talent and the reduction of turnover. At the same time, being productive is a stepping stone for employees to receive recognition for their good performance, which increases their motivation and commitment to deliverables.

METHODOLOGY

The methodology used was qualitative, through semi-structured interviews. E-mails were sent requesting participation in this study, and 13 (thirteen) interviews were conducted, compiling the perception of the actors directly involved in the DE&I department of their organizations. The following table shows the profile of the interviewees. It is observed that the sector linked to people management in each organization has professionals with the appropriate training to understand this research.

Table 1: Profile of the interviewees

Actors	DE&I Positions	Experience	Economy sector	Training
Alpha	assistant	2 years	Primary	psychology
Brave	assistant	3 years	Secondary	administration
Charlie	analyst	4 years	Tertiary	psychology
Delta	coordinator	5 years	Tertiary	MBA
ECHO	supervisor	6 years	Tertiary	MBA
Foxtrot	manager	11 years	Secondary	MBA
Golf	director	14 years	Secondary	MBA
Hotel	Vice President	21 years old	Primary	MBA
India	president	33 years	Primary	agronomist
Juliet	adviser	41 years old	Secondary	doctorate
Kilo	shareholder	42 years old	Tertiary	Engineering
File	Consultora Plena	23 years old	Tertiary	doctorate
Mike	Senior Consultant	39 years old	Tertiary	doctorate

Source: authors

For the data collected, Lawrence Bardin's Content Analysis was used. According to the author, the different phases of content analysis were organized around three chronological poles: 1) pre-analysis; 2) material exploration; and 3) treatment of results, inference and interpretation.

To guarantee the secrecy and confidentiality of the interviewees, it was decided to identify them in the sequence of the international phonetic alphabet. The interviews were conducted digitally and lasted an average of 30 minutes.

RESULTS

This article presents the categories that stood out the most during the DE&I research, which are: indigenous, women, black men, black women, older people, adolescents, LGBTQIA+ people, and PWD.

INDIGENOUS

Although the indigenous question only appeared among actors in the primary sector of the economy. The stories are moving, according to the ALFA interviewee: *"We received a young indigenous man from Pico do Jaraguá, with a wonderful life story, and he quickly learned the trade and shows up to work with up-to-date hygiene, clean nails and a beard, because here we mess with the food and the customer complains. He has been there for more than a year and no one has ever complained about his care. He works for two (...)"* (ALPHA).

For the HOTEL interviewee, the indigenous is very intelligent, educated and hardworking:

> *"She came here wanting to learn, she told the story of her tribe, then she enrolled in a technical school and now she's taking a technical course in IT. He said that after this course he will take the entrance exam and wants to be a data scientist. Their work doesn't even need supervision, it's always well done, with a lot of courtesy and respect"* (HOTEL).

The interviewee INDIA corroborates this by saying that the indigenous people have an above-average productive capacity: *"(...) an indigenous person came to work in the company and presents himself with many qualities, focus, concentration, empathy, joy, in addition to having a production capacity that already surpasses the others"* (INDIA).

In light of the reports, it is increasingly important to highlight that Law 11.645/08 makes the study of indigenous and Afro-Brazilian history and culture mandatory in primary and secondary education establishments. However, Law 12.711/12, known as the Quota Law, guarantees the democratization of access to federal institutions of higher education and technical secondary education for indigenous students.

WOMEN

All the interviews mentioned the woman. Statements, such as those of BRAVO, are striking: *"(...) after our Institution began to incorporate women, the organizational climate, quality and productivity increased absurdly"* (BRAVO).

For interviewee CHARLIE, women are highly productive:

> *"There is a lady who works here with us who does not miss a day if she wants to, she is not even late, she does not even get a certificate. Look, she has been working here for more than 20 years (...) she recently said that she was suffering sexist attacks in digital media by people who work in the same company, we did an investigation and we knew who she was, they advised her to report it to the authorities and we fired her"* (CHARLIE).

DELTA corroborates this statement: *"The owner (...) She is a woman who was beaten by her husband, before coming here, according to what she denounced, but she never stopped working for a day, despite the fact that she was marked by the aggressions that were reported. by us in HR"* (DELTA).

The ECHO interview also offers an emotional account:

> *"A girl works here, super educated and very productive, think of a woman who works, that is her, who reported that every day on the train she suffered sexual harassment at 5 in the morning. We gathered Human Resources, made the report and the police went to investigate the train cameras. The bastard was arrested a few years ago and is still here with us. She was promoted to manager"* (ECHO).

In line with the above, it should be noted that the Maria da Penha Law was published in 2006 and was created to curb domestic and family violence against women. Law No. 14,994/2024 amends the Maria da Penha Law to make femicide an independent crime and increase the penalty. Other laws that protect women are: Law No. 13,718/2018, which typifies the crimes of sexual harassment and disclosure of a rape scene; Law No. 13,642/2018, which assigns the Federal Police the investigation of misogynistic crimes on the Internet; Law No. 13,931/2019, which determines the mandatory notification of cases of violence against women; Law No. 14,232/2021, which establishes the National Policy on Data and Information Related to Violence against Women (PNAINFO); and Law No. 14,192/2021, which establishes rules to prevent, repress, and combat political violence against women.

BLACK MEN

All interviews mentioned the black man. The statements that move us are those of FOXTROTE: *"My husband is black, he has had a prosperous career for twenty years in a large foreign investment bank here in Faria Lima and he is currently a manager, he received a great award for reaching the goal and decided to go to a designer car store to buy a new model, When he got there, he was repelled by the new salesman who confused him and asked him to stay in the designated area for security. My husband told the manager that he was going to fire him. My husband asked her to reconsider and go back to work (...)"* (FOXTROT).

The interviewee GOLFE reinforces the previous report by saying:

> *"We are one of the biggest teams in the country, I am the director of human resources and I had a lot of work, because there was a terrible case that embarrassed us deeply, when a black player from the opposing team was harassed by our fans with words that are unrepeatable here (...) He was one of the best in the championship"* (GOLF).

The interview with JULIETE also presents a situation of an employee of his company: *"one of the best employees we have here in the company. He produces more than one machine on the production line, there is no shortage, there is no delay, in short, he was mistaken for a thief in a supermarket, he was forced to strip naked because he was accused of having stolen products. None of this was true, the company supported him to go to court in order to be compensated (...), but he was very bad for several days. He was recently promoted to manager on his merit"* (JULIETE).

The KILO interviewee also gives an emotional story:

> *"I have had a hotel for more than 50 years, I inherited it from my father and I hired a young man from that time, black, with an enviable intelligence. He has been doing great work for decades and has already become its CEO. (...) Recently, a foreign girl refused to be seen by him, because she was black, claiming that she was still a foreigner and was not used to having relations with black people. We filed a B.O. and the case is in court, deplorable, he emphasizes"* (KILO).

In light of so many sad reports above, it is important to emphasize that the Federal Constitution of 1988 determines that discrimination is punishable by law and that the Federative Republic of Brazil must promote the good of all without prejudice. The laws that combat racism in Brazil are: Law 7.716/89: also known as the Racism Law, it punishes any type of discrimination or prejudice, including race, color, origin, sex or age. The law provides for a prison sentence of 2 to 5 years for anyone who prevents or hinders someone's access to public office or employment in a private company; Law 12.288/2010: establishes the Statute of Racial Equality, which establishes policies to combat discrimination and promote racial equality; and Law 14.532/2023: classifies racial slur as a crime of racism.

BLACK WOMEN

All interviews mention black women. The most striking testimonies are those of LIMA: *"I appointed a girl as operational manager of the shopping center to which I give advice. She was fine, until one day she was harassed by customers who had stores and did not comply with internal rules (...) They insulted her in every way possible (...) we called the police and they arrested them. She ended up resigning. Sad (...)"* (LIMA).

MIKE's interview helps to understand the challenge of black women: "

> *"I was 8 years old, I went to school with braids. I was very happy because, with the braids, my hair bounces. But my classmates harassed me. I cried a lot and didn't*

> *want to go to school anymore. It was a middle-class school in Salvador, and I was the only one in the room with curly hair. For many years I felt angry with my hair and even with my parents so I could only wear natural hair. 35 years"* (MIKE).

GOLF reinforces the previous thesis: *"When I was about 13 years old, I was talking to my friends and, out of nowhere, a friend of mine said that God had cursed me because he had made me black and a woman."* (GOLF).

KILO corroborates:

> *"I have a black employee, she has been with me for two decades, she takes care of the finances and is the mother of a saint. One day he told me that from the moment blacks start exercising their religion, it is demonized. and this demonization grows throughout history, simply because it is a black religion, simply because it represents the ancestry of black people"* (KILO).

The story of this woman, black and priestess of Candomblé represents a reality lived by different people who follow African-based religions in Brazil. The statement makes it clear that intolerance and racism go hand in hand in the country.

The above reports are addressed by laws on racial and gender-based violence in Brazil. Statute of Racial Equality: guarantees equal opportunities, ethnic rights and the fight against discrimination; Article 5 of the 1988 Federal Constitution guarantees that the Brazilian State is secular, which is in line with what is expressed in the Universal Declaration of Human Rights. Law No. 9,459 of 13 May 1997 provides for penalties for crimes of discrimination, offence and injury committed on the grounds of race, colour, ethnicity, national origin or religion.

ELDER

Although few interviews mentioned the elderly, but the most shocking statements are those of JULIETE: *"I am a counselor and a premium for hiring older people to help in the maturity of the social organization"* (JULIETE),

KILO confirms:

> *"The labor market is no longer what it was two years ago, the pandemic accelerated this whole process. The population over 50 years of age must keep up to date, look for transversal careers and corporations must have this vision of new forms of hiring, with the contribution of knowledge, without suffering high salaries" (KILO).*

MIKE agrees: *"people with more experience have even gone through more difficult situations, they can contribute to those who are just starting out in the labour market, who cannot have a more systemic vision, and young people, on the other hand, who were born connected, can provide technological support"* (MIKE).

The above reports refer to the Statute of the Elderly, which is Federal Law 10.741/2003, aimed at regulating the interests and guarantees of the elderly. This law has been in force since 2004 and is an important instrument of citizenship and protection for people aged 60 and over. The Statute of the Elderly guarantees several important health-related rights. Laws protecting older people in Brazil include: The National Policy for the Elderly (Law 8842/94); and the Law on Priority Attention to Persons with Disabilities, Older Adults, Pregnant and Lactating Women (Law No. 10,048).

TEENS

Only two interviews mentioned teenagers, but the interviews highlight their qualities, according to ALFA: *"ageism, discrimination based on people's age, continues to be a challenge for companies, despite the fact that diversity is on the agenda of employers to create a plural and fairer work environment. And the most harmful effect of this prejudice arising from the conflict of generations is to cast doubt on the capacity of professionals in their work"* (ALFA),

BRAVO reinforces:

> *"Recent research by the company showed that professionals from Generation Y (born between 1980 and 1994) and Generation Z (born between 1995 and 2010) have also felt discriminated against by older people: 73% feel that older professionals doubt the professionalism of those who are younger. For 76%, Generation X is "position resistant"* (BRAVO).

The main laws that protect young people in Brazil are: Child and Adolescent Statute (ECA), Law No. 8.069/1990, which aims to guarantee the fundamental rights of children and adolescents; Brazilian Civil Code, which has legal provisions that guarantee the protection of children and adolescents; and the rights of young people, including the right to education and health.

LGBTQIA+

Although few interviews mentioned the LGBTQIA+ population, the impact of this population is highlighted in the interviews with LIMA: *"I am a business consultant and have advised many HR departments, with regard to the lesbian, gay, bisexual, transvestite, transsexual and intersex population. These human beings are wonderful and work very hard. Highly productive and intelligent. They need understanding in the work environment. That's all. The stereotype is a preconceived image and the basis of prejudice"* (LIMA).

MIKE reinforces:

> *"It is crucial to reduce the rates of economic exclusion. Prejudice and discrimination during hiring processes continue to push a significant portion of the LGBTQIA+ population into underemployment, unemployment, and informality. Despite the expansion of projects, the absorption of this workforce is still insufficient" (MIKE).*

Laws protecting the LGBTQIA+ community in Brazil include the 1988 Federal Constitution, which guarantees fundamental rights such as dignity, equality, and freedom, and the Penal Code, which criminalizes acts of discrimination based on sexual orientation. In addition to the Charter of Human Rights.

PCD

All interviews mentioned PWD. The statements that stand out the most are those of FOXTROT: *"The State is still far from implementing programs and measures that effectively allow these people access to the labor market. And here we are talking about all aspects: from the cultural, to the awareness/education of the population and society in respect for differences, the elimination of prejudices and the adequate social integration of people with disabilities in the professional environment, as well as accessibility"* (FOXTROT).

GOLF reinforces:

> *"The BCP is the guarantee of a monthly minimum wage to a person with a disability who proves that he or she does not have the means to support himself or have it for his or her family, which is suspended when the person with a disability begins to work, even if the benefit is repaid after the end of the employment contract. depending on the salary offered by the companies, it would not "benefit" to opt for the vacant position" (GOLF).*

JULIETE confirms: *"We are frequently contacted to carry out PWD inclusion projects with a focus on entry-level positions and our big challenge is to go against the grain and work in high-level and managerial positions, where there is a great shortage of professionals available. in the market."* (JULIETE).

KILO corroborates:

> *"In practice, what we see is that several companies have great difficulties in hiring people with disabilities, the main one being finding qualified people in the labor market*" (KILO).

A person with a disability is considered to be one who has a long-term physical, mental, intellectual or sensory impairment, which, in interaction with one or more barriers, may prevent their full and effective participation in society on equal terms. with other people.

Laws that protect people with disabilities in Brazil include: Law No. 13.146/2015: Establishes the Statute of Persons with Disabilities, guaranteeing the inclusion and civil

rights of people with disabilities; Law No. 8.213/1991: Regulates social benefits, offering economic support to persons with disabilities; and Quota Law: Obliges large companies to allocate a percentage of their vacancies to workers with disabilities, promoting labor integration.

CONCLUSION

This study aimed to analyze the perception of actors about DE&I in organizations, as well as to identify factors that hinder and hinder the productive performance of the people targeted by DE&I.

Semi-structured interviews were conducted to collect the perception of the actors directly involved with DE&I in the organizations. After the analysis of the interviews, the labor value of productivity on the part of indigenous people, women, black men, black women, older adults, adolescents, LGBTQIA+ people and PWD is evident, in addition to discriminatory and prejudiced barriers in organizations.

In relation to indigenous peoples, it is public and notorious that in addition to territorial challenges, indigenous peoples currently face problems of racism, prejudice, violation of indigenous women's rights, lack of access to health and public services, as well as scarce and nutrient-poor food. The lack of opportunities in the formal labor market is getting worse.

Women face several challenges, including: wage inequality: women earn less than men. Prejudice and discrimination: Women can be subjected to inappropriate behavior, such as sexual harassment, intimidation, and gender discrimination. Lack of opportunities: Women face difficulties in growing professionally and reaching management positions. Inadequate organizational culture: Organizational culture may not accept that women can command and lead. Lack of gender equality policies: Gender equality policies may be insufficient. Lack of maternity support: Maternity support may be insufficient. Violence: Women face violence at all levels, especially femicide. Gender stereotypes and biases: Gender stereotypes and biases can deter women from pursuing certain fields of study. Less insertion into the labour market: women are more represented in the number of unemployed.

The Brazilian black population faces several challenges, including: inequalities: The black population suffers from inequalities in access to education, health, housing, decent work and land. Poverty: The black population has suffered the most from the worsening of poverty in Brazil. Racism: Black people face the challenge of fighting prejudice, marginalization and violence on a daily basis. Labor market: Blacks face more difficulty

finding work than whites and receive lower wages, even when they have the same qualifications. Bullying: Black people are the most vulnerable to bullying in the workplace. Criminalization: Blacks make up the majority of the prison population and the majority of homicide victims. Entrepreneurship: Entrepreneurship among blacks arises from the need to survive, not from a choice.

Seniors face several health challenges: chronic diseases, cognitive decline, falls, and hearing problems. Mobility: loss of strength and mobility, which can lead to dependence on family members or caregivers. Social isolation: Changes in family structure, loss of friends, and retirement can lead to social isolation. Violence: Brazil constantly registers reports of violence against the elderly, involving cases of physical and psychological violence and abandonment. Adapt to changes: face retirement, the loss of loved ones and adapt to new routines. Social exclusion: exclusion of older people from social spaces, especially in the labour market. Prejudices: reproduction of stereotypes about older people, "jokes" about aging, prejudices that make many believe that older people are incapable of assuming roles and responsibilities. Ageing is not the same for everyone, and the differences that exist relate to factors such as living conditions, access to goods and services, coverage of safety nets and social assistance conditions.

Adolescents can face various challenges, such as: unemployment; family conflicts; desire for autonomy; lack of quality of life; Uncertainties; anxiety; excessive use of electronic products; lack of will; addiction to technology; dissatisfaction with body image; adolescents may also face global challenges such as climate change, social inequality, and political issues; Adolescence is a period of metabolic transformations, which can make adolescents feel tired and have a greater need for rest; Excessive use of electronic devices can lead to headaches, eye strain, sedentary lifestyle, and spinal changes. Addiction to technology can cause serious damage to health and studies; Body image is fundamental in the formation of adolescent identity. When teens feel dissatisfied with their bodies, they may have negative thoughts and feelings about their physical appearance.

The LGBTQIA+ community faces several challenges, including: discrimination and prejudice: the LGBTQIA+ population suffers discrimination and prejudice in different areas of life, such as the labor market, education, and health. Violation of rights: The LGBTQIA+ community faces violations of civil and human rights. Violence: Physical violence is one of the challenges faced by the LGBTQIA+ community, ranging from bodily harm to homicide. Difficulty accessing health care: The LGBTQIA+ population faces difficulties in accessing health treatments, especially trans people. Difficulty accessing education: The LGBTQIA+ community faces verbal aggression and school dropout. Difficulty in accessing the labor

market: the LGBTQIA+ community faces exclusion and violation of rights in the labor market. Family rejection: The LGBTQIA+ community faces family rejection, which can cause or worsen mental health symptoms. Pathologization: The Brazilian political sphere has been the scene of attempts to delegitimize the health demands of LGBTQIA+ people. The pandemic worsened the situation for LGBTQIA+ people across the country and has had consequences to this day.

Persons with disabilities (PWDs) face several invisibility challenges: The agenda of PWDs is not very visible, even when it comes to participation and social control. Access to technologies: There is a lack of access to assistive technologies and supplies. Prejudice and discrimination: PWDs face prejudice and discrimination in the professional environment, such as isolation, rejection, harassment and difficulties in growing in the company. Access to education: There are barriers to accessing education. Access to the labour market: people with disabilities face difficulties in finding a job aligned with their skills and objectives. Urban mobility: People with disabilities face difficulties accessing public transportation, which can lead to broken elevators and unprepared drivers. Accessibility: lack of physical and digital accessibility. Self-esteem and self-confidence: People with disabilities can develop self-esteem and self-confidence issues due to challenges. Cost of living: The cost of living for people with disabilities increases by about one-third of their income.

Finally, the Diversity, Equity, and Inclusion (DE&I) cell in organizations must confront bias: Breaking down entrenched biases in society, such as sexism, racism, and homophobia, is one of the main challenges for DE&I. Ageism: Age-based prejudice and discrimination, also known as ageism, are a major challenge in the workplace. Resistance to change: Implementing DE&I policies is not a simple task and you may encounter resistance to change. Lack of Committed Leadership: Lack of committed leadership can be a hindrance to DE&I. Lack of Data: Lack of data and limited resources can be challenges for DE&I. To overcome these challenges, it is important to adopt effective strategies, such as transparent communication, training, and the creation of safe spaces. Recognize and reward inclusive behaviors. Use appropriate tools and resources to measure the progress of DE&I initiatives. Develop outcome indicators to make data-driven decisions.

As a suggestion for future in-depth studies on individual issues by indigenous peoples, women, black men, black women, older people, adolescents, LGBTQIA+ people and PWD, in addition to discriminatory and prejudiced barriers in organizations.

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ACCOUNTING PRACTICES AS A STRATEGIC TOOL FOR THE SUSTAINABILITY OF MICROENTERPRISES: A STUDY IN HUMAITÁ/AM

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ABSTRACT

This study analyzes the importance of accounting practices as a strategic tool for the sustainability of microenterprises in Humaitá, Amazonas. The research seeks to highlight the correlation between the effective implementation of accounting practices and the financial performance of these companies, considering the challenges faced by them, such as lack of financial planning and inadequate management. Through a descriptive and qualitative methodology, with literature review and application of questionnaires to microentrepreneurs in the region, the study aims to identify effective accounting practices, challenges faced and propose solutions to improve accounting management. The results are expected to contribute to local economic development, offering valuable insights for entrepreneurs and public policy makers, in addition to fostering the sustainability of microenterprises in Humaitá.

Keywords: Accounting Practices. Micro. Sustainability. Humaitá. Financial Performance.

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INTRODUCTION

Accounting has currently become an important partner for the management of companies from large to micro companies, the data collected and organized providing detailed reports on the financial health of companies has been a tool that has been helping entrepreneurs to make the best possible decisions for the proper functioning of their businesses.

According to the Brazilian Micro and Small Business Support Service/SEBRAE (2021), an individual microentrepreneur is one who is self-employed, registered as a small entrepreneur and exercises one of the more than 460 types of services, commerce or industry. The figure of the Individual Microentrepreneur/MEI emerged with Complementary Law No. 128, of December 19, 2008, seeking to formalize Brazilian workers who, until then, performed various activities without any legal support or legal security. With the legislation in force since then, more than 7 million people have already formalized themselves as individual microentrepreneurs.

Also, according to SEBRAE studies, carried out from 2018 to 2021, the lack of planning and/or organization were the main reasons for these companies to close their activities in the first 5 years. MEIs were the ones with the highest rates, 29%, followed by Microenterprises/MEs with 21.6%, and small companies/EPPs with 17%. Given this scenario, the following problem-question arose: **How do accounting practices impact the performance, decision-making, and viability of microenterprises?**

Considering this niche, the research sought to highlight the fundamental role of accounting as an indispensable partner for microentrepreneurs. This occurs both with regard to tax organization and the creation of reports that allow solid decision-making for microentrepreneurs.

The present research is justified by the crucial relevance of accounting practices for the sustainability of microenterprises, especially in the challenging context faced in Humaitá, Amazonas. Despite their importance for local and national economic development, micro and small companies face high mortality rates, with the lack of professional financial management being pointed out as one of the main reasons.

According to data from SEBRAE (2023), about 23% of micro and small companies close their doors in Brazil before completing two years of existence, with the lack of planning and management being one of the main factors that contribute to this scenario.

Humaitá, like many other cities of similar size in the Amazon, has an economy heavily dependent on microenterprises, which are responsible for a considerable portion of the generation of jobs and local income. However, according to data from SEBRAE (2021),

the lack of planning and accounting organization has led to the early closure of many of these businesses. This study is justified by the urgent need to provide microenterprises with tools and knowledge that can improve their management and accounting practices, contributing to their survival and growth.

Similar studies carried out in other regions of Brazil confirm the relevance of effective accounting practices for the sustainability of microenterprises. For example, a survey conducted by Chupel, Sobral and Barella (2014) showed that the adoption of managerial accounting practices significantly increased the survival rates of individual microentrepreneurs (MEIs) in Mato Grosso, providing greater financial and operational stability. Similarly, a study conducted by Cardoso, Bernardo, and Moreira (2019) highlighted the contribution of accounting practices to the longevity of micro and small companies in the state of São Paulo, emphasizing that the professionalization of accounting management is directly associated with improved financial performance and reduced bankruptcy rates.

In addition, the survey aims to promote awareness of the strategic value of accounting, not only as a legal obligation, but as an ally in the decision-making process. By identifying and analyzing the challenges faced by microenterprises in the implementation of accounting practices, the study offers a unique opportunity to improve public policies and support initiatives aimed at this segment, potentially positively influencing the economic development of Humaitá.

The study is also justified by the potential social impact. Successful micro-enterprises not only promote economic stability, but also contribute to social cohesion by providing stable jobs and fostering local entrepreneurship. By highlighting success stories and proposing practical solutions, this research can serve as a model for other regions of Amazonas, which share similar characteristics and challenges with Humaitá.

Also considering the academic point of view, this research contributes to the development of knowledge in the area of management accounting applied to microenterprises. By filling gaps in the existing literature, especially in the context of microenterprises in more isolated regions such as the Amazon, the study may influence future academic work and offer valuable insights for the improvement of accounting practices.

The objective of the research is to evaluate the impact of the implementation of accounting practices on the financial sustainability of microenterprises in Humaitá, Amazonas; To achieve this goal, it is necessary to: Map the main difficulties in implementing effective accounting practices in microenterprises in Humaitá, Amazonas; To analyze cases of microenterprises in Humaitá, which have achieved success through the strategic use of

accounting practices and to measure the impact of the use of accounting practices on the financial management and performance indicators of microenterprises in Humaitá, Amazonas.

THEORETICAL FRAMEWORK

ENTREPRENEURSHIP

Dornelas (2001) states that the word entrepreneurship comes from the nineteenth century, when the economist Jean Baptiste Say (1776-1832) defined it as an individual who "transfers economic resources from a sector of lower productivity to a sector of higher productivity and higher yield".

According to Dornelas (2001), the entrepreneur is that individual who creates a business in the opportunities that appear, assuming possible risks that that enterprise has of failing.

In Brazil, entrepreneurship is strongly present and there are thousands of microentrepreneurs spread across the country, and in a great diversity of business activities.

Data from SEBRAE (2014) indicate that small businesses correspond to more than a quarter of Brazil's Gross Domestic Product (GDP). Together, the approximately 9 million Brazilian micro and micro companies represent 27% of the GDP, a result that has been growing every year.

MEI (INDIVIDUAL MICROENTREPRENEUR)

In 2006, the federal government created complementary law 123, with the objective of making the entrepreneur of a small business have less bureaucracy and that the opening of new companies is easier. But with opportunities appearing for the microentrepreneur, complementary law 123 of 2006, needed to have changes in 2008, with complementary law No. 128 of 2008, which made changes in relation to micro and micro enterprises, from then on the figure of the individual microentrepreneur – MEI began to emerge. Through (LC No. 128/08) informal workers will be able to legalize their businesses and thus have the right to become a legalized entrepreneur, being able to enjoy the benefits of being MEI.

The advantage of formalizing your business through MEI are many, among them are the absence of bureaucracy, zero fees in the company's registration, reduced tax burden, facilities for doing business with the government, in addition to having Sebrae's consultancy.

The service provided by Sebrae is undoubtedly very important to individual microentrepreneurs, as it offers full support in the formalization and organization of microentrepreneurs. In addition, Sebrae offers lectures and courses to MEIs related to planning, organization, customer service, are services created for small businesses to develop in the market.

The individual microentrepreneur also has the advantage of being exempt from several federal taxes such as: income tax, PIS, IPI, Confins. Paying only a fee of an amount fixed according to the current minimum wage for the INSS and ISS. In this way, the individual microentrepreneur will have rights like any other worker, such as sickness and maternity benefits.

ME (MICRO-ENTERPRISES)

Microenterprises (SMs) play a crucial role in the global economy, representing a significant source of innovation, job creation, and economic development. According to the Brazilian Micro and Small Business Support Service (SEBRAE), micro-enterprises are defined as those that have annual gross revenues of up to R$ 360,000.00 and employ up to nine people in the trade and services sector, or up to 19 people in industry. (SEBRAE, 2021)

Microenterprises account for a sizable share of employment and income in many economies. For example, in Brazil, MEs correspond to about 99% of the total number of companies, employing more than 16 million people and accounting for 27% of the national Gross Domestic Product (GDP) (IBGE, 2023). This importance is reflected in several public policies aimed at supporting and developing microenterprises, including facilitated credit programs, business training, and tax incentives.

In recent years, digital transformation has been a determining factor for the competitiveness of micro-enterprises. The adoption of digital technologies, such as e-commerce, digital marketing, and integrated management systems, has allowed these companies to increase their operational efficiency and reach new markets (OECD, 2022). The COVID-19 pandemic has further accelerated this process, forcing many EMs to adapt quickly to new market conditions. Studies indicate that micro-enterprises that invested in digitalization showed greater resilience during the pandemic crisis, demonstrating growth in online sales and an expanded capacity for customer retention (McKinsey; Company, 2021).

Despite the opportunities, micro-enterprises face significant challenges. Among the main obstacles are limited access to credit, the high tax burden, and excessive bureaucracy. In addition, inadequate management and lack of strategic planning are

frequent barriers that affect the sustainability of these companies (World Bank, 2023). To mitigate these challenges, initiatives such as the National Program to Support Micro and Small Businesses (PRONAMPE) have been essential, offering lines of credit with more favorable conditions and technical support for business management (Federal Government, 2022).

In conclusion, micro-enterprises are key to economic and social development, promoting innovation and job creation. However, for these companies to reach their full potential, a favorable business environment is needed, with public policies that facilitate access to credit, reduce bureaucracy, and promote business training. The continuity of government support and the integration of digital technologies are key elements for the sustainability and growth of microenterprises in the contemporary economic scenario.

ACCOUNTING

Accounting emerged from the moment that man began to have the need to control and register his assets. According to Iudícibus (2004), the first records of accounting appeared a long time ago, historians discovered that accounting appeared in the counts of hunting and fishing of ancient peoples. So we see how important accounting was to ancient peoples and how much it continues to be today.

In Brazil, accounting appeared in the colonial era and adapted according to the development of society that was taking place. This development of Brazilian society made accounting play an important role, because in this period began for example the circulation of paper money, the growth of production in coffee and sugar farms, the extraction of minerals and with such circulation of wealth the government needed to start controlling and buying taxes related to these activities.

The field of application of Accounting is that of the economic-administrative entities, to which it provides essential collaboration, not only for their good administration, but even for their very existence, because without the control and information provided by accounting it would not be possible for such entities to achieve their objectives, whether economic, social or economic-social (Franco, 2009).

According to Marion (2009), accounting is very important for a company, whether small or large, because accounting provides tools that help in the development of the company and companies that do not use this accounting support often end up going bankrupt.

MANAGEMENT ACCOUNTING

Management accounting has as its main focus to provide financial and administrative information of companies for the decision-making of their administrators, unlike financial accounting which has as its main objective to provide information to the external public, management accounting follows the opposite path, its main objective is to provide relevant information to its internal users of companies so that they have mapped all the information, and, thus, have the possibility to make the best decisions for the development and growth of the business.

Management accounting is the process of providing managers and employees of an organization with relevant information, both financial and non-financial, to make decisions, allocate resources, monitor, evaluate, and reward performance. (Atkinson, *et al.*, 2012). Among the main characteristics of management accounting are analysis, identification, accumulation, measurement, preparation, interpretation and communication of the company's financial and operational information.

Nowadays, companies use management accounting through integrated information systems, which can have access to all information related to the operation of the business and store it in banks, thus making this information collected, generate efficient and clear reports to support the decisions of their managers.

Management accounting, therefore, plays a very important role within organizations, as it helps to implement strategies, manage risks, and gain a competitive advantage in the market.

ACCOUNTING AS A TOOL FOR THE MICRO-ENTREPRENEUR

Accounting plays a very important role for the microentrepreneur, because through the information generated by the accountant in a detailed and clear way, the microentrepreneur can make safe and reliable decisions about his business. The basic function of the accountant is to produce useful information for Accounting users for decision making. We emphasize, however, that, in our country, in some segments of our economy, especially in small companies, the accountant's function has been distorted, being focused exclusively on satisfying the requirements of the tax authorities (Marion, 2009).

The partnership between the singer and the microentrepreneur is very important, as it is through it that the accounting professional will be able to provide all the advice that the MEI will need during the management of his business and thus provide the growth of the company. Accounting is the great instrument that helps the administration to make decisions. In fact, it collects all economic data, measuring them monetarily, recording them

and summarizing them in the form of reports or communications, which contribute greatly to decision-making (Marion, 1988).

It is unfortunate that there are still many microentrepreneurs who use accounting only as an instrument for complying with tax obligations. It can be very useful for the development of the company.

METHODOLOGY

RESEARCH CLASSIFICATION

This research is classified as descriptive and qualitative. The main objective of descriptive research is to describe the characteristics of a phenomenon or a specific population, providing a detailed and accurate view of the topic in question (Gil, 2019). The qualitative study, in turn, seeks to understand the meanings and interpretations of the participants in relation to the accounting practices adopted, offering an in-depth analysis that goes beyond the numbers, exploring the perceptions, attitudes and experiences of microentrepreneurs (Creswell, 2014).

The literature review will be used as a basis to theoretically support the study, analyzing articles, magazines and websites that address the topic of accounting in microenterprises. The literature review will allow the identification of gaps in existing knowledge and will provide support for subsequent analyses and discussions (Silva; Menezes, 2018).

DEFINITION OF THE UNIVERSE AND SAMPLE SELECTION

The universe of the research consists of microentrepreneurs from different business branches in the city of Humaitá, Amazonas. The sample will be composed of microentrepreneurs representing various sectors, such as commerce, services, and industry, ensuring a comprehensive view of accounting practices in the region. The sample selection will be carried out through non-probabilistic sampling, using the convenience sampling technique, which allows the selection of participants who are available and willing to collaborate with the research (Malhotra, 2018).

The sample is expected to include micro-enterprises of different sizes and stages of development, which will provide a more complete understanding of the accounting practices adopted and the challenges faced.

DATA COLLECTION INSTRUMENT(S)

Data will be collected through the application of a structured questionnaire, consisting of 10 questions related to the research theme. The questionnaire will be applied directly to microentrepreneurs in the city of Humaitá, Amazonas, and will be prepared based on previous studies, adapted to the local context. The questions will address topics such as the use of accounting practices, the perception of the importance of accounting, and the challenges faced in implementing these practices.

In addition to the questionnaire, a semi-structured interview may be conducted with some selected microentrepreneurs, with the aim of deepening the understanding of the data collected and exploring emerging themes that may arise during the research (Yin, 2016).

DATA PROCESSING AND DATA ANALYSIS

The collected data will be analyzed in a descriptive way, using qualitative and quantitative analysis techniques. The answers to the questionnaires will be compiled and organized in spreadsheets, facilitating the analysis through graphs and tables that will illustrate the main findings of the research (Miles; Huberman; Saldaña, 2014). The qualitative analysis will be carried out through categorization and coding of the answers, identifying recurring patterns and themes that can offer insights into accounting practices in microenterprises in Humaitá (Bardin, 2016).

The combination of these techniques will allow for a comprehensive analysis, which not only quantifies the data but also explores the nuances and complexities of accounting practices in the context of micro-enterprises.

RESULTS AND DISCUSSIONS

This research analyzed the importance of accounting practices as a strategic tool for the sustainability of microenterprises in Humaitá, Amazonas. The results of the research confirmed the hypothesis, evidencing a positive correlation between the effective implementation of accounting practices and the financial performance of the microenterprises analyzed in Humaitá. The data collected showed that companies that adopt more efficient accounting practices have more solid financial indicators and greater ability to adapt to market changes.

The survey also revealed that the main challenges faced by microenterprises in Humaitá in implementing effective accounting practices are related to the lack of technical

knowledge, difficulty in accessing qualified professionals, high costs of accounting services, and lack of a business culture focused on financial management.

It is important to highlight that this study has limitations, such as [citing the limitations of the research, such as:] the sample size, the geographic coverage restricted to one municipality, and the qualitative nature of the data. Thus, it is suggested that future research explore the topic in more depth, expanding the sample to other municipalities, using quantitative methods to complement qualitative data, and conducting longitudinal studies to monitor the evolution of accounting practices and their long-term impact.

Despite the limitations, this study contributes to the debate on the importance of accounting practices for the sustainability of microenterprises, especially in the Amazonian context. The conclusions of the research can support the formulation of public policies aimed at strengthening the financial management of microenterprises in Humaitá, such as the creation of training programs in accounting management, the facilitation of access to credit and the promotion of tax incentives for companies that invest in accounting services. It is hoped that this study will encourage further debate and research on the subject, contributing to the economic and social development of the region.

The research was carried out in the city of Humaitá/AM, with 4 microentrepreneurs who made themselves available to participate in the research. The survey is structured in five sections: entrepreneur profile, establishment data, information used in the management of activities and the use of accounting in the business. The data from this survey was collected through a questionnaire prepared on Google Forms, and through the answers provided we have valuable insights into the practices and challenges that local microentrepreneurs face.

ENTREPRENEUR PROFILE

In this section, the profile of the interviewees is presented, which was drawn through 5 specific questions. The first question shows the gender of the participants. The survey showed that 75% of respondents were women and 25% are men. This data shows the gender distribution among the microentrepreneurs in the survey. Next, the age of the interviewees was analyzed, which ranged from 18 to 54 years. The highest concentration is in the age group between 35 and 44 years, as shown in Graph 2.

Regarding marital status, the survey showed that all participants 100% identified themselves as single. Regarding the level of education, the survey indicated that 75% of entrepreneurs have completed higher education, followed by 25% with complete high school. This data is important to understand the academic background of the participants.

Finally, the time of operation of microentrepreneurs in their activities was analyzed. Most 50% have been working for 1 to 5 years, another part 25% have been in the market for 6 to 10 years and another 25% have been working for more than 15 years.

ENTERPRISE DATA

In this section, the results of the seven questions asked to microentrepreneurs are presented, which help to understand the characteristics of their businesses and the relationship with the status of Individual Microentrepreneur (MEI).

The first question addressed the time of formalization of the interviewees as MEI. The survey showed that 50% of the microentrepreneurs in the survey have been formalized for less than a year, while 50% have been formalized for more than four years. The survey also asked how entrepreneurs found out about the MEI. Most of the interviewees 75% learned about it through Sebrae, while the other 25% found out about it through the internet.

The survey also showed the reasons that made respondents become entrepreneurs. The most cited reason was related to financial independence with 50%, followed by Unemployment and Owning one's own business, both with 25%.

The survey also analyzed what is the main activity of the business, the results indicate that 75% of the entrepreneurs in this survey are in the commerce sector and another 25% in the service sector. Table 1 summarizes the core business activities.

Another issue addressed was participation in training. The survey showed that 75% of microentrepreneurs have already participated in some type of qualification for their activities. The interviewees were asked which bodies or entities provide or offer some type of training related to entrepreneurship, most of the interviewees mentioned Sebrae (75%) and others (25%).

Table 1 – Activity Performed by the Entrepreneur

Activities Developed by Entrepreneurs
Motorcycle courier
Clothing
Sale of optical products, frames, sunglasses and lenses
Confectionery

Source: Author, 2024.

INFORMATION USED IN THE MANAGEMENT OF ACTIVITIES

In this topic, the results of the questions asked to the interviewed microentrepreneurs are presented, which shows how they control the information related to the activities of their business. The first question sought to analyze whether entrepreneurs maintain any kind of

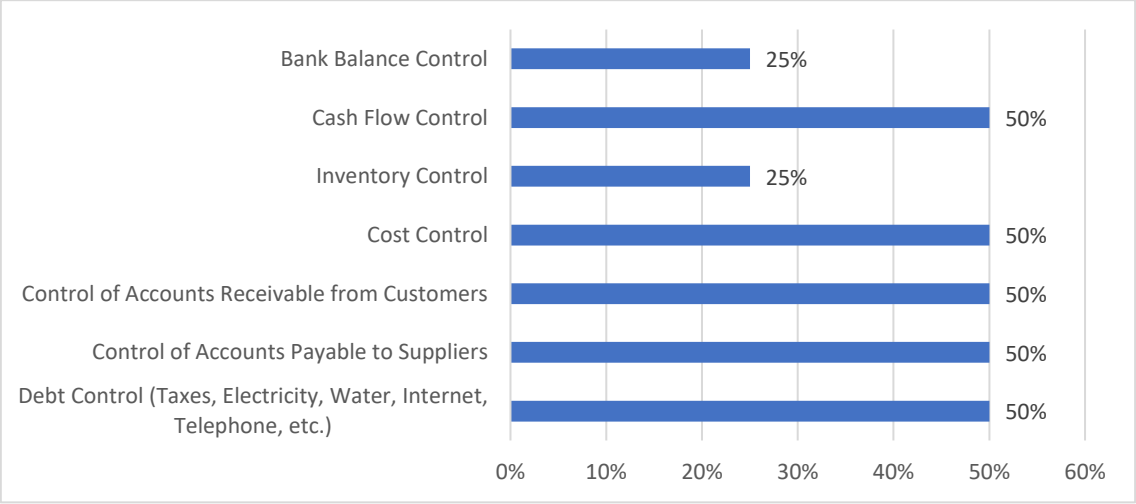
control over information related to their business activities. All survey respondents said yes, indicating that they have some control over the operations carried out in their businesses.

The second question explored how this control is carried out. The answers varied between manual and digital methods, with 25% using management systems, 25% using notebooks, and 50% using other control methods.

Regarding the types of information used to maintain this control, the interviewees were able to select multiple options available in the questionnaire, including cash flow control, control of accounts payable to suppliers, control of accounts receivable from customers, etc. In Graph 01 it is possible to analyze the frequency of each type of information used.

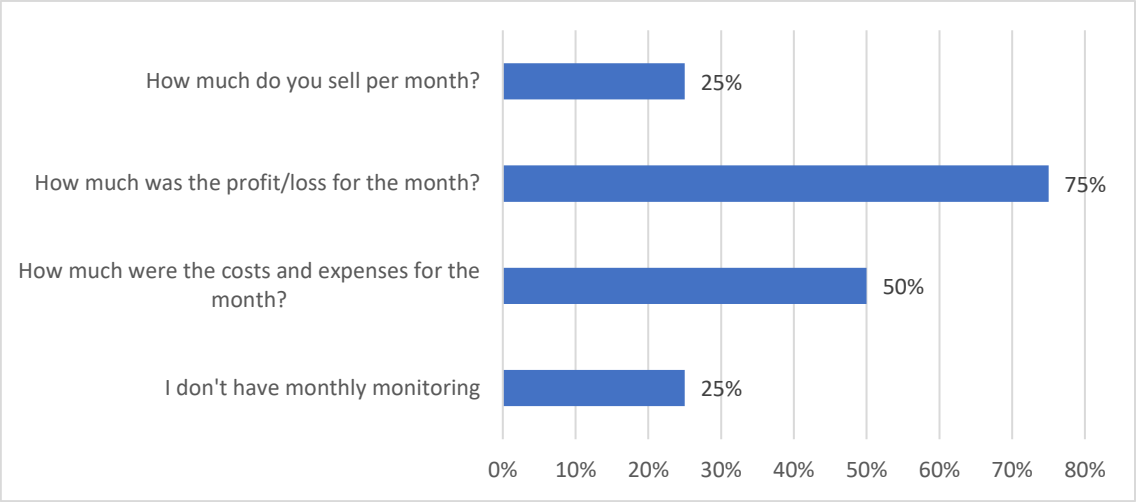
The entrepreneurs were also asked about their knowledge of management practices aimed at the development of productive activities. The survey revealed that everyone has knowledge about something related to the development of their activities such as how much they sell per month, how much was the profit or monthly loss, etc.

Graph 01 - Types of Information Used for Control



Source: Author, 2024.

Graph 2 - Knowledge about Activity Management



Source: Author, 2024.

One of the questions analyzed whether the interviewees face difficulties in conducting their business. The majority 75% answered yes, another 25% said they do not have any type of difficulty in conducting their business. Then, the main difficulties they face were specified, such as lack of capital, tax burden, etc. The survey also addressed whether entrepreneurs know the cost of each activity they develop and how they form the sale price. The results showed that 50% have a clear understanding of the costs and the other 50% are clear about their costs to develop their activities.

Another point analyzed in the survey was how microentrepreneurs form the sale price of their products or services, and the result was unanimous: 100% form their prices based on the cost of the product or service. In addition, it was investigated whether respondents separate their personal expenses from their business expenses. All respondents (100%) stated that yes, their personal expenses do not mix with those of the company.

Finally, the entrepreneurs were asked what they consider important for the growth of their companies. The answers varied between management system with 75% and marketing and advertising with 25%. The survey also addressed whether respondents know whether the company operated with profit or loss at the end of each month and 50% say they know, the other 50% do not know.

USE OF ACCOUNTING IN BUSINESS

In this last section, we present the results obtained from the seven questions asked to the interviewed microentrepreneurs, which analyzes the use and perception of accounting in their businesses. The first question investigated whether entrepreneurs use the services of an accounting professional. The answers were balanced: 50% answered

yes, indicating that there is a demand for accounting services, while the other 50% of respondents answered that they do not use accounting services.

Respondents who use the services of an accounting professional were asked what type of accounting service is used. The answers ranged from advice on tax obligations to assistance in decision-making. The survey also asked respondents if they use accounting for the administration and control of their company. One part (50%) answered yes, while the other part (50%) answered no. Also, it was asked who is responsible for accounting in the company. The answers varied between the owner (50%), accounting firm and employee (25% each). When asked if they thought it was necessary to have accounting in their companies, the majority (75%) answered yes, another 25% answered no.

The survey asked what was the opinion of the interviewees about the purpose for which the MEI seeks accounting, the answers indicated that microentrepreneurs seek an accountant mainly in situations involving tax and tax issues.

Table 2 - Purpose of Accounting for MEI

What purpose does the MEI go in search of accounting?
Profit control
Tax and Fiscal Costs
Pay income tax
I don't know

Source: Author, 2024.

Lastly, entrepreneurs were asked about the outlook for their companies in a short 5-year term. The answers ranged from growth, increased sales, and stability.

Table 3 - Outlook for the Company in the Next 5 Years

What is your perspective for your company in a short period of 5 years?
Maintain my business
Higher revenue
Growth
Be producing and selling 100%

Source: Author, 2024.

CONCLUSION

The financial performance of micro-enterprises in the municipality of Humaitá, in Amazonas, is positively related to an effective execution, with the presentation of concrete financial indicators and, above all, adapted to market changes. It is true that it lacks access to professionals with proven qualification through accounting service documents and who have the culture of financial management in the daily life of organizations.

This study had limitations related to the geographical distance from the municipality of Humaitá and a small sample of participants, with eminently qualitative data, it is

necessary to also use quantitative methods for future work in the region, in order to further improve the final result presented.

As a contribution, the study collaborates with the importance of theoretical practices and especially practice of accounting sciences in the Amazonian context, with proposals for idealization and creation of new public policies that foster the sector and the growth of the municipality. With the implementation and creation of accounting training programs, with greater access to credit resources and with tax incentives for the acceptance of accounting services.

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EPIGENETICS OF HUMAN COGNITIVE PERFORMANCE

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ABSTRACT

This article has as its objects of study the epigenetic factors involved in the expression of human cognition and seeks to offer a compilation of scientific knowledge about the epigenetic aspects associated with cognitive manifestation. In the meantime, a literature review was carried out with the collection of 21 articles produced between 2018 and 2024, which present as main findings the facts that, from epigenetic modifications, caused by environmental factors, in the patterns of methylation, acetylation, histones, and miRNA expression, impacts on individual intellectual expression are observed that may be directly or indirectly related to these epigenetic mechanisms or to neurological pathologies such as Alzheimer's. Therefore, with the understanding of these cognitive factors, there is the core for research on therapies aimed at cognitive maintenance with aging.

Keywords: Neurogenetics. Epigenetics. Cognition.

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INTRODUCTION

Epigenetics, understood as the study of hereditary modifications in gene expression that do not involve changes in the DNA sequence, has emerged as a fundamental field in understanding the biological processes that modulate human cognitive development. As we progress in investigating the complex mechanisms that govern brain function, epigenetics proves to be a crucial element in elucidating how environmental, behavioral, and social factors interact with the genetic basis to influence cognition.

Epigenetic influences affect critical neurobiological processes, such as neuroplasticity, which allows the nervous system to reorganize its connections in response to experiences. Epigenetic modifications, including DNA methylation and histone acetylation/deacetylation, are essential in regulating gene expression related to cognitive functions such as memory, attention, and learning. Exogenous factors, such as stress, diet, physical activity, and pollutants, can induce epigenetic changes that impact the central nervous system (HARMAN and MARTÍN, 2020). Understanding these interactions is crucial to developing effective interventions that address the various facets of cognitive development.

Critical periods of development, such as childhood and adolescence, are particularly vulnerable to epigenetic influences. During these phases, the brain is in a state of high plasticity, where lived experiences can induce lasting effects.

In addition, other studies raise questions about childhood adversities, such as care deprivation, unfavorable environments, and chronic stress, tend to result in methylation patterns that impact long-term cognitive ability (OH and JERMAN, 2018). Children exposed to adverse conditions often have epigenetic alterations that affect the regulation of the hypothalamic-pituitary-adrenal (HPA) axis and emotional response, leading to difficulties not only in learning, but also in the formation of social bonds and the regulation of behaviors. Research on the impact of childhood adversity on epigenetics suggests that traumatic experiences can leave lasting marks on the epigenetic profile, perpetuating a cycle of disadvantage that can span generations.

In the context of human aging, factors such as loneliness and mental health have often been associated with epigenetic changes that affect cognition (BOWIRRAT and ELMAN, 2023). Studies indicate that loneliness can induce a chronic inflammatory state which, in turn, alters the DNA methylation pattern, negatively impacting cognitive functions in elderly populations. The combination of these factors highlights the complexity of the interaction between aging, mental health, and epigenetics, underscoring the need for integrated approaches to promote healthy aging.

The study is justified by the need to understand the mechanisms of cognitive performance and its modulation. Identifying modifiable factors is essential for preventive and therapeutic interventions, especially in the face of increasing cognitive disorders. Potential contributions include new clinical paradigms to reverse or mitigate negative effects of epigenetic alterations and inform public policies that promote healthy environments, focusing on vulnerable populations such as at-risk children and the elderly.

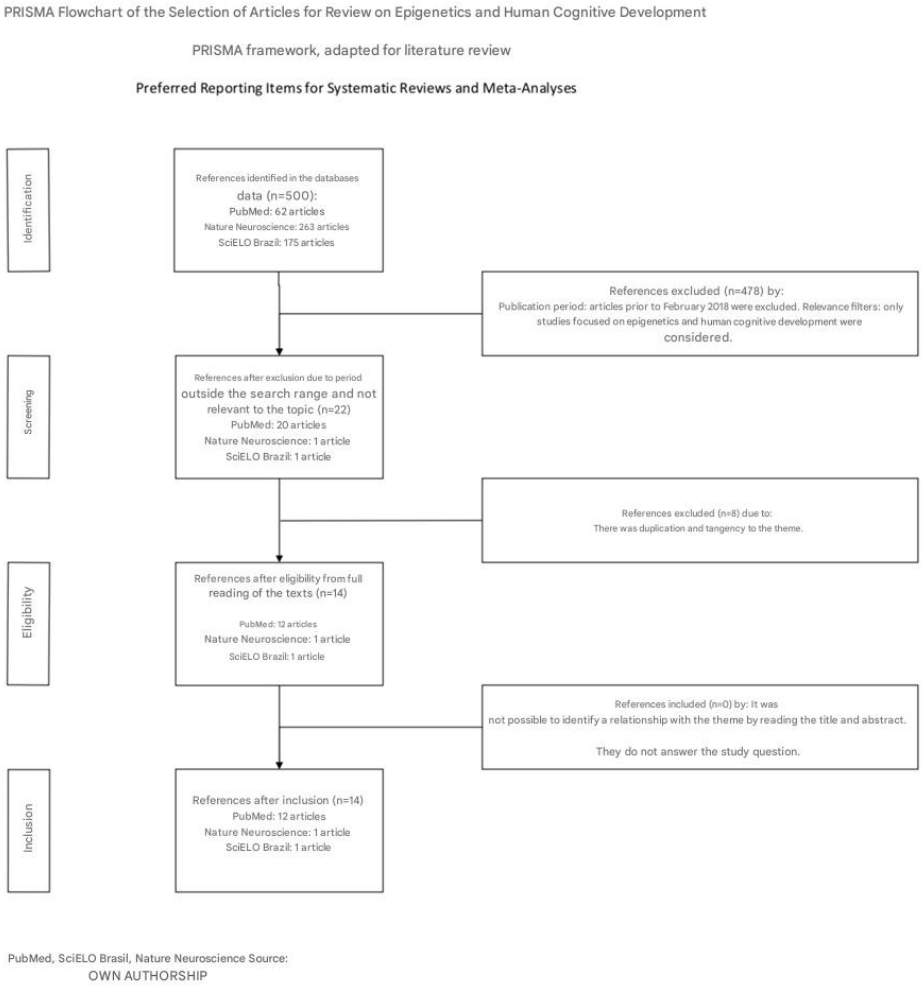
METHODOLOGY

Understanding the theme of epigenetic mechanisms is of paramount importance to investigate the development of human cognition at different levels and in varying intensity. As a result, due to the expressive availability of studies, which serve as support for researchers, those exposed on epigenetics requested an in-depth search in digital supports of technical and methodological rigor. Thus, searches were carried out that could effectively contribute to an answer to the theme "Epigenetics of human cognitive performance", based on the full reading of the selected materials with full inclusion and exclusion criteria, in order to review such recent contents in the field of science, with clear and objective files, for an adequate organization of the key points and main discussions, moving towards the writing of the article in the form of a literature review.

Based on the appropriate design, the scientific bases for the research were then defined, namely: PUBMED, SCIELO BRASIL and NATURE NEUROSCIENCE. This search was mostly guided by recent articles, in evident and renowned sources of knowledge propagation that corroborate the veracity of the information and generate reliability in the study. Thus, the studies that were analyzed are included in the period from February 2018 to August 2024, indicating an exclusion criterion for those that precede this interval. Finally, the files of each stage of each of the analyzed productions were of paramount relevance for the absorption of the content and direction for the writing of the article itself, obeying the specificities of each topic.

In following this plan, the search terms "epigenetic", "cognitive development" were used. To aid the research, Boolean terms were added, namely: AND and OR. With this, the research was carried out and a total of 500 studies were found in all data sources, and initially, only 22 of them were considered adequate for review. In the PUBMED data source, 62 results were found, and 20 results were chosen. On the NATURE SCIENCE platform, 263 studies were identified, and only 1 was considered viable to complement the study, as well as in SCIELO BRASIL, which found 175 articles, but only 1 was added to the review. After the stricter application of the flowchart, duplicity and tangency to the theme were

found, which caused the exclusion of 8 articles, thus leaving a total of 14 works, 12 from PUBMED, 1 from NATURE SCIENCE and 1 from SCIELO BRASIL. Among these texts are scientific articles, dissertations, reports and literature reviews.



Source: The author

RESULTS

The results of this study highlight a strong connection between epigenetic mechanisms and cognitive development across the lifespan, emphasizing how these molecular changes impact gene expression in brain cells. One of the most relevant processes is DNA methylation, particularly in CpG dinucleotides, since older neuronal cells have higher rates of Egr1 methylation. In addition, with the determination of methyloma, it was found that with aging, there is a displacement of the sites of methylation in the gene bodies and, therefore, hypermethylation of certain areas and hypomethylation of others occur and, consequently, the dysregulation of gene expression responsible for cognitive functions occurs. It is also worth noting that the alterations in DNA methylation patterns depend on the genomic region analyzed, the amount of CpG dinucleotide islands present in

the studied region and the target gene of data collection. It is also essential to highlight that enzymes known as DNA methyltransferases (DNMTs), including DNMT1, DNMT3A, and DNMT3B, are involved in this process and undergo significant modifications as the brain ages, influencing the expression of genes essential for cognitive functions (Harman and Martín, 2019).

It is essential to understand the factors that shape human cognition from childhood onwards due to the intrinsic relationship between childhood IQ and individual health in adult life, given that the cognitive level during the first years of life can influence, at an older age, behavioral choices such as smoking and alcoholism, at an individual socioeconomic level, and at the manifestation of genetic predispositions aimed at intellectual performance (STARR, 2019). In addition, it is observed that individuals exposed to troubled and unstable daily environments during their childhood tend to present changes in physiological and neuropathological mechanisms and, thus, alter their epigenetic ages. Thus, there is a scenario of divergence between the biological age and the epigenetic age of these individuals, who, due to this context, tend to present deficits in their cognitive expressions during adult life (FELT et al., 2023). It is also worth noting that studies have found that, based on the analysis of data collected by Enlow et al, Strathearn et al, and Richards and Wadsworth, individuals exposed to traumatic experiences between 0 and 24 months of life presented deficits in cognitive performance between the ages of 24 and 96 months, that maltreatment in the first years of life has repercussions on individual intellectual performance, and that children who have gone through traumatic events such as death of one of the parents or the divorce of the parents tend to have a lower intellectual performance between 8 and 15 years of age (OH et al., 2018).

Modifications to histones, proteins that help structure DNA, also play a crucial role in regulating genes. With aging, the acetylation of histones in genes linked to memory decreases, compromising their expression. This phenomenon is associated with increased activity of enzymes such as histone deacetylase 2 (HDAC2), which has been linked to a negative impact on memory and brain plasticity (Singh & Thakur, 2018). In addition, oxidative stress has been pointed out as a factor that accelerates brain aging and causes DNA damage, impacting neuronal function (STARR, 2019).

Another relevant point is the performance of microRNAs, which regulate protein synthesis in the brain. Changes in microRNA levels with aging influence the brain's ability to adapt to new stimuli and maintain proper cognitive functions (Mohammed et al., 2019). These microRNAs are related to genes that control neural plasticity and the formation of new synapses, which are vital for memory and learning.

It is also important to highlight that several genes are responsible for brain development through the phenotypic expression of processes such as neurulation, neurogenesis, neuronal development, and the development of synapse circuits. In the meantime, genes ARHGAP11B, CROCCP2, DUF1220, FZD8, ZNF558, TMEM14B, TKTL1a, TBC1D3, PPP1R17 and PDGF, NOTCH2NL, CBLN2, EPHA7, FOXP2a, OSTN, PLXNA1, and SRGAP2C (ZHOU et al., 2024) are associated with these neurological processes and, based on this, environmental factors can trigger epigenetic changes that affect the expression of genes related to neurological diseases such as microcephaly and Alzheimer's through gene alteration and increase vulnerability to psychiatric disorders such as anxiety, depression, schizophrenia and bipolar disorder (VAN IJZENDOORN et al. 2010). From this, it was found that, among the epigenetic factors related to depression, changes in DNA methylation rates stand out. In this sense, individuals with a confirmed diagnosis of depression had high methylation rates of nuclear receptor subfamily 3 member 1 of group C (NR3C1) and of the solute 6 member 4 carrier family (SLC6A4) and, thus, showed a dysregulation of the stress response of the hypothalamic-pituitary-adrenal axis in addition to an impairment of gene expression that is responsible for regulating the body's response to stress. In addition, it was observed that in the brains of schizophrenic people there are considerable changes in the methylation levels of genes related to neuronal development and dopamine functionality, which have the effect of effecting the schizophrenic condition. Another relevant epigenetic alteration found in the brains of individuals with this pathology is the modification of histone patterns when comparing the epigenomes of individuals with and without the disease (COLITĂ et al., 2024). It is also worth noting that Alzheimer's, responsible for cognitive decline, has, from oxidative stress, a scenario in which a reduction in DNA methylation can be triggered, as a DNA oxidation scenario occurs, which increases the levels of hydroxymethylation mediated by TET enzymes and interferes in the binding between DNA and DNMTs that synthesize the methyl S-adenosylmethionine donor and, therefore, this change in the DNA methylation pattern favors the development of Alzheimer's disease and thus directly affects memory and cognition. It is also worth noting that oxidative stress is an indirect stimulant to H3K9 methylation through stimulation of SIRT1 action, which protects itself from oxidative stress through its increase in mitophagy and autophagy. Thus, SIRT1 stimulates the action of histone methyltransferase, which causes an increase in H3K9me3 rates. (IONESCU-TUCKER and COTMAN, 2021).

DISCUSSION

The results found by this study emphasize the diverse relationships between genetic, epigenetic and environmental mechanisms and their effects on cognitive performance. Among these relationships are the functions of genes in brain development, the influence between the daily environment experienced during childhood and future cognitive performance, the impacts of aging on intellectual functioning, and the role of neurological diseases in the decline of cognitive activity. From this perspective, a strong scientific basis is noticeable that seeks to prove that cognitive performance depends on several factors to be expressed and, based on this, the main epigenogenic factors aimed at intellectual activity and their effects will be discussed.

Several genes are responsible for brain development through the phenotypic expression of processes such as neurulation, neurogenesis, neuronal development, and the development of synapse circuits. In the meantime, genes are related to these brain processes and the development of neurological diseases such as microcephaly and schizophrenia (ZHOU et al., 2024). Thus, it is evident the role played by genes in the constitution of brain mechanisms such as the synthesis of neurons and synaptic circuit mechanisms and that neurogenetic dysregulation is capable of resulting in neurological disorders such as microcephaly and schizophrenia, which directly affect individual cognitive development.

In addition, it was found that there is a strong relationship between environmental stimuli and cognitive performance in memory processing activities and IQ levels, as external factors are capable of increasing the epigenetic age of young individuals and, thus, alter their neuronal DNA methylation mechanisms (FELT et al., 2023). Based on this, it is possible to infer that the experiences lived during childhood are capable of reflecting on individual cognition even during adult life and, thus, the importance of maintaining a family environment and healthy social interaction for ephebes is highlighted so that they can have an adequate intellectual development.

It is also possible to establish a direct relationship between aging and changes in cognitive performance, given that with the advance of biological age, there is a dysregulation of epigenetic mechanisms such as methylation, acetylation, and histone alterations that can lead to a faulty memory and, consequently, in lower intellectual performance (HERMAN and MARTÍN, 2019).

It is essential to understand the fact that dysregulations in brain epigenetic mechanisms lead to damage to neurological functions and, in this bias, there is a scenario conducive to the development of diseases that have the effect of reducing the cognitive

performance of individuals affected by these maladjustments (PEEDICAYIL, 2024). Based on this, given the role of the study of epigenetics in understanding how environmental factors can interfere with gene expression and, therefore, the development of pathologies (COLITĂ et al., 2024), some of the clinical conditions that are related to lower intellectual performance will be addressed. In light of this, Porto et al found that depression can affect individual cognition by promoting a reduction in memory and attention in those affected by this condition (PORTO et al., 2002). Based on this, it was contacted by Colită et al that, among the epigenetic factors aimed at depression, changes in DNA methylation rates stand out and, therefore, there is a scenario conducive to the development of depression and, consequently, to the reduction of intellectual performance (COLITĂ et al., 2024). Regarding bipolar disorder, it has a decline in cognitive activity as a clinical characteristic (MONTEJO et al., 2022). Based on this fact, it is worth noting that the increase in methylation levels in the gene whose function is to encode the dopamine D2 receptor is a prominent epigenetic factor for the occurrence of bipolar disorder and, therefore, there is a decrease in the full reception of dopamine, a reality that has the effect of an instability in individual mood (COLITĂ et al., 2024). With this, one of the epigenetic causes for the occurrence of bipolar disorder is emphasized, a clinical condition that must be understood due to its reflexes in the cognitive sphere.

It is also important to highlight the influences that schizophrenia exerts on cognition, since reduced intellectual performance is characteristic of this disease (MCCUTCHEON et al., 2023). From this perspective, it is observed that in individuals diagnosed with schizophrenia there are alterations in methylation patterns and histone modifications in their brains (COLITĂ et al., 2024). Therefore, the presence of epigenetic modifications that originate psychic pathologies responsible for reducing the cognitive performance of individuals affected by them is clear. Alzheimer's is a neurodegenerative disease that presents, in most confirmed cases, a symptomatic picture characterized by memory lapses and, consequently, a reduction in intellectual performance (KNOPMAN et al., 2021). In the meantime, this clinical condition has a great influence on its development of oxidative stress from physiological aging and, as a result, epigenetic modifications occur that influence cognitive expression (IONESCU-TUCKER and COTMAN, 2021). Therefore, it is evident that these oxidative factors must be scientifically understood in order to be adequately combated in order to avoid a neurodegenerative condition that affects individual cognition.

As this is a literature review, this study was carried out based on the collection of articles whose themes are focused on neurodevelopment, epigenetics and neurogenetics. However, it is important to emphasize that, given the considerable scope of research

focused on genetic factors responsible for human cognition, this study has as its main limitation the fact that it was not possible to address all the research focused on this field, but rather the articles that were judged as most relevant by its authors.

Therefore, in order to review the knowledge related to the epigenetics of cognitive performance, the authors selected the scientific articles judged as more relevant and more coherent to the discussion of this theme and, therefore, other studies focused on this area were not addressed, a fact that can be considered negative and limiting to the study because it may not have analyzed data that are also relevant, however, not found in the data collection for the writing of this article.

From the presentation and discussion of the data emphasized in this article, it is possible to establish that the study of epigenetic mechanisms aimed at human cognition is essential for the understanding of intellectual functioning and, therefore, based on this understanding, it may be possible to develop therapeutic measures for the treatment of neurological diseases that result in cognitive decline. Thus, based on the neurogenetic bases made by this study, it is expected that in the future, they will be used to deepen scientific knowledge about cognition and to develop therapeutic ways to maintain it during all stages of life. In addition, based on what has been discussed in this article, it is possible to observe how several factors, ranging from the genes responsible for neurogenesis to oxidative stress arising from old age, are responsible for the expression of human cognition and intellectuality and that these are the result of several neurogenetic processes and, therefore, this article is fundamental for the compilation of these data through a systematic review to offer an overview of the factors epigenetic responsible for cognition. Thus, this study may serve as a basis for further studies aimed at understanding intellectuality and aimed at developing clinical techniques that ensure, for all age groups, the effective fight against cognitive decline originating from a range of neurodegenerative diseases such as Alzheimer's disease.

CONCLUSION

It was highlighted in the review that DNA methylation and histone modifications, which are some of the epigenetic mechanisms, play essential roles in the development and maintenance of cognitive functions during life. Under this bias, the regulation of processes, such as neuroplasticity, memory, and learning, is carried out through DNA methylation, mediated by DNMTs, which undergoes changes with aging, which mainly affects gene expression in crucial regions, such as the prefrontal cortex and the hippocampus. In addition, histone modifications and HDAC activity, specifically HDAC2, were associated

with memory decline and reduced gene expression in older individuals. Furthermore, microRNAs are essential regulators of protein production and brain adaptation to new stimuli and changes in their levels is directly related to the impact on neuronal plasticity.

It has also been observed that external factors, such as obesity and oxidative stress, are negative influencers of epigenetic regulation, as they can accelerate cognitive decline. In this sense, some evidence cited in the article indicates that therapeutic interventions, such as the inhibition of HDACs, the use of antioxidants, and the modulation of microRNAs, have great potential to reverse these epigenetic modifications and restore cognitive functions, creating ways to prevent and treat neurodegenerative diseases, such as Alzheimer's.

There are several limitations to the study, even though the findings presented provide a detailed insight into the influence of epigenetic factors on cognition. In principle, most of the studies observed are based on animal models, which may limit the generalization of studies to humans, since animal and human systems have different complexities. In addition, small samples are usually used in DNA methylation analysis studies and histone modifications, reducing the statistical robustness and reliability of the results.

Another limitation is that the influence of multifactorial factors, such as diet, stress, and lifestyle, which interact in a complex way with epigenetic modifications, is not yet fully understood, introducing uncertainties about the extent and specificity of these effects. Finally, most research studies epigenetic modifications at specific stages of life, such as child development and aging, which leaves gaps in how these changes accumulate and interact during adulthood.

In the review, important points are analyzed both in the practical and theoretical spheres. In the practical field, detailed knowledge of the influence of epigenetic factors on cognition can bring new ways to prevent the effects of aging and neurodegenerative diseases. As an example, therapies directed to the modulation of enzymes such as HDACs and DNMTs, as well as the regulation of microRNAs, can be developed, in order to restore cognitive function and promote neuroplasticity. It is also noticeable that there is the possibility of reversing epigenetic alterations through HDAC inhibitors and antioxidants, thus opening new hopes for preventive and therapeutic treatments in elderly populations or those at risk of cognitive decline.

On the other hand, from a theoretical point of view, during the review it becomes clear that epigenetics plays a central role in the interaction between exogenous factors and gene expression, which shapes brain function and cognition. Thus, in the study, the

theoretical basis on brain plasticity is expanded, making it evident how lifelong experiences, such as stress, diet, and exposure to substances, can influence cognitive performance. Similarly, the relationship between epigenetics and factors, such as oxidative stress and obesity, contributes to a more integrated understanding of the conditions that favor or harm brain health.

Thus, the need for interdisciplinary approaches, which combine molecular biology, neuroscience, psychology and public health, is noticeable, in order to develop programs and policies that promote cognitive well-being during life.

For future studies, it is recommended that they focus on expanding the use of human models, either through advanced cell culture techniques, such as brain organoids, or through clinical studies, which will examine epigenetic modifications at different stages of life. This change would contribute to the improvement of the translation of preclinical findings to clinical practice.

In addition, it is essential that longitudinal studies that follow epigenetic changes over time in diverse populations are carried out. With this change, the understanding of how epigenetic factors accumulate, interact and affect cognitive development during the individual's life would be better understood.

Therefore, epigenetics not only provides information about how the environment shapes gene expression, but also contributes to the development of new approaches to prevention and treatment of neurodegenerative diseases of cognitive declines associated with aging. Thus, continuous research and the development of interventions based on these mechanisms have the potential to improve quality of life and well-being in vulnerable populations.

In conclusion, it is imperative that scientists, health professionals, and policymakers recognize the importance of these findings and work together to transform theoretical knowledge into practical actions that benefit society as a whole. Epigenetics, with its modulation and reversal possibilities, represents a promising frontier for promoting healthy and sustainable cognitive development across generations.

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PERINATAL REPERCUSSIONS OF CONGENITAL SYPHILIS IN NEWBORNS FROM A HABITUAL RISK MATERNITY HOSPITAL IN 2020

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ABSTRACT

Objective: To evaluate the perinatal repercussions of newborns (NB) affected by congenital syphilis (CS) in comparison with the profile of NB not exposed in the same period of time. Methodology: This is a historical cohort study carried out through the collection of maternal and neonatal data obtained through the Birth Book of the Municipal Maternity of São Vicente, a habitual risk maternity hospital in the Metropolitan Region of Baixada Santista - São Paulo, during the year 2020. The exposure group was characterized by NB affected by congenital syphilis and the control group by NB not exposed. Results: The exposure group is composed of 45 NB with notified and confirmed CS, and 80% of them have low VDRL titers. In the analysis of maternal variables, 82.22% of the mothers are between 19 years old and under 35 years old; 66.67% had less than 6 prenatal consultations; and only 33.33% had a cesarean section. Neonatal variables show that 75.56% of the NB were born with a gestational age (GA) between 37 weeks and 41 weeks and 6 days. Among the NB analyzed, 28.89% were underweight; 20% were classified as SGA; and of the NB classified as SGA, 55.56% were proportional. In addition, 44.44% had small stature for GA and 26.67% were classified as small PC for GA. Regarding the Apgar score in the 1st minute, 24.44% had scores less than or equal to 7 and 71.11%, between 8 and 10; in the 5th

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minute, 88.89% received a score between 8 and 10. After birth, 73.33% of the NB were sent to rooming-in and 17.78% to the neonatal ICU. Conclusion: The presence of CS was related to a higher incidence of unfavorable neonatal outcomes, when compared to those not exposed, in the variables prematurity, low weight for GA, 1-minute Apgar score less than 7 and referral to the neonatal ICU.

Keywords: Congenital syphilis. Incidence of syphilis. Vertical transmission.

INTRODUCTION

Syphilis is a systemic infectious disease of chronic evolution, with outbreaks of sharpness and latency, caused by the etiological agent *Treponema pallidum*. The main diagnostic strategy for this infection is screening through the *Venereal Disease Research Laboratory Test* (VDRL) and the rapid test (treponemal). Considering that syphilis has sexual and/or vertical (transplacental) transmission, pregnant women are a relevant risk group, because, being infected, they can transmit the disease to their fetuses. In order to perform early diagnosis of gestational syphilis and avoid the installation of congenital syphilis (CS), both screening tests are made available in the primary health care sector for all women in the first and third trimester of pregnancy (FIGUEIREDO et al., 2020).

Treponemic tests should ideally be performed at the first prenatal visit, at the beginning of the third trimester, at the time of delivery or abortion, and in the face of a history of exposure or sexual violence. The positivity of its result indicates the presence of gestational infection, creating the need for compulsory notification2.

Even with simple diagnostic methods and treatment, widely available to the population, congenital syphilis remains a serious public health problem, mainly due to non-adherence, or incomplete adherence to treatment during pregnancy. In addition, if the sexual partner does not receive adequate treatment, the pregnant woman may be reinfected after her treatment, since the presence of previous syphilis does not confer immunity (VESCOVI et al., 2020). In cases without treatment or with inadequate treatment, the incidence of vertical transmission of syphilis is high, and can reach values close to 100%.

However, early diagnosis and timely treatment of the pregnant woman and her partner are highly effective in eradicating maternal infection and reduce the chance of vertical transmission by up to 97% (DOMINGUES et al., 2020).

CS represents the vertical transmission of the etiological agent of the infected, untreated or inadequately treated pregnant woman, with consequent installation of the disease in the fetus. Contagion can occur by hematogenous dissemination to the bloodstream of the fetus, transplacentally – at any time during pregnancy and at any stage of maternal infection –, directly through contact of the newborn (NB) with the birth canal, or during breastfeeding in the presence of a breast lesion. The highest probability of transmission occurs in the primary and secondary stages of maternal infection (CAVALCANTE et al., 2019).

From effective contagion, the etiological agent multiplies throughout the fetal body, especially in the nervous system, lungs, pancreas, bones, mucous membranes, and skin.

Complications depend on the stage of syphilis in the mother, the trimester of pregnancy, and previous maternal treatment (SASS, 2013). In the early stages of pregnancy, a miscarriage or intrauterine fetal growth restriction (FGR) may follow. In subsequent stages, complications such as premature labor and fetal death become more frequent. About 20% of newborns (NBs) are symptomatic, presenting early (< 2 years) and/or late (> 2 years) manifestations (CAVALCANTE et al., 2019).

All children exposed to gestational syphilis – even those born to adequately treated mothers – should receive comprehensive follow-up with VDRL control at 1, 3, 6, 12 and 18 months, and the investigation may be interrupted after two consecutive negative results. In addition, they must be submitted to ophthalmic, audiological, neurological evaluation, among others deemed relevant by the pediatrician in charge. It is also necessary to perform a six-monthly analysis of the cerebrospinal fluid (CSF) in children who had altered it at birth, until the normalization of the parameters examined (proteins, cytology, and VDRL titration) occurs (CAVALCANTE et al., 2019).

This study aims to describe the perinatal repercussions of congenital syphilis in newborns during the year 2020 in a habitual risk maternity hospital in the Metropolitan Region of Baixada Santista (RMBS), in addition to comparing the outcomes and characteristics of these infected newborns with newborns without exposure to syphilis. The analysis of the reported cases of CS allows the recognition of the epidemic at the regional level, a fact that guarantees the importance of strengthening the fight against infection.

METHODOLOGY

This is a historical cohort, carried out from the collection of data from pregnant women and newborns at the Municipal Maternity of São Vicente, a habitual risk maternity hospital located in the RMBS, during the year 2020, in order to identify the perinatal repercussions of CS.

The present study was authorized by the Human Research Ethics Committee (CEPSH) of the Centro Universitário Lusíada (UNILUS), by Plataforma Brasil and by the São Vicente Health Department, and the researchers are responsible for using the collected data exclusively for scientific purposes, ensuring confidentiality of information and no harm to the participants.

NBs from the year 2020 registered in the Maternity Birth Book were included, and cases of miscarriage (gestational age less than 20 weeks or birth weight less than 500 grams) were excluded.

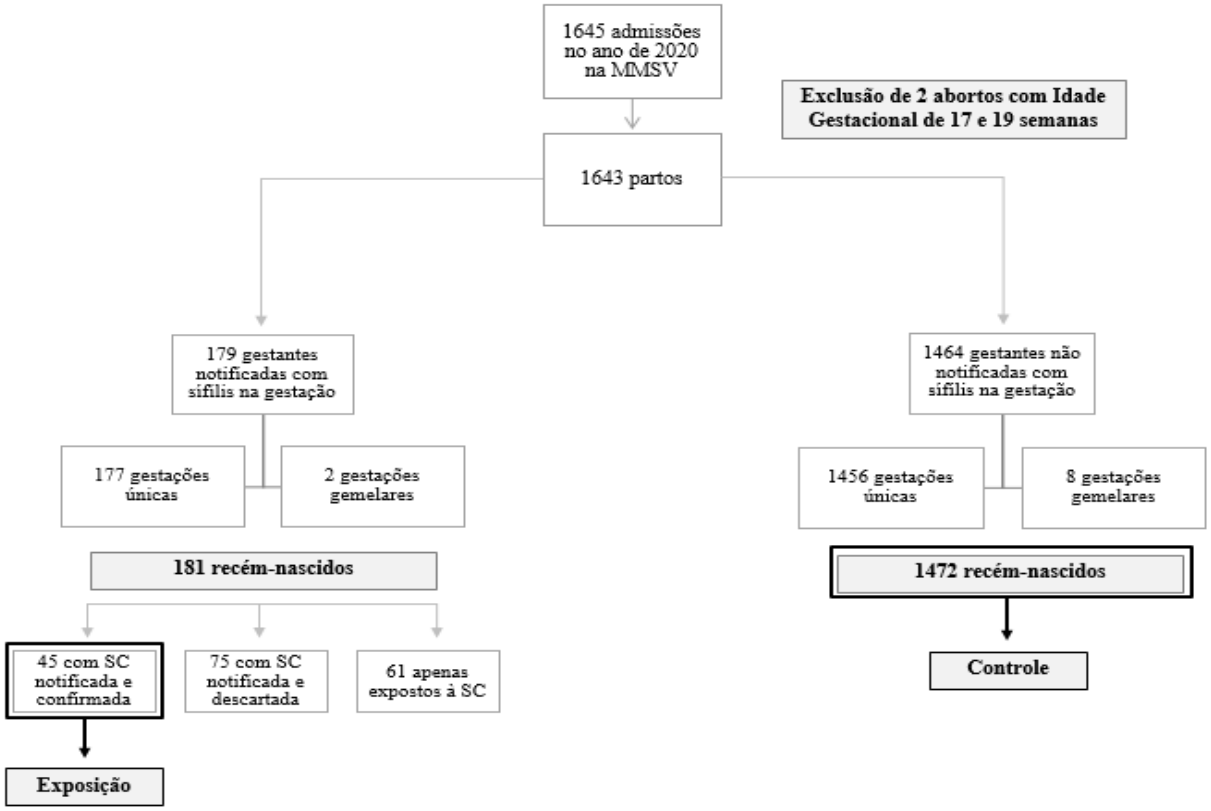
The exposure group was characterized by NBs with confirmed CS, while the control

group consisted of NBs not exposed to CS. According to the Brazilian Ministry of Health (MS) Diagnostic Assessment Flowchart for Suspected CS, newborns with a notified CS classification and discarded or exposed to syphilis were excluded because they did not have a confirmed CS diagnosis.

To confirm the diagnosis of CS, paired VDRL samples from pregnant women reported with syphilis and their respective newborns were analyzed. Thus, a confirmed diagnosis of congenital infection was obtained in the following cases: 1) the mother was adequately treated during the current pregnancy + the child's treponemal test at least two dilutions higher than the maternal one + negative answer to the question "physical examination of the newborn, blood count, cerebrospinal fluid and X-ray of long bones are normal AND is the non-treponemal test non-reactive?"; 2) the mother is adequately treated during the current pregnancy + the child's treponemal test is not at least two dilutions higher than the mother's test + the child's physical examination is not normal + the treponemal test is reactive + negative answer to the question "physical examination of the newborn, blood count, cerebrospinal fluid and X-ray of long bones are normal AND non-treponemal test is non-reactive?"; 3) mother treated inappropriately or not treated during the current pregnancy + negative answer to the question "physical examination of the newborn, blood count, cerebrospinal fluid and X-ray of long bones are normal AND is non-treponemal test non-reactive?" (FLOWCHARTS, 2021).

In 2020, 1645 newborns were identified admitted to the Birth Book of the Municipal Maternity of São Vicente. 2 abortions with GA at 17 and 19 weeks were excluded. 181 NBs were evaluated with suspected CS, 45 of whom were 75 NBs with CS notified and discarded; 61 newborns only exposed to syphilis. Thus, the total sample of the study was composed of 1517 NBs, with the exposure group consisting of 45 NBs with confirmed CS and the control group of 1472 NBs. The sample selection flowchart is summarized in Flowchart 1.

Flow Chart 1: Sample Selection



Source: prepared by the authors

STATISTICAL ANALYSES AND METHODS

For the interpretation of the data, maternal and neonatal variables were identified, both in the control group and in the exposure group. Maternal variables include maternal age group, number of prenatal consultations, type of delivery, and association with some co-infection.

The maternal age group was divided into ≤ 18 years, 19 years to < 35 years, ≥ 35 years, and unknown. The frequency of prenatal care was classified as less than 6 visits and 6 or more visits. As for the type of delivery, it is classified as normal delivery, cesarean delivery, forceps delivery and unknown. Finally, the occurrence of some type of co-infection is related.

Neonatal variables are defined as sex, gestational age (GA) at birth, birth weight, weight for GA, height for GA, head circumference for GA, Apgar score in the 1st minute of life, Apgar score in the 5th minute of life and fate of the NB after birth.

The subclassifications of each of the neonatal variables mentioned are as follows: sex – male, female, and unknown; gestational age – less than 37 weeks, from 37 to 41 weeks and 6 days, 42 weeks or more and unknown; birth weight – low weight, adequate weight, macrosomia and unknown; weight for GA – small (SGA), adequate (AGA), large (LGA) and unknown; , height for GA - small (SGA), adequate (AGA), large (LGA) and

unknown; head circumference for GA – small (SGA), adequate (AGA), large (LGA), and unknown; Apgar score at 1 minute – ≤ 7 points, 8 to 10 points and unknown; Apgar score at 5 minute – ≤ 7 points, 8 to 10 points and unknown; and destination of the NB – infirmary, neonatal ICU, death and unknown.

Statistical analysis of the data was performed based on the calculation of the percentage referring to each identified variable and their respective classifications. In addition, for certain variables, it was possible to calculate the mean and median.

Thus, after the individual analysis of the control and exposure groups, based on the contingency tables, bivariate analysis was performed, using the chi-square test to verify whether there was an association between the variables, that is, to identify possible perinatal repercussions resulting from congenital syphilis infection.

ANALYSIS RESULTS

The control group consists of 1472 newborns not infected and not exposed to syphilis. In this group, 1464 pregnant women not infected by syphilis during pregnancy were counted, of which 1456 had a singleton pregnancy and 8 had a twin pregnancy.

The exposure group consists of 45 newborns with notified and confirmed congenital syphilis. To select the number of this sample, 181 newborns of mothers with syphilis notified during pregnancy were selected. Of these, 75 newborns with notified but discarded congenital syphilis and 61 newborns only exposed to syphilis were later excluded. The incidence of congenital syphilis was then calculated at 2.97% within the population studied.

To confirm the diagnosis of congenital syphilis, paired VDRL samples from pregnant women notified with syphilis and their respective newborns were analyzed. In this analysis, the VDRL presented high titers (greater than or equal to 1:8) in 13.33% of the sample (6 NBs), low titers (less than or equal to 1:4) in 80% (36 NBs) and non-reactive titration in 6.67% (3 NBs). The sample composed of newborns with non-reactive titration was included as a confirmed case of congenital syphilis when, despite the negativity of the VDRL, the NB presented alterations in the physical examination, blood count, cerebrospinal fluid and/or long bone X-ray.

It is noteworthy that, in the exposure group, of the 9 newborns classified as SGA, 55.56% of the sample (5 NBs) represents proportioned SGA (head circumference less than p10) and 44.44% (4 NBs) represents disproportionate SGA (head circumference from p10 to p90).

The analysis of maternal and neonatal variables in the control and exposure groups is available in Tables 1 and 2, respectively.

Table I. Maternal Variables

		Control		Exposure		Chi-square (p)
	Variable	N	%		%	
Age group Maternal	≤ 18 years old	175	11,95	6	13,33	
	19 to < 35 years old	1052	71,86	37	82,22	
	≥ 35 years old	218	14,89	2	4,44	
	Unknown	19	1,30	0	00,00	
	Total	1464	100	45	100	0,20605
	Average	26,37		23,93		
	Median	25		23		
Inquiries prenatal	Less than 6	497	33,95	30	66,67	
	6 or more	967	66,05	15	33,33	
	Total	1464	100	45	100	0,00001*
Type of delivery	Normal delivery	787	53,76	30	66,67	
	Cesarean delivery	672	45,90	15	33,33	
	Forceps delivery	1	0,07	0	00,00	
	Unknown	4	0,27	0	00,00	
	Total	1464	100	45	100	0,38972
Coinfection	No coinfection	1456	99,45	44	97,78	
	HIV	8	0,55	1	2,22	
	Total	1464	100	45	100	0,15042

**: Crosses with significance.* Source: Prepared by the authors

Table II. Neonatal Variables

		Control		Exposure		Chi-squared (p)
	Variable	N	%	N	%	
Sex	Male	756	51,36	25	55,56	
	Female	709	48,17	20	44,44	
	Unknown	7	0,48	0	00,00	
	Total	1472	100	45	100	0,78301
Gestational age	Under 37 without	150	10,19	8	17,78	
	37 a 41 sem 6/7	1236	83,97	34	75,56	
	42 without or more	5	0,34	0	00,00	
	Unknown	81	5,50	3	6,67	
	Total	1472	100	45	100	0,38514
	Average	38,42		38,02		
	Median	39		39		
Birth weight	Low weight	179	12,16	13	28,89	
	Suitable weight	1230	83,56	30	66,67	
	Macrosomia	60	4,08	2	4,44	
	Unknown	3	0,20	0	00,00	
	Total	1472	100	45	100	0,01039*
	Average	3119,64		2871,64		
	Median	3190		2910		
Weight for IG1	PIG2	115	7,81	9	20,00	
	AIG3	1088	73,91	29	64,44	
	GIG4	180	12,23	4	8,89	
	Unknown	89	6,05	3	6,67	
	Total	1472	100	45	100	0,03071*
Stature for GI	PIG2	413	28,06	20	44,44	
	AIG3	888	60,33	22	48,89	

	GIG4	66	4,48	0	00,00	
	Unknown	105	7,13	3	6,67	
	Total	1472	100	45	100	0,06904
PC5 to IG	PIG2	178	12,09	12	26,67	
	AIG3	927	62,98	24	53,33	
	GIG4	262	17,80	6	13,33	
	Unknown	105	7,13	3	6,67	
	Total	1472	100	45	100	0,03577*
Apgar 1st minute	≤ 7 points	305	20,72	11	24,44	
	8 to 10 points	1121	76,15	32	71,11	
	Unknown	46	3,13	2	4,44	
	Total	1472	100	45	100	0,71278
	Average	8,05		7,74		
	Median	8		8		
Apgar 5th minute	≤ 7 points	59	4,01	3	6,67	
	8 to 10 points	1367	92,87	40	88,89	
	Unknown	46	3,13	2	4,44	
	Total	1472	100	45	100	0,58571
	Average	8,98		8,84		
	Median	9		9		
Fate of RN6	Infirmary	1054	71,60	33	73,33	
	Neonatal UTI7	140	9,51	8	17,78	
	Death	17	1,15	0	00,00	
	Unknown	261	17,73	4	8,89	
	Total	1472	100	45	100	0,13562

Crossings with significance / 1. GA: gestational age / 2. SGA: small for gestational age / 3. AGA: suitable for gestational age / 4. LGA: large for gestational age / 5. CP: head circumference / 6. NB: newborn / 7. ICU: Intensive Care Unit. Source: Prepared by the authors

DISCUSSION

Comparing the results of the exposure (NBs with confirmed and notified congenital syphilis) and control groups, it can be inferred that the number of prenatal consultations seems to be a risk factor for the diagnosis of CS, since, among the NBs diagnosed with CS in the present study, about 60.67% of the pregnant women had not had sufficient prenatal care, that is, less than 6 consultations during pregnancy. On the other hand, in the group of pregnant women not exposed, these values are inverted and only 33.95% of the sample had insufficient prenatal care. The data found in this study are in line with the study by Vallejo et. al (2016) (VALLEJO et al., 2016), carried out in Colombia, in which it was found that 69% of CS cases did not have adequate prenatal care. (VALLEJO et al., 2016). Another literary review carried out by Saraceni et. al (2017) confirms this data, as it was observed that most women did not receive adequate prenatal care in the six federal units found in the study, namely Amazonas, Ceará, Distrito Federal, Espírito Santo, Rio de Janeiro and Rio Grande do Sul. (SARACENI et al., 2017) However, according to Vescovi et. al (2020), only 11.8% of pregnant women did not receive adequate prenatal care. (VESCOVI et al., 2020)

A lower rate of adherence to treatment is not related to young pregnant women, since only 13.33% of pregnant women with CS were young (< 19 years) and the majority,

82.22%, were between 19 and 35 years old (insignificant results, as they are similar to those of the control group). The most prevalent age group matches the data found in the literature, since, in the study carried out by Qin et. al (2014), the most prevalent age group was pregnant women between 25 and 30 years old (44.1%), followed by the rate in < 25 years old (26.5%). (QIN et al., 2014) In the study by Vescovi et. Al (2020) previously cited, it was found that 65.7% of pregnant women were in the 20-34 age group, a result that confirms the age group pattern of previous studies. (VESCOVI et al., 2020)

Regarding HIV co-infection data, this study showed that the group with syphilis during pregnancy had 2.22% of co-infection while the group without gestational syphilis was 0.55%, corroborating the idea that the presence of a Sexually Transmitted Infection (STI) suggests a risk factor for co-infections. In any case, investigation for other STIs becomes mandatory when diagnosing one of these infections.

Despite the neonatal variables, the group exposed to syphilis had a higher rate of pregnancies with less than 37 weeks of GA, with 17.78%, while in the unexposed group the rate was 10.19%, revealing a higher probability of a newborn in the exposed group being born prematurely, which already represents a risk of higher morbidity and mortality for the newborn. The literary data found regarding prematurity point to a rate of 14.3% Vallejo et. et al (2016)[9] and 11.8% Qin et. al (2014), so the rate found in this study was slightly higher in relation to the other literary findings. (QIN et al., 2014)

When comparing the anthropometric data of the newborns in the control group with the exposure group, it is evident that a newborn exposed to syphilis is at higher risk of being born with low birth weight (28.89% versus 12.16% of those not exposed). Regarding weight-for-gestational age (GA), 20% of the exposure group was SGA versus 7.8% of the control group (data similar to those found in Vallejo et. Al (2016), where 17.9% of the NB were born PIGs). (VALLEJO et al., 2016) The data are also confirmed in relation to height for GA and head circumference (HC) for GA, revealing higher percentages of SGA NBs in the group exposed to the disease, which already guarantees, by itself, vulnerability to the NB.

In addition, the Apgar analysis in both groups suggests that the presence of CS also influences this score. We obtained 20.72% of the NBs with Apgar scores lower than 7 (representing some degree of suffering) in the 1st minute, of the NBs in the control group, compared to 24.44% of the NBs in the group with CS. The increase in the statistic was maintained at the 5th minute, from 4.01% in the control group to 6.67% in the exposure group. Similarly, the mean Apgar score of the 1st and 5th minutes in the study by Mola et. Al had the same difference between the groups, both with statistical significance. (MOLA et al.,

2008)

Finally, regarding the fate of the NB, the results show that CS increases the incidence of admission to the neonatal ICU, since, in the control group, 9.51% of the NBs had to go to the neonatal ICU after delivery, and this number increases considerably to 17.78% in the group of NBs with the disease, which can be explained by the higher incidence of neonatal complications related to CS, such as hepatomegaly, jaundice, meconium obstruction and other intestinal obstructions resulting from syphilitic enteritis, as addressed in the study by Lee et. al (2020). Thus, the previously mentioned study suggests that, in premature newborns, CS may manifest as severe and uncommon neonatal comorbidities, which may result from a combination of syphilitic pathologies or conditions associated with prematurity (multisystem immaturity), which consequently require better neonatal support (ICU), justifying the data obtained in the present study.

Taking into account the limitations of the study, the results show that the presence of CS does not guarantee the positivity of the VDRL test, since 80% of the NBs obtained the non-reactive test, even with the disease. In another study conducted by Gleich et. al (1993), about 61 of the 75 cases of congenital syphilis were VDRL positive, which corroborates the idea that, even with non-reactive VDRL, the NB can have the disease. In addition, data extracted from medical records increase the risk of bias, since different professionals attend, perform anthropometry, and write down the values. (GLEICH et al., 1994)

After the statistical analysis of maternal variables, the number of prenatal consultations showed a significant correlation with the incidence of congenital syphilis infection ($p < 0.05$), inferring that, when performed properly, that is, with 6 or more consultations, prenatal care results in a lower incidence of congenital infection.

In the analysis of newborns, birth weight, weight-for-gestational-age, and head circumference for gestational age were the variables that showed a significant correlation, revealing that, in those exposed to congenital syphilis, there is a higher incidence of low birth weight, in addition to small weight and head circumference for GA.

In the other maternal and neonatal variables, there was no statistical significance in the present study. However, the data collected about the MMSV population in 2020 may serve as a basis for future studies that will prove new correlations, in addition to those already found.

In summary, further studies are needed for further comparative evaluations of the profile of newborns with the pathology addressed in this sapience in order to further statistical findings, since the immediate repercussions are still being studied and compared to control groups. It is hoped that this can be used, as well as the previously mentioned

articles, for further study and comparison with the results found by other researchers.

RESULTS OF THE LITERATURE REVIEW

TABLE 1 – collaboration of each author.

Author	Year	Major Contributions
Vallejo et al.	2016	69% of cases of congenital syphilis (CS) did not have adequate prenatal care (VALLEJO et al., 2016).
Saraceni et al.	2017	It was observed that most women did not receive adequate prenatal care in the six federal units studied (Amazonas, Ceará, Federal District, Espírito Santo, Rio de Janeiro and Rio Grande do Sul) (SARACENI et al., 2017).
Vescovi et al.	2020	Only 11.8% of pregnant women did not receive adequate prenatal care; 65.7% of pregnant women were in the 20-34 age group (VESCOVI et al., 2020).
Qin et al.	2014	The most prevalent age group was pregnant women between 25-30 years old (44.1%), followed by pregnant women under 25 years old (26.5%) (QIN et al., 2014).
Vallejo et al.	2016	Prematurity rate in newborns (NB) with CS was 14.3%; 17.9% of the NB were born SGA (small for gestational age) (VALLEJO et al., 2016).
Qin et al.	2014	Prematurity rate in NB with CS was 11.8% (QIN et al., 2014).
Mola et al.	2008	Apgar scores at the 1st and 5th minutes showed a significant difference between the groups exposed and not exposed to CS (MOLA et al., 2008).
Lee et al.	2020	CS can manifest as severe and uncommon neonatal comorbidities in preterm newborns, requiring intensive neonatal support (ICU) due to complications associated with CS and prematurity (LEE et al., 2020).
Gleich et al.	1994	About 61 of the 75 cases of congenital syphilis were VDRL positive, confirming that even with non-reactive VDRL, the NB can have the disease; data extracted from medical records increase the risk of bias (GLEICH et al., 1994).

SOURCE: prepared by the author himself

CONCLUSION

In the present study, based on data obtained from the Birth Book of the Municipal Maternity Hospital of São Vicente, it was possible to conclude that fetal exposure to syphilis was shown to be related to a higher incidence of unfavorable neonatal outcomes, when compared to newborns not exposed to gestational syphilis.

The maternal-fetal profile found in the MMSV is variable according to the characteristics studied, however, a greater presence of CS was found in children of mothers who did not receive adequate prenatal care. In this way, it becomes possible to reflect on the importance of quality prenatal care, effective in the screening, diagnosis and treatment of maternal diseases that may affect and harm the fetus.

In other words, a greater number of quality antenatal consultations can increase the window of opportunity for early identification and treatment of gestational syphilis, thus preventing vertical transmission and its consequences. In fact, a higher statistical probability of premature birth was found when exposed to syphilis, in addition to being more prevalent in low birth weight for gestational age, 1-minute Apgar score less than 7 and referral to the neonatal ICU at birth.

It is important to emphasize the relevance of an even greater focus on HIV-positive patients who, as demonstrated in the present study, had a higher rate of infection by

gestational syphilis, thus adding two comorbidities that may lead to neonatal complications.

Therefore, it is possible to associate a greater susceptibility to negative outcomes in newborns exposed to syphilis. The present study serves as a basis for further studies in the area to be carried out in order to expand infection control and thus reduce the risks of congenital disease.

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ACUPUNCTURE FOR PAIN CONTROL AMONG BREAST CANCER PATIENTS: AN INTEGRATIVE LITERATURE REVIEW

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ABSTRACT

Introduction: Pain is a frequent symptom among women with breast cancer and acupuncture is a widely used intervention to control the symptoms of the disease and minimize the impact of the adverse effects of cancer treatment. However, the contexts of use and their effectiveness need to be better explored. Objective: To describe the studies that used acupuncture as an intervention for pain control in patients with breast cancer. Method: Integrative literature review. The searches were carried out using the descriptors breast cancer, pain, and acupuncture in the Scientific Electronic Library (SCIELO), National Library of Medicine (PubMed) and Latin American and Caribbean Literature on Health Sciences (LILACS) databases through the Virtual Health Library (VHL) and in the Cumulative Index to Nursing and Allied Health Literature (CINAHL). SCOPUS and Web of Science. To report the integrative review and systematize the inclusion process, the criteria of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses were used. Results: The final sample consisted of 17 studies, grouped into four thematic categories: arthralgia related to aromatase inhibitors (41.2%; n=7); multiple symptoms/complications related to treatment (29.4%; n=5); pain and chronic pain (17.6%; n=3) and (11.8%; n=2) peripheral neuropathy and chemotherapy. The studies were mostly published by Asian countries (64.7%; n=11), mainly in the years 2020 (29.4%) and (23.5%) 2021, by journals related to oncology and complementary/integrative practices. Systematic reviews with meta-analysis accounted for the majority of studies (52.9%; n=9), followed by Randomized Clinical Trials (n=3) and (n=2) pilot studies. Among the instruments for assessing pain, the BPI stood out, used in 70.6%; n=12) of the cases. Most studies (52.9%) used systemic acupuncture alone, 29.4% used systemic acupuncture and auriculotherapy, and two studies (11.8%) used systemic acupuncture and acupressure. In most studies (76.5%; n=13), acupuncture decreased pain (intensity and/or impact and/or mean pain) among women with breast cancer. Conclusion: Although there is no consensus, in most studies, acupuncture decreased pain (intensity and/or impact and/or mean pain and/or worse pain) among patients with breast cancer.

Keywords: Acupuncture Analgesia. Acupuncture. Auricular acupuncture. Electroacupuncture. Breast Neoplasms.

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INTRODUCTION

Breast cancer control is a priority on the Brazilian health agenda (NOVAES *et al*., 2017) and, despite being considered a cancer with a good prognosis, when detected and treated early, mortality rates remain high, since most diagnoses are made in advanced stages of the disease (VALLIM *et al*, 2019), characterizing breast cancer as a serious public health problem (NOVAES et al., 2017; VALLIM *et al*., 2019). It is the first cause of cancer death in the Brazilian female population and the second most prevalent type of cancer among women, with an estimated 73,610 new cases for the 2023-2025 triennium (INCA, 2023).

Among women with breast cancer, pain is a frequent symptom, its prevalence and intensity varies throughout the evolution of the disease, being moderate or intense in 30% of individuals during treatment and between 60% and 90% of those in an advanced stage of the disease (MOURA; GONÇALVES, 2020). It is described as imprecise, painful, frightening or as an unbearable sensation, with episodes of intense sensations, accompanied by difficulties sleeping, irritability, depression, suffering, isolation, hopelessness and helplessness, and its adequate control is a challenge for health services and for the multiprofessional team (RUELA *et al*, 2018). When not properly controlled, pain results in undesirable effects and, despite having received more attention in recent years and being considered a worldwide medical emergency, about 40% to 50% of cancer pain cases still have inadequate relief (RUELA *et al*., 2018).

Pain control can be effective through pharmacological and non-pharmacological measures. Acupuncture is a technique of Traditional Chinese Medicine (TCM) (TAFFAREL; FREITAS, 2009), implemented in Brazil in 1981 and inserted in the Unified Health System (SUS). It consists of inserting needles into specific anatomical points on the body, with the aim of producing a therapeutic or analgesic effect (MENDES *et al*., 2019). It stimulates the sensory fibers of the peripheral nervous system (PNS), triggering an electrical transmission in neurons, which when it reaches the central nervous system (CNS) causes the release of substances such as: endorphins, cortisol, dopamine, serotonin (VALLIM *et al*., 2019). Acupuncture points, when in conditions of imbalance, show higher concentrations of substance P, compared to placebo points, lowering the pain threshold and making these points more sensitive when touched (AZEVEDO *et al*., 2021).

Health services have the possibility of incorporating integrative and complementary health practices (AMADO *et al*., 2017), especially when conventional treatments become limited. The National Policy on Integrative and Complementary Practices (PNPIC) brought guidelines for Traditional Chinese Medicine/Acupuncture, Homeopathy, Medicinal Plants

and Phytotherapy, among others (AMADO *et al*., 2017; NOVAES *et al*., 2017; MENDES *et al*., 2019; VALLIM *et al*., 2019). In this context, new ways of learning and practicing health (JÚNIOR, 2016) in line with the increase in demand resulting from chronic diseases and the costs of health services, dissatisfaction with existing health services, and the resurgence of interest in holistic and preventive care for diseases and treatments that offer quality of life when a cure is not possible, the demand for practices such as acupuncture, homeopathy and phytotherapy in the health system increased from the year 2000 onwards (2018 *apud* TESSER; BROOK; AFONSO, 2020).

Studies evaluating the effect of acupuncture in the oncological context are carried out in the management of symptoms, varying with the type of tumor. Studies on the use of acupuncture in breast cancer are carried out with the aim of controlling the symptoms of the disease and minimizing the impact of the adverse effects of cancer treatment, presenting promising results (NOVAES *et al*., 2017). In this context, PICS are used in association with chemotherapy, surgical treatment, and in clinical cases with a worse prognosis, seeking benefits for patients (MENDES *et al*., 2019).

However, despite many studies showing that acupuncture associated with conventional cancer treatment is effective and well accepted by cancer patients, including patients diagnosed with breast cancer, the contexts of use and the effect of the intervention need to be further explored.

In view of the above, the objective of this integrative review is to describe the characteristics of studies that used acupuncture as an intervention for pain control, as well as the context of use and the effect of the intervention in patients with breast cancer.

METHODOLOGY

It is an integrative review carried out in five stages: definition of the guiding question; elaboration of the inclusion and exclusion criteria of the articles to carry out the search in the databases; critical analysis; presentation of the results and discussion (SOUZA, SILVA, CARVALHO, 2010). The investigation was guided by the question: "What has been produced in relation to the use of acupuncture for pain control in women with breast cancer?"

Articles that met the inclusion criteria were selected: (a) full articles, theses or dissertations, and experience reports; (b) studies published in Portuguese, English or Spanish; (c) with any methodological design, published between 2017 and 2022. Abstracts published in annals of events, editorials, and those not available for access to the full text were excluded.

The searches were carried out between March and May 2022, using the Health Sciences Descriptors (DeCS), *Medical Subject Headings* (MeSH), *Cinahl Heading,* and *Emtree of Embase* by two researchers independently.

The bibliographic survey was carried out with the keywords *breast cancer*, *pain*, and *acupuncture* in the *Scientific Electronic Library* (SCIELO), *National Library of Medicine* (PubMed) and *Latin American and Caribbean Literature on Health Sciences* (LILACS) databases through the Virtual Health Library (VHL) and in the *Cumulative Index to Nursing and Allied Health Literature* (CINAHL), SCOPUS and *Web of Science*.

Along with the descriptors, the terms AND, OR and NOT were used to compose the search keys to be used for searches in the databases.

After the duplicate articles were excluded, 59 potentially eligible articles were identified (Table 1).

Initially, the words contained in the titles, abstracts and descriptors were analyzed. The selected studies that corresponded to the guiding question of this review were read in full and their references were analyzed for additional studies.

After reading the material by two independent evaluators, articles that did not answer the study question and did not meet the eligibility criteria were excluded (n=42; Table 1). Divergences were discussed among the evaluators and consensus was reached.

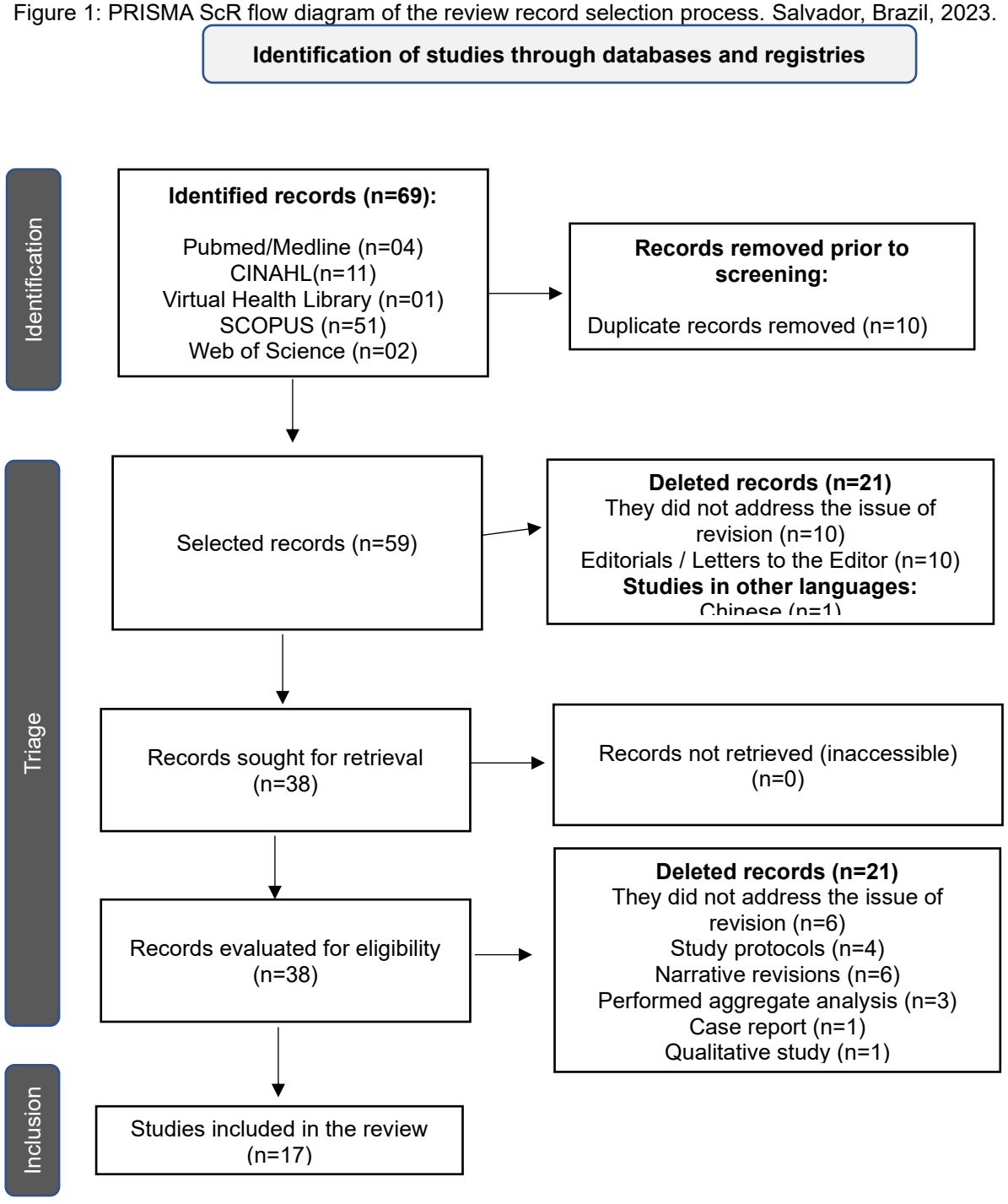
The criteria of the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) were used to report the integrative review and systematize the process of inclusion of studies (Figure 1) (SHAMSEER *et al*, 2015).

Table 1. Distribution of studies, according to the database. Salvador (BA), Brazil, 2023.

Database	Retrieved studies (%)	Repeat studies (%)	Mutually exclusive studies (%)	Excluded studies (%)	Selected studies (%)
BVS	1(1,4)	1 (10,0)	0 (0,0)	0 (0,0)	0 (0,0)
Scopus	51 (73,9)	1 (10,0)	50 (84,7)	35 (83,3)	15 (88,2)
Web of Science	2 (2,9)	2 (20,0)	0 (0,0)	0 (0,0)	0 (0,0)
Cinahl	11 (15,9)	4 (40,0)	7 (11,9)	5 (11,9)	2 (11,8)
Medline	4 (5,8)	2 (20,0)	2 (3,4)	2 (4,8)	0 (0,0)
TOTAL	69 (100,0)	10 (100,0)	59 (100,0)	42 (100,0)	17 (100,0)

Source: authors (2023).

Figure 1: PRISMA ScR flow diagram of the review record selection process. Salvador, Brazil, 2023.



Detailed and standardized information was extracted by the *Joanna Briggs Institute* (JBI), such as: title, author and year, journal and place, year of publication, method and number of patients included, as well as the instrument for pain assessment and the effect of acupuncture for analgesia. The information extracted was summarized and is presented in Tables 1, 2, 3 and 4.

RESULTS

The final sample consisted of 17 studies, grouped into four thematic categories: (41.2%; n=7) arthralgia related to aromatase inhibitors (Chart 1); (29.4%; n=5) multiple symptoms/complications related to treatment (Chart 2); (17.6%; n=3) pain and chronic pain (Chart 3) and (11.8%; n=2) peripheral neuropathy and chemotherapy (Chart 4).

The studies were mostly published by Asian countries (64.7%; n=11), especially China (35.3%; n=6), Korea (23.5%; n=4) and (5.9%; n=1) Iran. Four studies (23.5%) were published by the United States, one by Iceland and one by Australia. It was observed that the publications were concentrated in the years 2020 (29.4%; n=5) and 2021 (23.5%; n=4). In 2018 there were three publications, in 2017 and 2019 two publications per year and one study was published in 2022. Studies published by journals related to oncology and complementary/integrative practices stood out, with five studies (29.4%) each, as well as systematic reviews with meta-analysis, which represented the majority of studies (52.9%; n=9), followed by Randomized Clinical Trials (RCTs) (n=3) and (n=2) by pilot studies. The remaining studies were a systematic review, a retrospective cross-sectional study, and a prospective longitudinal study.

Among the studies that used a single instrument to assess pain (52.9%; n=9), the BPI stood out, used in 66.7% of the cases. The Visual Analogue Scale (VAS) and the NPSI were used separately in two and one study, respectively. Seven studies (41.2%) combined instruments for pain assessment, and in one study the instrument used was not described. Most studies (52.9%; n=9) used systemic acupuncture alone, 29.4% (n=5) used systemic acupuncture and auriculotherapy, two studies (11.8%) used systemic acupuncture and acupressure, and one study did not describe the type of acupuncture used. In most studies (76.5%; n=13), acupuncture decreased pain (intensity and/or impact and/or mean pain) among women with breast cancer. One study reported moderate improvement of the intervention, one study concluded that acupuncture may or may not decrease pain, one study observed no difference between acupuncture and massage in reducing pain, and one study did not recommend the use of acupuncture for pain control.

AROMATASE INHIBITOR-RELATED ARTHRALGIA

Acupuncture decreased pain in most studies evaluating the effect of the intervention on arthralgia related to the use of aromatase inhibitors. However, one study concluded that the evidence is not strong enough to recommend it for this purpose (Exhibit 1).

MULTIPLE TREATMENT-RELATED SYMPTOMS/COMPLICATIONS

The studies grouped in the multiple symptoms/complications related to the treatment category showed a decrease in pain intensity and interference, with a variation in magnitude depending on the instrument used. One study showed inconclusive results, concluding that manual acupuncture and auriculotherapy may or may not relieve pain and improve the function of the affected region in women with breast cancer. While two studies with manual acupuncture and electroacupuncture showed decreases in pain intensity. Massage combined with acupuncture did not significantly influence pain intensity (Chart 2).

Table 1. Characterization of studies related to arthralgia related to aromatase inhibitors. Salvador, Brazil, 2023.

Title	Author (Year)	Newspaper (Country)	Study Type (Sample Size)	Instrument(s) used for pain assessment	Type of acupuncture	Effect of acupuncture on pain
Acupuncture for arthralgia induced by aromatase inhibitors in patients with breast cancer: a systematic review and meta-analysis	Liu et al (2021)	Integr Cancer Ther (China)	Systematic Review and Meta-Analysis (7 RCTs/n=603)	BPI	Auriculotherapy and systemic	Decreases (impact, intensity and the worst pain)
Acupuncture for hormone therapy-related side effects in breast cancer patients: a GRADE-assessed systematic review and updated meta-analysis	Yuanqing et al. (2020)	Integr Cancer Ther (China)	Systematic Review and Meta-Analysis (Pain = 5 RCTs/n=319)	WOMAC; BPI; EVN;	Auriculotherapy and systemic	Moderate improvement; Low quality of evidence (SMD = -1.05; 95% CI = -1.89 to -0.21; P = 0.01)
Genetic predictors of response to acupuncture for aromatase inhibitor-associated arthralgia among breast cancer survivors	Genovese et al. (2019)	Pain Med (Iceland)	Retrospective Cross-Sectional Study (n=38)	BPI	Systemic	60.5% (30% reduction in mean pain at the end of treatment)
Effect of Acupuncture vs Sham Acupuncture or Waitlist Control on Joint Pain Related to Aromatase Inhibitors Among Women With Early-Stage Breast Cancer: A Randomized Clinical Trial	Hershman et al. (2018)	JAMA (USA)	Randomized Clinical Trial (True acupuncture = 110; Sham acupuncture=59; Control group=57)	BPI-WP	Systemic	Statistically significant reduction in pain (2.05 points) at 6 weeks
Therapeutic options for aromatase inhibitor-associated arthralgia in breast cancer survivors: a systematic review of systematic reviews, evidence mapping, and network meta-analysis	Kim et al. (2018)	Maturitas (Korea)	Systematic Review and Meta-Analysis (6 systematic reviews)	BPI	Not Described	Significantly improved pain intensity scores (mean difference [MD] -2.00); Low evidence

Management of aromatase inhibitor induced musculoskeletal symptoms in postmenopausal early breast cancer: a systematic review and meta-analysis	Roberts et al. (2017)	Crit Rev Oncol Hematol (Australia)	Systematic Review and Meta-Analysis (6 acupuncture-related studies / 221 patients)	BPI-SF	Systemic	The evidence is not strong enough to recommend it
Effect of acupuncture on aromatase inhibitor-induced arthralgia in patients with breast cancer : A meta-analysis of randomized controlled trials	Chen et al. (2017)	Breast (China)	Systematic Review and Meta-Analysis (5 RCTs / 181 patients)	BPI e WOMAC	Auriculotherapy and systemic	Significant decrease in worst pain score by BPI and pain score by WOMAC after 6-8 weeks of treatment

Source: Authors (2023).

Table 2. Characterization of studies related to multiple symptoms/complications related to treatment. Salvador, Brazil, 2023.

Title	Author (Year)	Newspaper (Country)	Study Type (Sample Size)	Instrument(s) used for pain assessment	Type of acupuncture	Effect of acupuncture on pain
Acupuncture for symptoms management in Korean breast cancer survivors: a prospective pilot study	Kim et al. (2019)	Acupunct Med (Korea)	Prospective pilot study (n=8)	BPI-SF; NRS; WOMAC	Auriculotherapy and systemic	Decreased pain intensity and interference; The individual items (pain, stiffness and physical function) on the WOMAC scale improved little (score 59 to 56)
Acupuncture as an adjuvant therapy for management of treatment-related symptoms in breast cancer Patients	Jang et al. (2020)	Medicine (Korea)	Systematic Review and Meta-Analysis (19 RCTs / 4 Pain-related)	WOMAC; BPI-SF; M-SACRAH	Auriculotherapy and systemic	Can or not relieve pain and improve the function of the affected region.
Acupuncture improves multiple treatment- related symptoms in breast câncer survivors: a systematic review and meta-analysis	Li et al. (2021)	J Altern Complement Med (USA)	Systematic Review and Meta-Analysis (26 RCTs/7 related to pain (arthralgia; neuropathy)	Not described	Systemic	Significantly decreased pain intensity
Effects of acupuncture and moxibustion on breast cancer-related lymphedema: a systematic review and meta-analysis of randomized controlled trials	Gao et al. (2021)	Integr Cancer Ther (China)	Systematic Review and Meta-Analysis (14 RCTs / 10 Acupuncture-related)	VAS	Systemic	Decreased the intensity

Massage compared with massage plus acupuncture for breast cancer patients undergoing reconstructive surgery (cirurgia)	Dilaveri et al. (2020)	J Altern Complement Med (USA).	Prospective longitudinal study (n=42/n=21: received massage and acupuncture)	VAS	Systemic	No significant difference was observed between the groups

Source: Authors (2023).

CHRONIC PAIN AND SORENESS

In studies related to pain/chronic pain, positive effects of acupuncture (acupressure, systemic acupuncture, electroacupuncture) were observed, such as a reduction in intensity and a lower incidence of chronic pain. The positive effect of acupuncture for postoperative pain control is highlighted. However, the effect of acupressure on reducing pain intensity was not statistically significant (Chart 3).

Table 3. Characterization of studies related to pain and chronic pain. Salvador, Brazil, 2023.

Title	Author (Year)	Newspaper (Country)	Study Type (Sample Size)	Instrument(s) used for pain assessment	Type of acupuncture	Effect of acupuncture on pain
Efficacy of physical therapy interventions on quality of life and upper quadrant pain severity in women with post-mastectomy pain syndrome: a systematic review and meta-analysis	Kannan et al (2022)	Qual Life Res (China)	Systematic Review and Meta-Analysis – RSM (18 RCTs)	NPRS/ BPI-SF	Systemic/Acupressure	Significant decrease in pain intensity; The meta-analysis showed no significant effect of acupressure on pain intensity
Transcutaneous electrical acupoint stimulation before surgery reduces chronic pain after mastectomy: a randomized clinical trial	Lu et al. (2021)	J Clin Anesth (China)	Randomized Clinical Trial – RCT (Electroacupuncture with isolated suture=198; Electroacupuncture with combined point = 190; Control group=188)	NRS and DN4	Systemic	Combined electroacupuncture of stitches before surgery was associated with reduced pain score (3 months) and lower incidence of chronic pain (6 months) after surgery

Effect of complementary and alternative medicine interventions on cancer related pain among breast cancer patients: a systematic review	Behzadmehr et al (2020)	Complement Ther Med (Iran)	Systematic review (n=46 studies / n=3685 patients)	BPI-SF / VAS/NRS	Systemic/Acupressure	Decreased

Source: Authors (2023).

PERIPHERAL NEUROPATHY

Systemic acupuncture decreased pain related to peripheral neuropathy associated with the use of taxanes (Chart 4).

Table 4. Characterization of studies related to peripheral neuropathy. Salvador, Brazil, 2023.

Title	Author (Year)	Newspaper (Country)	Study Type (Sample Size)	Instrument used for pain assessment	Type of acupuncture	Effect of acupuncture on pain
Acupuncture for chemotherapy-induced peripheral neuropathy in breast cancer survivors:randomized controlled pilot trial	Lu et al. (2020)	Oncologist (EUA)	Randomized Clinical Trial – RCT (n=40)	BPI-SF	Systemic	Decreased
Acupuncture for the treatment of Taxane-induced peripheral neuropathy in breast cancer patients: a pilot trial	Jeong et al. (2018)	Evid Based Complement Alternat Med (Coréia)	Pilot Study (n=10)	NPSI	Systemic	Decreased

Source: Authors (2023).

DISCUSSION

The present study evaluated the influence of acupuncture on pain control among patients with breast cancer.

The predominance of publications by Asian countries was expected since acupuncture and its derivations date back to cosmological texts, legacies of Taoism, taking into account the thinkers and philosophers of the Eastern world, where the 'primordial breath', called Qi, pre-existent to the formation of Heaven and Earth, is spoken of. The essence of Eastern philosophy was the foundation of the so-called traditional Eastern medicines, especially Chinese (JÚNIOR, 2016). In this sense, the absence of studies

carried out in Brazil and Latin American countries is highlighted, reinforcing the need for greater investments for research in the area of integrative practices.

The predominance of systematic reviews with meta-analysis drew attention and is a particularly important result of the present study. This type of study consists of combining results from different studies and thus producing estimates, which summarize the whole. In order to consider that the result of a meta-analysis has applied meaning, the studies that make up its data must be the result of a systematic review, which consists of a set of rules to identify studies on a given issue and thus select which of them will be included (ROEVER, 2016). This fact highlights the search for robust evidence on the influence of acupuncture on pain control among cancer patients.

The instruments used to assess pain included the BPI (Brief Pain Inventory), the ESAS (Edmonton Symptom Assessment), the Visual Numeric/Analog Scale (VAS/EVN), the Patient Neurotoxicity Questionnaire (PNQ), Neuropathic Pain Symptom Inventory (NPSI), Modified Douleur Neuropathique (DN), Analysis of covariance (ANCOVA), Guideline Development Tool software (GRADEpro GDT), Well-being QoI (MYCAW) and Related symptoms (BC).

The BPI measures pain severity and its interface, assessing pain location, pain intensity, comparison between extremes of pain intensity, and relief brought by the treatment being researched (MAO et al., 2017). The ESAS scores for symptoms such as pain, fatigue, nausea, depression, anxiety, loss of appetite, drowsiness, shortness of breath, sleepiness, and decreased well-being (NARAYANAN *et al*., 2021, RAZ *et al*., 2020, GRANT *et al*., 2021).

The VAS scale evaluates pain intensity and allows the analysis of the individual's evolution during treatment and at each visit, in a reliable way (CASASSOLA *et al*., 2020, GENOVESSE; MAO, 2019). The PNQ aims to detect sensory nerve deficit and interference of neuropathy symptoms in activities of daily living (LU *et al*., 2020). The NPSI is a self-administered questionnaire that evaluates the different symptoms of neuropathic pain, where description 1 means spontaneous burning pain, 2 pain when pressing, characteristic of paroxysmal pain, and 3 evoked pain, related to paresthesia/dysesthesia. The assessment is valid for 24 hours and quantified on a scale ranging from 0 (no pain) to 10 (unimaginable severe pain) (JEONG *et al*., 2018). The DN instrument evaluates aspects related to pain intensity, neuropathic pain components, and the quality of recovery (LU *et al*., 2021). The GRADEpro GDT (*Guideline Development Tool software*) instrument evaluated variables such as hot flashes, fatigue, pain, stiffness, and physical well-being (YUANQING et al., 2020). The MYCAW instrument assessed quality of life, pain, fatigue,

hot flashes, neuropathic pain, nausea/vomiting (STOCKIGT 2021, KIM; KANG; LEE, 2018, NARAYANAN et al., 2021, GRANT *et al*., 2021). The BC (*related symptoms*) instrument assessed pain intensity, quality of life, sleep, emotional state, lymphedema, neuropathic pain, cognitive impairment, and gastrointestinal symptoms (JANG *et al*., 2020).

Most studies used systemic acupuncture and the techniques used ranged from manual stimulation, electroacupuncture, stimulation of acupuncture points with infrared laser light and the use of associated moxitherapy.

Acupuncture is the set of theoretical-empirical knowledge of Chinese medicine that aims to cure diseases through the application of needles, seeds, moxas, and other techniques (WEN 2006 *apud* COSTA *et al*. 2017; VALLIM *et al*., 2019). Systemic acupuncture through manual stimulation consists of introducing the needle into the acupuncture point and manually stimulating the needle to the sensation of the deqi, which describes the "sensation of the needle" during the proper stimulation of an acupuncture point (FOCKS; MARZ, 2018). Electroacupuncture, on the other hand, consists of inserting the needle into the acupuncture point and applying a mini-stimulation of electric current via needles (ZHANG *et al*., 2021). The electric current passes along the needles and promotes a great electrical stimulus (GREENLEE *et al*., 2018).

Auriculotherapy was also used in some studies. Originating in Traditional Chinese Medicine (TCM), it is described about 2,500 years ago and seeks harmony and balance in the body through stimuli performed at specific points of the pinna that cause direct reflexes on the central nervous system (RUELA *et al*., 2018; AZEVEDO *et al*., 2021). This technique acquired scientific support through the first publication in France in the mid-50s. The basis of this method aims to promote analgesia and diagnosis by stimulating the pinna, obtaining homeostasis and thus regulating energy within the meridians (AZEVEDO *et al*., 2021). Auriculotherapy promotes stimulation for the production of the release of endorphins, cortisol, dopamine, serotonin and noradrenaline, which can cause well-being (VALLIM, 2019). It has shown satisfactory results in the treatment of cancer pain (RUELA *et al*., 2019; VALLIM *et al*., 2019). It is a complementary treatment that does not use drugs and offers minimal risk to the patient (RUELA *et al*., 2018). It improves quality of life, controls nausea, vomiting, and constipation in cancer patients, and controls pain in certain clinical conditions (AZEVEDO *et al*., 2021). Auriculotherapy with needles is indicated in clinical practice, controlling common signs and symptoms of cancer patients who have received cancer treatment (VALLIM *et al*., 2019). Auricular therapy involves an approach that seeks to stimulate the natural mechanisms of health recovery, with an emphasis on welcoming listening, the development of the therapeutic bond, and the integration of the human being

with the environment and society, which contributes positively to the effect of the intervention (AZEVEDO *et al*., 2021). The stimulus exerted on the pinna activates energy channels throughout the body (AZEVEDO *et al*., 2021).

In most studies acupuncture decreases pain (intensity, impact, average pain, worst pain) (LU *et al*., 2020, JEONG *et al*. 2018, BEHZADMEHR *et al*. 2020, KANNAN *et al*. 2020, LIU *et al*., 2021, HERSMAN *et al*., 2018, CHEN *et al*., 2017, KIM *et al*., 2018, LIU *et al*., 2021, KIM *et al*., 2019, LI *et al*. 2021, GAO *et al*., 2021, LU *et al*., 2021, GENOVESE *et al*., 2019), but there were studies where the influence of the intervention on this outcome was not significant (DILAVERI *et al*., 2020, YUANQING *et al*. 2020, JANG *et al*. 2020) and one study did not recommend the use of acupuncture for pain management in women with breast cancer (ROBERTS *et al*., 2017).

In this sense, it is important to highlight that the heterogeneity between the studies regarding the technique applied in the intervention, the instrument used to measure pain, and the acupuncturist's experience, may influence the results. Still The evaluation of pain and consequently of the influence of any intervention on the symptom is subjective.

To facilitate the interpretation of the results, the studies were grouped into four categories, with emphasis on arthralgia related to aromatase inhibitors and the multiple symptoms/complications related to cancer treatment. The other categories were chronic pain and pain, and chemotherapy-related peripheral neuropathy.

Aromatase inhibitors consist of drugs that inhibit estrogen production and are associated with arthralgia and joint pain, which are symptoms that affect half of breast cancer survivors, being one of the main adverse effects related to the use of this class of drugs (GENOVESE; MAO, 2019). Arthralgia induced by aromatase inhibitor was the category that included the largest number of studies, with a decrease in pain with the use of acupuncture, auriculotherapy and association of techniques, evidencing the efficacy of the technique with a considerable reduction in edema and pain (ANAND; NIRAVATH, 2019, JANG *et al*., 2020, HERSHMAN *et al*., 2018, LIANG *et al*., 2020, LIU *et al*., 2021, KIN; KANG, 2019, GREENLEE *et al*., 2017, ABBASI, 2018, KIN; KANG; LEE, 2018, KIM; KANG; LEE, 2018, BAE; SONG, 2019, POO *et al*., 2021, BEHZADMEHR *et al*., 2020, CHEN *et al*., 2017, SHIN *et al*., 2019, GENOVESE; MAO, 2018, FRANZOI *et al*., 2021, ROBERTS *et al*., 2017, KIM, KANG, LEE, 2018).

Although acupuncture decreased pain in most studies that evaluated the effect of the intervention on this symptom, one study concluded that the evidence is not strong enough to recommend it for this purpose. Similarly, among the studies that evaluated the efficacy of acupuncture in relation to multiple treatment-related symptoms/complications, including

pain, there was no consensus among the authors. A decrease in pain intensity and interference was observed, but one study presented inconclusive results, concluding that manual acupuncture and auriculotherapy may or may not relieve pain.

Although it goes beyond the scope of this review, it is important to highlight that the use of acupuncture, auriculotherapy and/or the association of integrative techniques increased quality of life, reduced insomnia and improved sleep quality, reduced fatigue, and reduced nausea and vomiting, showing that integrative techniques contribute to a better quality of life and well-being of patients undergoing or post-cancer treatment for breast cancer (ERAN BEN-ARYE *et al*., 2017, JANG *et al*., 2020,YUANQING *et al*., 2020, NARAYANAN *et al*., 2021, JEONG *et al*., 2018, RAZ *et al*., 2020, KIN, KANG, 2019, GREENLEE *et al*., 2017, GRANT *et al*., 2021, LU *et al*., 2021, KIN; KANG, 2019, ZHANG *et al*., 2021, MAO *et al*., 2019, SHIN *et al*., 2019, GENOVESE; MAO, 2019, FRANZOI *et al*., 2021, STOCKIGT, 2021).

In a retrospective study conducted in the United States on the impact of acupuncture on the management of symptoms caused by cancer, a better quality of life was observed for patients (VALLIM *et al*., 2019; BINBIN XU *et al*., 2021), emphasizing the improvement of symptoms such as fatigue, anxiety, physical and emotional suffering (VALLIM *et al*., 2019).

The measurement of the quality of life of cancer patients is an important resource for assessing the implications of treatment outcomes and provides valuable information on the impact of the disease on the physical, functional, social, and emotional aspects of patients. In this sense, quality of life acquires fundamental importance as an objective of cancer treatment, along with traditionally used parameters such as survival time, disease-free interval, tumor response, and toxicity (COSTA *et al*., 2017).

Studies evaluating the efficacy of acupuncture for pain control/chronic pain specifically, reported positive effects such as reduced intensity and lower incidence of chronic pain, as well as pain related to peripheral neuropathy associated with the use of taxanes.

Most oncological pain is chronic, lasting more than three months, being continuous, and there may be episodes of worsening, with acute conditions known as *breakthrough* pain. In chronic cancer pain, in addition to the pharmacological approach, integrative practices should be applied with the aim of offering the patient a more humanized medicine through physical, emotional and spiritual care (ERCOLANI *et al*., 2018).

The possible mechanisms that explain the complex and multiple pathophysiology of cancer pain are: primary afferent nociception (inflammatory factors, tumor-induced acidosis,

tissue compression due to tumor invasion), acute nociception (postoperative), nerve tissue injury and compression, and hyperalgesia due to central sensitization.

Nociceptive pain can be divided into somatic and visceral. Neuropathic pain occurs due to injury to the central or peripheral nervous system (ERCOLANI *et al*. 2018).

According to Traditional Chinese Medicine (TCM), pain results from the condition of excess or deficiency of Qi or blood (TAFFAREL; FREITAS, 2009).

While Western thought was the basis of the so-called modern scientific medicine, the essence of Eastern philosophy was the foundation of the so-called traditional Eastern medicines, especially Chinese (JÚNIOR, 2016). Inadequate pain management favors depressive symptoms, anxiety, impairs cognitive functions, affects daily and social activities, promotes sleep disorders (VALLIM *et al*., 2019). Even with the availability of simple strategies for the treatment of cancer pain, its prevalence demonstrates the urgency of developing actions that lead to more favorable outcomes for patients. Health services have the possibility of incorporating complementary and safe techniques in an attempt to provide better pain control, especially when conventional treatments become limited. Regardless of the choice of the type of therapy for the management of cancer pain, this symptom must be treated and evaluated individually and holistically because it is a particular process and influenced by different factors (RUELA *et al*., 2018).

Considering the National Comprehensive Cancer Network, acupuncture is recommended for cancer pain in adults as one of the integrative interventions, in conjunction with pharmacological interventions (COSTA *et al*., 2017). It should be noted that, in acupuncture, each individual should be considered unique, and that the choice of points should occur according to the course of the meridian and the distribution of the nerves that cross the pain area (COSTA *et al*., 2017).

It is important to mention that few studies reported adverse effects related to the use of acupuncture such as hematoma, pain, and itching, and these did not prevent the use of the technique, which was well accepted by the patients (SOOBIN JANG *et al*., 2020, TING BAO *et al*., 2018, WEIDONG LU *et al*., 2020, XIAOMENG LIU *et al*., 2020, WENZHEN HOU *et al*., 2019, TAE-HUN KIN; JUNG WON KANG, 2019).

CONCLUSION

Acupuncture, auriculotherapy and association of techniques, which uses auriculotherapy together with acupuncture and electroacupuncture, obtained a positive result in pain control in women with breast cancer. Only one study showed the opposite result. Integrative techniques, such as acupuncture, reduce pain and lymphedema, improve

insomnia, fatigue and anxiety, as well as nausea and vomiting caused by chemotherapy, with minimal side effects and good acceptance among patients, leading to a better quality of life.

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INNOVATIVE READING STRATEGIES TO IMPROVE ACADEMIC WRITING

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ABSTRACT

The work carried out investigated the innovative reading strategies to improve academic writing, in the learning process of students of Basic General Education of the Elías Cedeño Jerves Educational Unit, which brings together the cantons of Sucre and San Vicente, The technique used was the survey, the methodology applied was given from the quantitative and qualitative perspective, the type of research was based on the descriptive process for processing the information, the SPS27 computer program was used, from which the statistical indicator that allows measuring the reliability of the instrument could be extracted, through Cronbach's alpha giving a reliability result in the instrument of 0.87, this value indicates that the instrument was reliable, in addition, the Google forms form was used to reach the participants. One of the most important conclusions was that teachers must be prepared with methodological innovations to respond to the challenges that today's new knowledge society imposes. In addition, educational institutions must develop a plan based on innovative strategies for the continuous training of teachers and thus improve the academic writing of students from a critical reading of the environment.

Keywords: Comprehensive reading. Strategies. Innovation. Techniques.

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INTRODUCTION

Academic writing is a fundamental skill for teachers, as it directly influences their ability to effectively transmit knowledge and promote critical thinking among students. In the context of teachers in district 13D11 of the Sucre-San Vicente canton, the need to improve academic writing skills in students is identified, requiring proper guidance from teachers to enhance the quality of teaching and improve student academic performance. This article focuses on the search for innovative reading strategies as a tool to improve students' academic writing, based on the preparation of professionals who impart knowledge in the researched educational institution.

The primary interest of this research is to improve reading through active strategies so that students can improve their academic writing and become knowledge-bearing agents for society. This research is crucial to solving these problems by seeking alternatives that motivate teachers in the reading process of their students and raise awareness about the potential and competencies needed to acquire new learning. It highlights the importance of improving academic writing, thereby enhancing reading, and requires teachers to look for innovative strategies to achieve the objectives of this research. The central question posed is whether it is possible to propose new innovative reading strategies to improve academic writing. This leads to specific objectives, such as analyzing the historical context of the object of study, investigating the theoretical construct of the variables, diagnosing the reality of the problem, and proposing new strategies to foster academic writing.

In the General Report (PISA, 2018), Ecuador's reading results place it at level 2, corresponding to a minimum competency level where students are capable of locating one or more fragments of information. If the information in the reading is not abundant, students at this level cannot make high-level inferences (p. 77). The next PISA test will take place in 2025, and it is expected that the preparation of students facing this test will improve substantially. Based on the results of the 2017 test, necessary adjustments are being made, considering various topics and utilizing resources that allow students to improve their performance in scenarios with varying levels of difficulty, ranging from simple idea recognition to contrasting opinions and critical thinking (PISA, 2024). Documents have already been developed in 2023 to conduct pilot tests in May and June 2024. It is expected that in 2025, approximately 8,000 students will take this test, and results will be released in 2026.

In light of this, teachers aim to prepare students at different levels to face these challenges, not as a confrontation with a test, but as comprehensive preparation to tackle real-world situations.

To perform a comprehensive reading, a series of skills and abilities need to be solidified, which are acquired when the child experiences multidisciplinary activities through movement, enabling the maturation of mental functions and organizing perceptions, thereby fostering learning. This leads to the following questions: Do you believe that reading strategies are important for developing students' vocabulary? Do reading and writing strategies play a fundamental role in education? Is reading a matter of practice that must be continuously refined?

To strengthen students' abilities as they advance in their studies, a series of innovative strategies for comprehensive reading are proposed to help them understand texts of various types (technical, scientific, sports, social, etc.), which they will access through different information media, both print and audiovisual. A study was conducted with a group of 32 students from different grade levels, from 5th to 7th grade, to justify the use of these comprehensive reading strategies.

In this sense, this document presents a series of strategies that were used and yielded positive results, allowing the students who participated to improve their grades in a written test.

DEVELOPMENT

Comprehensive reading enables the reader to situate themselves temporally and spatially within the context in which the text unfolds (Martínez, B., 2022). It allows for the association of ideas, the sequencing of thoughts, and the formation of definitions based on the content being read. According to the author, this allows the reader to place themselves in the time and space of the context, facilitating the organization of ideas into sequences and the formation of definitions based on the reading. This provides the reader with the ability to argue in a well-founded and coherent manner, basing their viewpoints on a solid understanding of the material.

Comprehensive reading is the foundation of all subjects studied in Ecuador's educational curriculum (Cusco, D., 2020) and other countries, as it allows for inferences based on what is read, the relating of concepts, the making of comparisons, and laying the groundwork for subsequent concepts. As the author points out, comprehensive reading is the cornerstone of all subjects in Ecuador's educational curriculum because it first allows students to deepen their understanding and draw conclusions beyond explicit information. It also facilitates the ability to relate concepts, fostering a more holistic and connected understanding of knowledge.

Several strategies have been implemented in various studies (Fonseca, L. et al., 2018), such as reciprocal teaching, text comprehension, object-oriented reading, comparison of work modes, establishing causal relationships in texts, and content comprehension, among others.

Among these strategies, the study focused on selecting interesting books, conducting short and practical readings, reading on various topics, and adapting reading to the environment in which students are immersed. These strategies are adapted to each of the aforementioned methods, with students focusing on content, objects, reciprocal teaching, and content comprehension.

According to (Carrasco & Villacis, 2023, p. 329), active learning is effective at every educational level because students, along with the teacher's strategies, create learning environments where they actively participate, using their interactive and communicative skills to acquire meaningful learning, i.e., learning that will last a lifetime.

As the authors state, every pedagogical strategy produces meaningful learning outcomes. Therefore, we must continue to strengthen strategies that help students take a proactive role in their holistic education, which will help them respond to the needs of their community.

Consequently, (Olvera & Villacis) active learning is linked to the constructivist model, where the student constructs their learning by discovering knowledge through personal experiences. This type of learning begins with the students and moves at their pace and style, making it an exciting and engaging adventure for both the student and the lesson. (p. 329)

This type of learning is important to enhance because it is a strategy that enables students to build their learning, creating a style where they feel satisfied with what they discover and produce through their efforts, creating awareness of their ability to create and recreate what they read. This is how they develop and create a productive discipline.

From the perspective of (Morales & Villacis), the PEI (Institutional Educational Project) allows for the detection and prioritization of institutional problems, establishing strengths, weaknesses, opportunities, and threats. It clearly outlines the objectives, strategies, and goals to be achieved, as well as designing, executing, monitoring, and evaluating plans and projects to address diversity.

It is important to revisit the content throughout the curriculum to strengthen students' strengths through strategies that help them take ownership of their learning through daily activities across all subjects. This is essential for achieving the goals set in various areas of

knowledge and in a collaborative team approach among teachers, necessitating coordination and evaluation of the curriculum programming.

Today, innovative reading strategies are discussed within teacher training, using platforms to strengthen learning activities. Working in networks is the most appropriate strategy for contributing to social, professional, and spiritual development during times of contingency and natural disasters. Globalization has brought higher demands in a world that is increasingly digitalized and chaotic, requiring functional strategies at the technological level (ICTs) to strengthen economic activities and market positioning. I adhere to Bill Gates' (2000) statement: "If your business is not on the Internet, your business does not exist." University and educational institution administrators, as well as teachers, now have the resources to face online and virtual teaching challenges, evidenced by the use of virtual platforms (Microsoft Teams, Zoom, Google Meet, etc.) as a way to enhance academic activities.

The survey shows that WhatsApp is the medium through which students maintain constant communication with their teachers and peers. This application offers multiple options that can contribute to disseminating educational and learning materials.

According to Rivera (2019), the flipped classroom approach represents active learning, where students engage in activities that require reflection on ideas and how they are using them, differing from the current approach, which doesn't fully utilize the potential of ICTs that students already use extensively in their daily lives (p. 13).

Students must engage in learning through active and innovative strategies that motivate them to read life, and their concerns, and identify with who they are and what they have. As Freire said in one of his books, if education is not liberating, it ceases to be formative. Therefore, we must educate for life through a theoretical context that can later be demonstrated in real-world active learning.

From the perspective of Orosz et al. (2008), "All this is possible because of the many benefits and advantages of instruction based on active learning" (p. 14).

As the author points out, today’s learning remains relevant through active strategies that teachers employ to ensure students respond to life-formative education, equipping them with reading techniques that lead to critical, real learning, allowing them to handle information objectively and responsibly. The mechanical copying of information stifles their thinking abilities, which results in null learning.

This research is based on teachers' perceptions of written test results related to comprehensive reading conducted with their students. Perceptions were quantified through a survey using a Likert scale, where respondents selected one of the available options

(Bloom, E., 2024). In the survey conducted with teachers in district 13D11, the responses were based on the following scale: 1. Low; 2. Below basic; 3. High; 4. Very high. Some questions included other options on the scale.

To determine the reliability of the data collection tool, Cronbach's alpha (α) coefficient was used, which ranges from 0 to 1 (values between -1 and 0 may also appear) and indicates the strength of the correlation between the variables being analyzed (Oviedo, H. & Campo-Arias, A., 2005), in this case, the surveyed teachers and the items or questions answered.

Finally, to determine the improvement in student performance based on comprehensive reading strategies, a t-test (also known as Student's t-test) was conducted, comparing the means of two tests: a pre-test and a post-test. The confidence interval for the t-test is 95%.

MATERIALS AND METHODS

The research had a descriptive approach, and the methodology was both quantitative and qualitative. To gather relevant information, a survey technique was used, which was processed by SPS 27, yielding a reliability coefficient of 0.87 for Cronbach's alpha, indicating that the applied instrument was reliable. A sample of 85 teachers from the region was selected. The research was carried out in two parts. In the first part, a survey was administered to 85 teachers from district 13D11. The survey included 6 questions related to teachers' perceptions about students' mastery of comprehensive reading, difficulties encountered in comprehensive reading, pedagogical tools that could improve students' performance, and the relationship between comprehensive reading and student behavior in real-life situations. The survey results were presented in individual tables with the corresponding validation. Additionally, a sample of 32 students from the middle grades was taken, allowing for the analysis of the responses from each group to conclude.

RESULTS

Table 1 - Reliability Statistics

Cronbach's Alpha	Number of Items
0.872	5

Source: Teachers from district 13D11 Sucre-San Vicente. Prepared by: Author.

Upon analyzing Cronbach's Alpha, the result was 0.88, which indicates that the applied instrument was reliable, as shown in the reliability analysis.

Table 2 - How would you rate the level of reading comprehension in your students?

Category	F	%	%V	%A
Valid	LOW	20	23.5	23.5
	LOW BASIC	32	37.6	37.6
	HIGH	26	30.6	30.6
	VERY HIGH	7	8.2	8.2
Total	85	100.0	100.0	

Source: Teachers from district 13D11 Sucre-San Vicente. Prepared by: Author.

The results showed that 37.6% of respondents indicated that the reading comprehension level is basic, suggesting the need to work on strengthening this skill in students.

Table 3 - For you as a teacher, how useful or important are strategies in reading comprehension in the teaching-learning process?

Category	F	%	%V	%A
Valid	LOW	1	1.2	1.2
	LOW BASIC	7	8.2	8.2
	HIGH	28	32.9	32.9
	VERY HIGH	49	57.6	57.6
Total	85	100.0	100.0	

Source: Teachers from district 13D11 Sucre-San Vicente. Prepared by: Author.

The results presented in Table 3 show that 32.9% of the respondents consider the importance of applying reading strategies as high, for reading comprehension to become a habit and to help students apply what they've learned in their daily lives.

Table 4 - Do you think it is important to tackle reading problems in learning from the root?

Category	F	%	%V	%A
Valid	NOT RELEVANT	1	1.2	1.2
	IRRELEVANT	12	14.1	14.1
	YES	72	84.7	84.7
Total	85	100.0	100.0	

Source: Teachers from district 13D11 Sucre-San Vicente. Prepared by: Author.

One of the major problems in educational centers is related to the difficulty of learning through reading processes, a problem associated with various factors such as a culture of non-reading, and incorrect strategies used by teachers and students, among others. This result suggests that it is important to apply innovative strategies that help students break down these barriers to achieve comprehensive reading.

Table 5 - Which of these main problems, such as lack of fluency in more complex words, slow and syllabic reading, phonological equivalence errors, or omitting words or parts of words, have you identified in your students, related to reading comprehension?

Category	F	%	%V	%A
Valid	LOW	3	3.5	3.5
	LOW BASIC	17	20.0	20.0
	HIGH	47	55.3	55.3
	VERY HIGH	18	21.2	21.2
Total	85	100.0	100.0	

Source: Teachers from district 13D11 Sucre-San Vicente. Prepared by: Author.

It is noted that 55.3% of respondents struggle with reading skills, lacking verbal fluency, making phonological mistakes, and omitting words, which hinder reading comprehension. These persistent difficulties suggest a need for interventions to improve fluid reading.

Table 6 - Do you think reading influences the use of language and the personal and social development of students?

Category	F	%	%V	%A
Valid	HIGH	2	2.4	2.4
	VERY HIGH	83	97.6	97.6
Total	85	100.0	100.0	

Source: Teachers from district 13D11 Sucre-San Vicente. Prepared by: Author.

According to the respondents, 97.6% believe that reading significantly influences language development and social and personal growth, emphasizing the importance of socialization experiences to strengthen knowledge areas in an integrated manner.

Table 7 - Do you think that with these new innovative strategies (project-based learning, cooperative learning, flipped classroom, educational gamification, competency-based learning, virtual and augmented reality, and technology integration), the reading comprehension levels of your students can be improved?

Category	F	%	%V	%A
Valid	LOW	5	5.9	5.9
	LOW BASIC	4	4.7	4.7
	HIGH	5	5.9	5.9
	VERY HIGH	71	83.5	83.5
Total	85	100.0	100.0	

Source: Teachers from district 13D11 Sucre-San Vicente. Prepared by: Author.

The results showed that 83.5% of teachers agree that innovative strategies will be a key point to developing constructivist skills and abilities that would promote positive aptitudes in the process of performing a great capacity for critical reading within meaningful learning.

RESULTS (SECOND PART OF THE RESEARCH)

Socialization is carried out with 32 students from the Elías Cedeño Jerves Fiscal Educational Unit, located in the Canoa parish of the San Vicente canton, on the process to be developed to verify the level of reading comprehension they have at the time of taking the test. The students are told that after the entrance test, some strategies will be applied to improve the results obtained in the first test (entrance test) and later a second test will be carried out with which the improvement of reading comprehension will be verified.

The reading presented to the 32 students is related to a story and its subsequent moral. The story of “The Little Red Hen”. Students from Fifth Grade, Sixth Grade, and Seventh Grade were invited to an extra work session, so 10 students from Fifth Grade, 16 students from Sixth Grade and 6 students from Seventh Grade voluntarily attended.

Figure 1. Screenshot of the reading done by the students



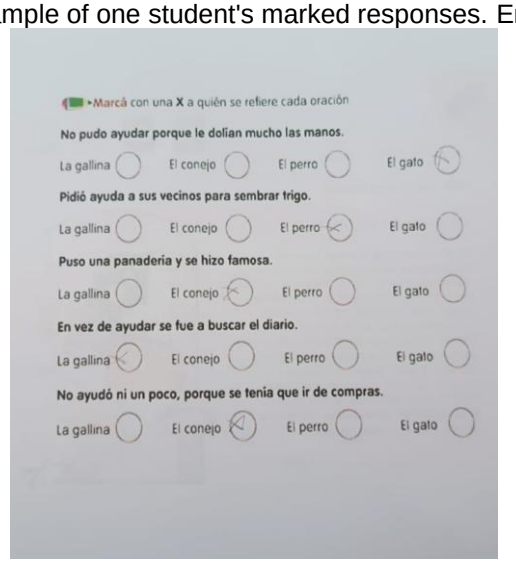
Leé en forma silenciosa

La gallinita colorada

La gallinita colorada le pidió a sus vecinos si la podían ayudar a sembrar trigo. Pero el conejo dijo que le dolían las manos. El perro le contestó que tenía que ir a buscar el diario y el gato se negó diciendo que tenía que ir de compras. La gallinita hizo todo el trabajo sola: sembró, regó y cosechó el trigo. Cuando estaba haciendo panes con el trigo que había cosechado, el conejo, el gato y el perro se acercaron pidiéndole un poco. La gallinita no les regaló nada. Puso una panadería. Vendía muchas tortas y galletitas, tantas que se hizo famosa y salió en la tapa de varias revistas.

Silvia Beatriz Zurdo

Figure 2. Sample of one student's marked responses. Entrance test



Marcá con una X a quién se refiere cada oración

No pudo ayudar porque le dolían mucho las manos.
La gallina ◯ El conejo ◯ El perro ◯ El gato ✗

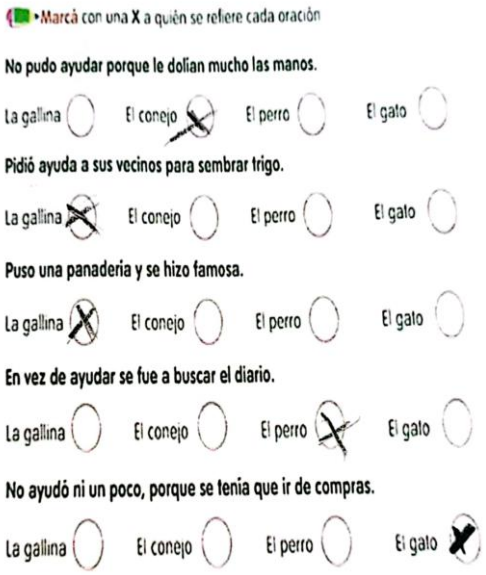
Pidió ayuda a sus vecinos para sembrar trigo.
La gallina ◯ El conejo ◯ El perro ✗ El gato ◯

Puso una panadería y se hizo famosa.
La gallina ◯ El conejo ✗ El perro ◯ El gato ◯

En vez de ayudar se fue a buscar el diario.
La gallina ✗ El conejo ◯ El perro ◯ El gato ◯

No ayudó ni un poco, porque se tenía que ir de compras.
La gallina ◯ El conejo ✗ El perro ◯ El gato ◯

Figure 3. Sample of one student's marked responses. Exit test.



The following table shows the results obtained in the entrance exam taken by the 32 students. Additionally, the final grade obtained by the students and the average of the total number of students are shown on the right side.

Table 8. Entry test results

	NAME	1	2	3	4	5	Note					
1	LEONEL MACIAS	A	B	D	C	A	0	0	0	1	0	1
2	ANDRES ZAMBRANO	B	A	D	D	C	1	1	0	0	0	2
3	JORGE MENDOZA	C	B	A	A	D	0	0	1	0	1	2
4	JULIO ANGULO	B	B	A	C	A	1	0	1	1	0	3
5	FELIPE MARTINEZ	D	A	B	D	D	0	1	0	0	1	2
6	FIDEL PEREZ	A	C	C	A	A	0	0	0	0	0	0
7	JOSE MOREIRA	C	D	A	A	D	0	0	1	0	1	2
8	PEDRO CARRASCO	B	A	B	B	B	1	1	0	0	0	2
9	JORGE ANDRADE	A	A	C	C	C	0	1	0	1	0	2
10	RENE ZAMBRANO	B	A	A	C	D	1	1	1	1	1	5
11	LUIS TORRES	B	A	A	C	D	1	1	1	1	1	5
12	TAYLOR FERNANDEZ	B	A	A	C	C	1	1	1	1	0	4
13	OLIVER ZAMORA	B	C	A	C	C	1	0	1	1	0	3
14	JOSHUE ESMERALDA	A	A	A	C	C	0	1	1	1	0	3
15	CARLOS TRIVIÑO	B	A	A	C	D	1	1	1	1	1	5
16	DAVID CEVALLOS	B	A	A	D	D	1	1	1	0	1	4
17	ALBERTO LARA	D	A	A	C	D	0	1	1	1	1	4
18	MARIA ZAMBRANO	B	A	A	C	D	1	1	1	1	1	5
19	ANA MOREIRA	B	A	A	C	C	1	1	1	1	0	4
20	MONICA SOLIZ	B	A	A	C	D	1	1	1	1	1	5
21	DAYANA CASTRO	B	A	A	C	D	1	1	1	1	1	5
22	JULIANA CASANOVA	B	A	A	C	D	1	1	1	1	1	5
23	FERNANDA AYONG	B	A	A	C	D	1	1	1	1	1	5
24	LISBETH RODRIGEZ	B	A	A	C	D	1	1	1	1	1	5
25	PAOLA TORRES	D	A	A	B	D	0	1	1	0	1	3
26	GISSELA RAMOS	B	A	A	B	D	1	1	1	0	1	4
27	DANIELA LOPEZ	B	A	A	C	D	1	1	1	1	1	5
28	ROMINA VITERI	B	A	A	C	D	1	1	1	1	1	5
29	LUCIANA MOSQUERA	B	A	A	C	D	1	1	1	1	1	5

30	STEFANIA CEDEÑO	B	A	A	C	D		1	1	1	1	1	5
31	KARLA SOLEDISPA	B	A	A	C	D		1	1	1	1	1	5
32	XIOMARA MERA	B	A	A	C	D		1	1	1	1	1	5
							Promedio						3,75

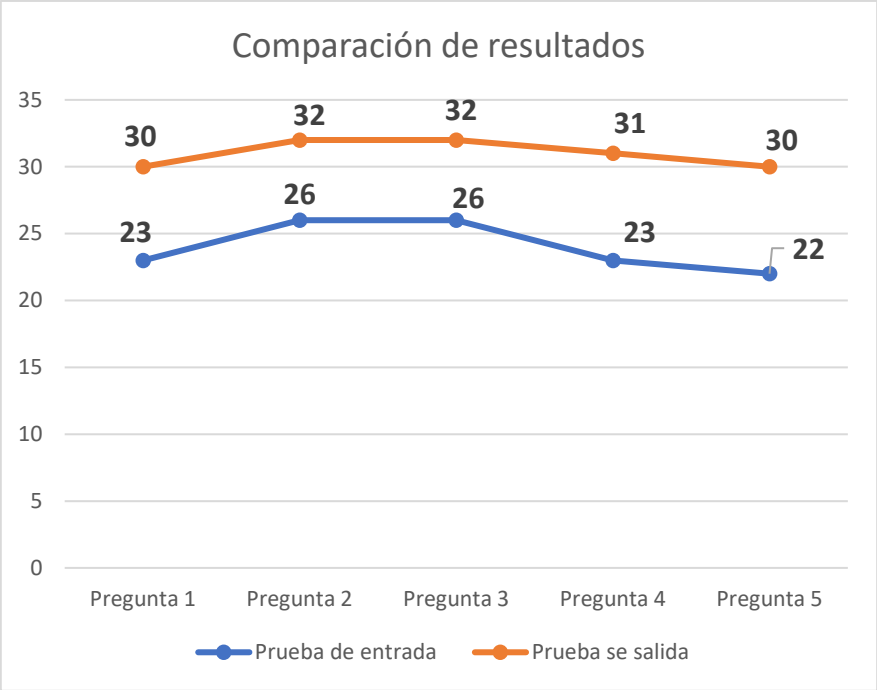
The following table shows the results obtained by the students in the exit test, in which an improvement in the grades of each of the students can be observed.

Table 9. Exit test results

	NAME	1	2	3	4	5	NOTE					
1	LEONEL MACIAS	B	A	A	C	A	1	1	1	1	0	4
2	ANDRES ZAMBRANO	B	A	A	C	C	1	1	1	1	0	4
3	JORGE MENDOZA	B	A	A	C	D	1	1	1	1	1	5
4	JULIO ANGULO	B	A	A	C	D	1	1	1	1	1	5
5	FELIPE MARTINEZ	D	A	A	D	D	0	1	1	0	1	3
6	FIDEL PEREZ	A	A	A	C	D	0	1	1	1	1	4
7	JOSE MOREIRA	B	A	A	C	D	1	1	1	1	1	5
8	PEDRO CARRASCO	B	A	A	C	D	1	1	1	1	1	5
9	JORGE ANDRADE	B	A	A	C	D	1	1	1	1	1	5
10	RENE ZAMBRANO	B	A	A	C	D	1	1	1	1	1	5
11	LUIS TORRES	B	A	A	C	D	1	1	1	1	1	5
12	TAYLOR FERNANDEZ	B	A	A	C	D	1	1	1	1	1	5
13	OLIVER ZAMORA	B	A	A	C	D	1	1	1	1	1	5
14	JOSHUE ESMERALDA	B	A	A	C	D	1	1	1	1	1	5
15	CARLOS TRIVIÑO	B	A	A	C	D	1	1	1	1	1	5
16	DAVID CEVALLOS	B	A	A	C	D	1	1	1	1	1	5
17	ALBERTO LARA	B	A	A	C	D	1	1	1	1	1	5
18	MARIA ZAMBRANO	B	A	A	C	D	1	1	1	1	1	5
19	ANA MOREIRA	B	A	A	C	D	1	1	1	1	1	5
20	MONICA SOLIZ	B	A	A	C	D	1	1	1	1	1	5
21	DAYANA CASTRO	B	A	A	C	D	1	1	1	1	1	5
22	JULIANA CASANOVA	B	A	A	C	D	1	1	1	1	1	5
23	FERNANDA AYONG	B	A	A	C	D	1	1	1	1	1	5
24	LISBETH RODRIGEZ	B	A	A	C	D	1	1	1	1	1	5
25	PAOLA TORRES	B	A	A	C	D	1	1	1	1	1	5
26	GISSELA RAMOS	B	A	A	C	D	1	1	1	1	1	5
27	DANIELA LOPEZ	B	A	A	C	D	1	1	1	1	1	5
28	ROMINA VITERI	B	A	A	C	D	1	1	1	1	1	5
29	LUCIANA MOSQUERA	B	A	A	C	D	1	1	1	1	1	5
30	STEFANIA CEDEÑO	B	A	A	C	D	1	1	1	1	1	5
31	KARLA SOLEDISPA	B	A	A	C	D	1	1	1	1	1	5
32	XIOMARA MERA	B	A	A	C	D	1	1	1	1	1	5
							Promedio					4,84

Comparing the results shown in Table 8 and Table 9, it can be seen that the written test scores improved substantially, such that the average score of the 32 students went from 3.75 to 4.84, which corresponds to an increase of 29.1% in performance. Figure 4 shows the comparison of the results.

Figure 4. Comparison of input and output test results



In carrying out this study, the hypothesis is raised that the average of the exit test scores will be higher than the average of the entrance test scores, after using the reading comprehension strategies. The t-test will be used to statistically verify the above. This test is used when you want to check the variation of the arithmetic means of two samples. Next, the null hypothesis, H_0, is presented, but not before indicating that we will call the exit test average μ_0, while the entrance test average μ_0os.

$$H_0: \mu > \mu_0$$

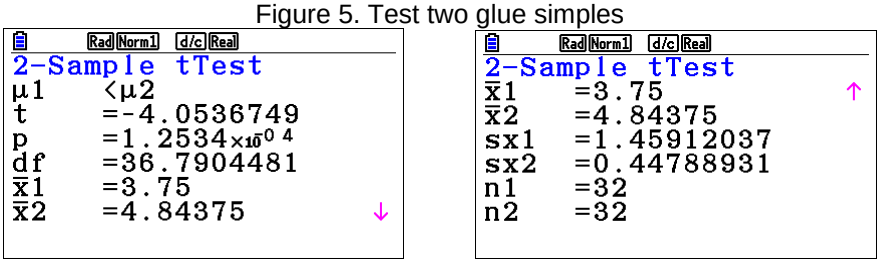
From the previous one, it is clear that the alternative hypothesis, H_1 would be established as

$$H_1: \mu \leq \mu_0$$

To be able to carry out the verification, we will use the technological resource that allows the calculation to be carried out with the following considerations:

- The statistical test to be carried out is a glue
- The significance level is 5%. You can also decide that the confidence level is 5%

Figure 5. Test two glue simples



It is observed that the p indicator has a value of p=0.00012534 value which is smaller than the 5% and corresponds to 0.05, and if this value is smaller, the null hypothesis that indicates that the average (the average) of the input test was greater than the average of the output test, μ>μ_0.

DISCUSSION

The implementation of innovative reading strategies among teachers of district 13D11 Sucre-san Vicente raises several important questions for educational research and pedagogical practice. The importance of a participatory and collaborative approach in teacher training stands out, as well as the need to adapt reading strategies to the specific characteristics and contexts of institutions and their teachers. Furthermore, it highlights the importance of continuing to investigate and develop innovative approaches to improve written competence and the quality of teaching in diverse educational environments.

These investigations support the relevance and effectiveness of innovative reading strategies in improving academic writing among teachers in the 13D11 district of Sucre-San Vicente. It is important to be clear that this problem must be addressed with new reading strategies to counter the problem.

In the work (Moreno.2018) he socializes the problem investigated regarding the design of a didactic strategy to promote the development of investigative skills, which demonstrates that the applications of strategies develop investigative skills to raise the quality of students through strategies that allow them to direct students to a higher level comprehensive, providing positive attitudes in comprehensive reading.

In the investigative work of (Ventosilla et al. (2021), entitled Inverted Class as a Tool for Achieving Autonomous Learning in University Students, they indicate that the end of the learning process is that the student achieves skills, but above all it develops autonomous learning and to achieve this is important the use of active methodologies such as the flipped classroom. It is important to resume these techniques in the first years of education so that they facilitate them at higher levels and the teacher level of students because they also involve failures that are difficult to counteract at higher levels.

In the work of Lemoine et al. (2023.), known as inclusive literacy in Ecuador, is a strategy based on the effects of COVID-19. It concludes by proposing to work on strategies that enable us to reach where the most needs are met in rural and urban areas from the social, economic, and value context, working together with governments to strengthen inclusive education. (p.2). This makes it possible to apply reading strategies in any area of knowledge and in an interdisciplinary way according to social, economic, and cultural contexts.

In the work of Chong and Marcillo (2020), referring to Tendencias investigativas sobre la innovación educativa en México, they state that “The educational trend proposes to «innovate» the skills, environments, resources, and techniques that tend to motivate students and optimize the quality of education” (p. 59). innovative strategies that make it possible to obtain resources to promote reading efficiently and effectively in all educational contexts

CONCLUSIONS

From the results, it is evident that the integration of innovative reading strategies has a significant impact on the improvement of academic writing among teachers in the 13D11 district of the canton of Sucre-San Vicente. These on-the-ground strategies will strengthen writing skills. However, it also promotes greater reflection regarding teaching practice and the role of reading in the teaching-learning process. However, the importance of continuing to provide support and resources to maintain and strengthen these skills in the learning process is recognized.

Teachers must receive continuous and comprehensive training concerning the use of new pedagogical innovations within the curricular preparation of contents to be dosed at each level of education, the same things that are reflected in the practice of each educator.

The investigation allowed us to become aware of the need to undertake using innovative strategies, to recreate comprehensive reading, and to learn a new way of learning from practice, in this way improving active learning by promoting participatory collaborative teaching by forming critical awareness among students.

Another significant element was to verify that the strategies are indispensable in the academic training of teachers, the same ones that helped them to be in a continuous critical, analytical, and reflective training to respond to the challenges that today present the proactive students of the new society of knowledge, so only they will be new professionals who will give answers operating in their surrounding reality.

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FACTORS THAT INFLUENCE THE DEVELOPMENT OF AUTONOMY FOR BEGINNER ENGLISH LEARNERS

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ABSTRACT

This research sought to understand the development of autonomy in beginners of the English language learning and aimed at identifying factors that encourage or discourage the development of autonomous learning. Methods included a survey to find out if and how they learn the language autonomously. A case study was carried out in English classes at the language courses at the Universidade Federal do Pará. Results showed that students have the habit of studying the language outside the classroom, they know their potentials and limitations and have motivational factors that lead them to the language study. However, the time they dedicate to study and practice is minimal and they also assign the teacher many responsibilities related to the learning process. When they practice, they tend to focus on the skills they already are good at. Even though they have the notion of autonomy in learning, in general, students are not autonomous.

Keywords: Autonomy. Learning. Foreign Languages. Beginners.

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INTRODUCTION

The language learning process involves numerous factors and specific contexts. In a teaching and learning environment, students and teachers play a fundamental role in the construction of knowledge. In this context, one of the processes that stands out as an object of study among specialists concerns the development of learners' autonomy.

Autonomy is defined by the Cambridge Dictionary as "the ability to make one's own decision without being controlled by anyone else" (AUTONOMY, 2023). In history, this concept has a Greek origin, referring to the idea of self-government, and was used in Greek democracy to indicate forms of government in cities that were autonomous in their way of administration. This concept was extended to individuals during the Modern Age, marked by the Renaissance movement, when it began to be used to refer to the individual as a rational being who acts on his own.

In Education, the concept of autonomy finds in Paulo Freire one of its exponents. In his book Pedagogia da Autonomia: saberes necessários à prática educativa (1996), the educator highlights the need for students to play a leading role in their learning. He reflects on the importance of fostering criticality and autonomy for the students to develop their learning.

Within the scope of language learning, autonomy has been a field of vast study among theorists. Some focus on explaining the concept of autonomy, others on its importance and development, and others on developing models for its enhancement. In this sense, it is important to mention that learners might use autonomy as a resource for different kinds of problems and thus accomplish benefits concerning their language learning.

In teaching and learning foreign languages this process is crucial since different levels of proficiency can be observed in this context. As beginners, learners might face challenges during the learning process which can be pivotal to encourage or discourage the development of autonomy, creating the need to promote it to achieve meaningful learning.

Based on this, we cannot discuss autonomy without mentioning motivation, since both are interconnected and go hand in hand in the foreign languages learning process. In order for the students to develop autonomous behavior, it is essential that they feel motivated, as motivation is the key that will trigger the pursuit of learning, thus fostering autonomy. Thereby, factors external to learning affect motivation, such as the student's context, as well as their identity. Outside the learning environment, individuals assume numerous identities, such as student, father, mother, child, etc. Therefore, these identities can be transported to learning, which contributes to the motivation engagement.

In this sense, the teacher plays an essential role in this process. Sometimes it is not enough for students to seek autonomy by themselves, they need to have the space and tools to do so. Thus, the teacher adopts other roles, including that of facilitator and mediator in learning, providing the instruments and possibilities necessary to develop the learners' autonomous behavior.

In this learning environment, it is possible that some students have never had a deep contact with the language before. This can arouse fear and inhibition in students during the learning process. For example, fear of speaking, pronouncing words incorrectly or even communicating in their mother tongue, since they may feel uncomfortable to talk in their own language, worrying about judgments from other people.

In this context, the complex nature of learning emerges, especially concerning autonomy. Since to foster student autonomy it is also necessary to develop their motivation, and this involves social and cultural factors, sometimes external to learning, we realize the complex nature of autonomy.

Considering the pertinent difficulties in learning a new language, it is of fundamental relevance to understand the development of autonomy for beginner English learners so that it can be possible to enhance factors that encourage and manage ones that discourage it. Thus, the present study is justified as an attempt to identify such influences, which constitutes its greatest importance.

AUTONOMY

Henri Holec worked in the field of foreign languages learning since the 1960's. As a scholar, he advised the European Council during the 1970's, where he conducted research in a number of language learning-related fields, including autonomy. According to the author, autonomy is "the ability to take charge of one's own learning" (Holec, 1981, p. 3). This means the form of ensuring and taking responsibility for all decisions made in the learning process. Also, according to the author, this ability is not always innate, but can be acquired by "natural" means or during the learning process, as it is in most cases.

Within this context, the author claims that the autonomous learners can choose the learning paths they are taking or would like to take, such as determining objectives, selecting methods and techniques, as well as evaluating and monitoring their own learning. Learners aim to achieve a level of autonomy where they can understand and communicate effectively in the language.

For a long time, autonomy was seen as something new, which should break with traditional classroom teaching methods and work in a completely new way (Allwright, 1988).

In accordance with Benson (2006), autonomy can also be observed in the involuntary actions of students in the classroom, which may escape the teacher's control.

Over the years, the interest in autonomy has grown and, as Benson (2006) affirms, the deconstruction of the idea of traditional classrooms around the world is one of its reasons. At Faculdade de Letras Estrangeiras Modernas at the Universidade Federal do Pará, Magno e Silva (2008) has also researched autonomy, bringing light to the concept and even developing a model for its enhancement. The author states that students need to leave passivity aside and be encouraged by the teachers to learn to make decisions about how to take the role of managers of their own learning. Regarding this, Menezes (2013) claims that:

> Teachers are not in control of their students' acquisition processes and there will always be some space for autonomy which empowers students to overcome the boundaries posed by the context. Autonomy or control of one's own learning is manifested in decision making by the language learners and by their ability to overcome social, economic and political constraints which limit their learning experiences (Menezes, 2013, p. 411).

In this sense, the student is seen as independent, especially from the teacher, in the search for learning outside the teaching environment, mediating instruments through their skills (Estarneck, 2022). On this perspective, White (2008, p. 7) had already suggested that learners need to be "active agents who evaluate the potential affordances within their environments, and then create, select and make use of tasks, experiences and interlocutors in keeping with their needs, preferences and goals as learners".

Within this framework, Scharle and Szabó (2000) point out that autonomy goes through a process of awareness, changing attitudes and transferring roles. Once students become aware of their own role, that is, that they must seek for their own learning as autonomous learners, this can cause a change in attitude, and they begin to assume different roles in the learning process. However, it is necessary to draw attention to the fact that this does not occur in a linear way, but rather as a multifaceted process. Learners can change their attitudes and take on another role before they are even aware, thus highlighting the complexity of the process.

In that regard, Benson (2001) emphasizes that by taking control of their own learning, learners develop motivation patterns that lead them to more effective learning. In this way, it is possible to observe a connection between autonomy and motivation, since, for meaningful learning, what students learn needs to be significant and enjoyable. Based on this, we will briefly discuss motivation in the next section.

MOTIVATION

Motivation is a multidisciplinary field of study that seeks to understand why people behave the way they do and what drives them to act in certain ways. Dörnyei and Ushioda (2011) define motivation as what moves a person to make certain choices, to engage in action, to expend effort and persist in action.

According to the authors, when it comes to language learning, motivation does not remain constant, it flows in a complex way and suffers internal and external influences. Therefore, they state that it is very difficult for someone to be motivated to learn something all the time.

On the other hand, they believe that the learner's motivation can be encouraged and developed through motivational strategies, which are actions that teachers can use to promote motivational behaviors. In a classroom, students' engagement in learning will interact with a complex variety of other activities, which will have a significant influence on the language acquisition process.

Furthermore, there is a debate about whether motivation is a cause or effect of learning, establishing a current consensus on a relationship in cycles within learning. For Dörnyei and Ushioda (2011, p. 6), “motivation to do something usually evolves gradually, through a complex mental process that involves initial planning and goal setting, intention formation, task generation, action implementation, action control and outcome evaluation”. Consequently, it is possible to observe a link between motivation and autonomy since both processes are related to the student's engagement in the learning context.

In that respect, Ushioda (2011) brings an alternative perspective on motivation, with a descriptive analysis. With insights from autonomy theory, the author investigates the motivation engagement of particular learners and discusses how processes of constructing and negotiating identities are crucial to this process. With a ‘person-in-context relational view’ of motivation, Ushioda (2009) argues that there should be a focus on real people rather than just learners as theoretical abstractions.

Thus, it is necessary to focus on individuals as human beings with personality, identity, and history, in addition to experiences and complex social relationships of which they are part. She states that the motivation needs to be seen as a process that emerges through this complex system of interrelations. In this sense, Richards (2006) had already highlighted the importance of identity in the language motivation process. Students need to be encouraged to speak as themselves and express their identities through the language they are learning (Ushioda, 2011). In that regard, she states that this identity perspective on motivation brings a connection with autonomy.

Since motivation is concerned with self-expression, this highlights its relevance when the objective of learning is to learn a language. In accordance with Richards (2006), Ushioda (2011) claims that when students are encouraged to express their identities in the target language, this can contribute to the socialization of these identities and motivational trajectories, especially in learning contexts that promote autonomy. This socialization is related to how learners use the language to express themselves.

Concerning autonomy development, especially for beginners, some researchers state that the environment in which the learner is involved assumes crucial importance in the learning process. This environment should be supportive, collaborative, and allow for interaction and communication among learners since they should be encouraged to engage in real-life situations to practice their language skills. Based on this, the teacher has a fundamental role in the process of developing autonomy in beginners. Therefore, we are going to discuss this role in the next section.

TEACHER'S ROLE

In a teaching and learning environment that seeks to develop learners' autonomy, awareness is fundamental. Teachers and students need to be aware of their roles in this process so that the objective is achieved. Concerning the teacher's role, according to Freire (1996), teachers must know how to balance practice and theory, giving the student possibilities to develop and build their knowledge autonomously. So, the teacher's function, more than teaching content, is to develop a pleasant space for interaction between the student and the environment.

In addition, teachers must seek an emancipatory education, providing students with possibilities for choices, thus giving students autonomy in the construction of their knowledge. In this way, it is possible to observe an interdependent character in this relationship between teachers and students.

Thereby, Little (1995) argues that successful teachers are autonomous in having a sense of responsibility for their teaching, which results in affective and cognitive control of the teaching process in addition to exploring the freedom it offers. Huang (2005) defines teacher autonomy as teachers' willingness, capacity, and freedom to take control of their own teaching and learning. Thus, it is important for the teacher to understand and be aware of students' needs.

Furthermore, in the context of autonomous language learning, control and responsibility for the practices involved in the process become a debate. In this sense, Voller (1997) states the importance of negotiation. In order to seek the development of

autonomy, negotiation between teacher and student must be a constant exercise in the teaching environment. In this context, the power relations established in the learning environment call for a reconfiguration and the teacher needs to give up part of his power as an educator, thus giving space for students to express their ideas and desires, regarding their own learning, consequently highlighting the autonomous characteristic of the process.

In accordance with Voller (1997), Rodrigues (2008) points out that in a learning context that promotes autonomy, the roles assumed by the student and the teacher need to be reconfigured. Thus, responsibilities are shared and aspects that concern learning begin to be negotiated. In that regard, Larsen-Freeman and Cameron (2008) claim that negotiation of many factors such as type of activities, topics, and evaluation tend to make language learning more efficient for students as it supports the development of autonomous behaviors.

Additionally, it is interesting to point out the context in which the teacher is inserted. In formal education, the pedagogical curriculum, in most cases, limits the teacher's role in promoting students' autonomy. In this sense, Candy (1989) states that formal education can represent a threat to students' freedom to make their choices and, furthermore, that autonomy can be suppressed or distorted by institutional education. Regarding this, in many cases, it is necessary to strictly follow a pedagogical plan, contents and teaching materials previously established by spheres hierarchically above the teachers, causing them to limit themselves. These are characteristics of traditional teaching, thus inhibiting their role as autonomy-promoting teachers.

Within this context, Lorenzen (2002) argues that education is an uncertain task. According to the author, in addition to being difficult to predict what will happen in a classroom, it is also difficult to define the best direction for an individual's education. For the author, because it is connected to the rest of the universe, education is totally subject to the chaos that naturally exists in reality (Lorenzen, 2002).

LANGUAGE AS A COMPLEX SYSTEM

Complexity theory can explain language and language learning. This theory is dedicated to the study of systems that are “dynamic, complex, non-linear, chaotic, unpredictable, sensitive to initial conditions, open, self-organizing, sensitive to feedback and adaptive” (Larsen-Freeman, 1997, p. 142).

A complex and dynamic system is made up of several elements that interact with each other. These elements influence others and are influenced by them. Furthermore, the interaction between these elements causes changes and adaptations in their behavior and,

as they are open systems, their energies flow within the system due to the interaction process (Paiva, 2011).

Based on this, it is pertinent to observe a phenomenon through a complex perspective. Taking a complexity approach, Borges (2022) asserts that autonomy is a complex dynamic system interrelated with other subsystems, such as motivation, identity and emotions, which interact in different ways and in different contexts.

In that regard, the author states that the trajectory of autonomy can be organized in different perspectives, which consider the social, the individual and the complex. Moreover, the process of developing autonomy is not linear, since several subsystems interact with each other, and there may be ups and downs, advances, and stability.

Furthermore, when it comes to teaching and learning languages, context appears as a primary element. Taking into account the learner's context, culture and social reality is of fundamental importance in the search for meaningful learning. Given this, it is relevant to highlight external factors that interfere with the learner's autonomy, such as social factors.

Paiva (2006) recognizes the obstacles that someone can face when trying to be autonomous and points out that students are rarely completely free from interference from external factors that act as obstacles to the desired autonomy. In this sense, Merriam and Caffarella (1999) point out that marginalized individuals or those from lower social classes may have limited access to learning resources, which can directly interfere with the search for autonomous learning.

In accordance with the authors, Paiva considers that “other factors, such as characteristics of the learner; teachers; technology; educational legislation; and cultural, economic and political aspects can also interfere in the autonomy process” (Paiva, 2006, p. 81). Considering the complexity of the concept and certain restrictions that interfere with the individual's autonomy, Paiva proposes the following definition:

> Autonomy is a complex socio-cognitive system, which manifests itself in different degrees of independence and control over the learning process itself, involving capabilities, skills, activities, desires, decision-making, choices, and evaluation both as a language learner or as its user, inside or outside the classroom (Paiva, 2006, p. 88).

In this way, Paiva considers autonomy a socio-cognitive system because it involves not only individual mental processes, but also the social dimension since our view of language is that of communication and not that of just a set of linguistic structures. Thus, autonomy encompasses both external and internal factors relating to learning.

Given this context, through the work of various theorists and specialists, it is observed that the process of developing autonomy depends not only on the student and

teacher, in teaching and learning environments, but also on many other factors related to the agents involved in the process. In addition, it is important to emphasize that the difficulties of beginners in language learning can influence the development of autonomy, since these students have different perspectives and learning contexts from other more proficient students.

METHODOLOGY

This work is characterized as a field research which, according to Gonçalves (2001), is defined as one that seeks information directly from the target public. It de-mands the researcher to have direct contact with the public, requiring their presence in the space where the phenomenon occurs for the collection and documentation of in-formation.

This research uses the qualitative approach and it is an exploratory case study. Bogdan and Biklen (1997) define qualitative research as the acquisition of descriptive data, which emphasize the process rather than the product and focuses on relating the perspectives of participants. Whereas Yin (2001) defines the case study as a research strategy that answers the “how” and “why” questions and focuses on real-life contexts of current cases.

Therefore, the goal of this study is to better understand autonomy in beginner learners of English. The objectives of this work are: to survey the procedures that stu-dents use to seek knowledge of the language autonomously and to identify factors that encourage or discourage the development of autonomous learning.

Based on these objectives, these are the guiding research questions: (1) How do students seek the language knowledge autonomously? (2) What factors encourage or discourage the development of autonomous learning?

With this purpose, the present research takes place at the language courses at the Universidade Federal do Pará, in Belém, Pará. The university's language courses are part of an extension project developed by the Faculdade de Letras Estrangeiras Modernas and it aims to serve the university's internal and external community, offe-ring courses in several languages in face-to-face and online modalities.

The participants were 17 students, beginners, adults from 18 to 50 years old. The instrument used for data collection was a questionnaire. According to Gil (1999, p.128), the questionnaire can be defined “as the investigation technique composed of a more or less high number of questions presented in writing to people, with the objecti-ve of knowing opinions, beliefs, feelings, interests, expectations, situations experien-ced, etc.”.

Furthermore, Marconi and Lakatos (1999) highlight that along with the questio-nnaire, a note or letter must be sent explaining the nature of the research, its importan-ce, and the need to obtain answers, trying to arouse the participant's interest so that they fill it out and return the questionnaire within a reasonable time.

The questionnaire used in this research was developed through Google Forms platform. The participants responded anonymously. The instrument was developed in Portuguese since students were beginners in English.

The questions were divided into three groups: (1) objective questions, contai-ning multiple choice alternatives, (2) Likert scale questions, where participants che-cked their level of agreement with a statement and (3) subjective and open questions, which they answered freely. The questionnaire was made available on October 28, 2023 and was sent to students through a link, using WhatsApp. The answers were re-ceived until November 8, 2023.

Through this instrument, it was possible to survey the procedures that students use to seek knowledge of the language autonomously. In addition, it was possible to identify factors that encourage or discourage the development of autonomous learning during the beginners' English language learning process.

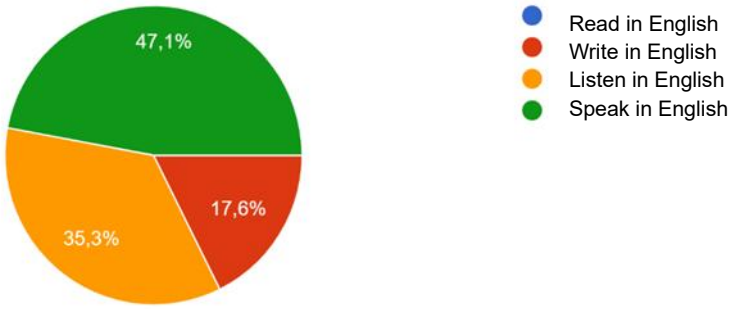
RESULTS

The data were analyzed based on four perspectives: students' potential and limitations, the distribution of the roles, learners' perception of autonomy in learning, and non-autonomous learners.

POTENTIALS AND LIMITATIONS

Concerning their skills, asked about which ones they consider easy and difficult, most students have greater ability in reading in English. In the graph below, we can see this prevalence as the strongest among students.

Figure 1 – Students' easier skills.

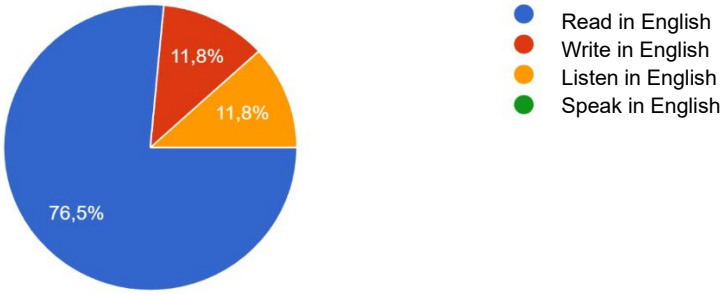


Source: Data collected. Created by Google Forms.

In addition, we can also see that writing and oral comprehension also appear as easy skills in some students' conception.

The biggest difficulty students have concerns speaking. This fits in with the fact that this skill did not even appear in the answers to the previous question (Figure 1). In the graph below, we can see the prevalence of this difficulty.

Figure 2 – Students' most difficult skills.



Source: Data collected. Created by Google Forms.

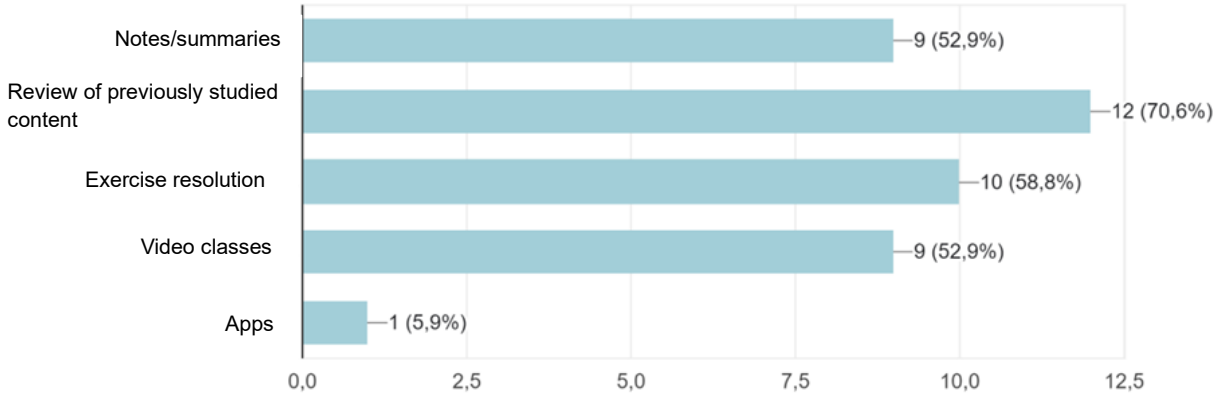
Oral comprehension and writing appear to be difficulties for some of them, in contrast to a minority who have ease in these skills.

Asked how they prefer to study English, most students use forms of entertainment to practice the language, such as music, series, and movies, in addition to also having a preference for reading texts in English. Apart from using entertainment, doing grammar activities is also a preference for students. Only one student practices the language through speaking, by conversations with another person present in his/her context.

Furthermore, 70% of students use the review of previously studied content as a method of studying the language outside the classroom. This is in line with the answers to question 10, in which the act of revising is often cited as one of the actions that students

take when they become aware of their difficulties. In the graph below we can see the methods they mostly use to practice the language.

Figure 3 – Students' methods to practice the language outside the classroom.



Source: Data collected. Created by Google Forms.

According to the data, solving exercises is another method that most students use to study the language, which is also in line with the answers to question 10, as the act of practicing is also commonly used by students when they become aware of their difficulties. Thus, the results show that this practice takes place mostly through exercise resolution and reviewing content (Figure 3).

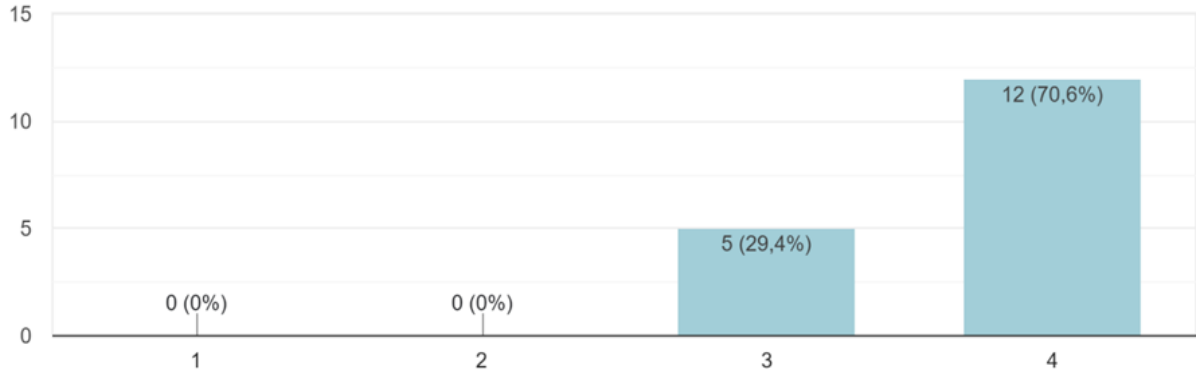
THE DISTRIBUTION OF THE ROLES

The data shows that most students attribute the development of their language skills to the teacher, even though the majority are aware of the concept of autonomy indicated in the answers to question 14. However, some students (6) believe that this role does not belong to the teacher.

Moreover, most students believe that the teacher should point out their strengths and weaknesses in relation to language skills, which demonstrates that students are tied to the teacher's role in identifying their own capabilities as students. Even though they are aware of their strengths and weaknesses, as shown in the answers to questions 3 and 4, respectively, students still feel the need for the teacher to validate their language skills. Only one student says he/she does not have this necessity.

Concerning the development of language skills, all students participating in the research believe that the teacher has a fundamental role in evaluating their progress. The graph below shows this data.

Figure 4 – Students' belief in the need for the teacher to evaluate their progress.



Source: Data collected. Created by Google Forms

Thus, the data indicates that, even if some students are opposed to this result, the vast majority point to the teacher all the factors related to their own language skills, with regard to developing, pointing out, and evaluating such skills. In this sense, the data shows that students tend to place the teacher at the center of their learning, giving him/her most of the responsibility in this process.

LEARNERS' PERCEPTIONS

When it comes to learners' perceptions of autonomy in language learning, asked if they were aware of the concept, most students say they already have an idea of the concept of autonomy. Among these, we highlight some definitions:

> [1] Yes, I already had that ide a. However, the teacher needs to be the mediator in the teaching and learning process, offering conditions and tools so that the student can access and interact with different knowledge and sources of information (Student 2).[2]
>
> [2] Autonomy is seeking something beyond requests and help. Try to carry out learning alone and in a critical and reflective way (Student 5).
>
> [3] Yes. I think the teaching-learning process should take place through methodologies that guarantee student autonomy (Student 6).
>
> [4] Yes, being able to communicate individually in another country (Student 7).

Given these conceptions, it is possible to observe in excerpt [1] that student 2 is aware of the definition of autonomy, as well as the role of the teacher as mediator in this process.

Furthermore, as we observe in excerpts [2] and [3], students 5 and 6 have a notion of autonomy directly linked to the teaching and learning process, highlighting criticality and

[2] The answers to the questionnaire were originally written in Portuguese. This and all the translations of the students' words are our responsibility.

reflection, in addition to language teaching methodologies. While in excerpt [4] student 7 understands the autonomy associated with communication in real contexts of language use

Among the participants, only four said they had no idea of the concept of autonomy. However, this conflicts with the answers to question 14, in which all participants can point to a definition of what it means to be an autonomous learner.

When asked about the influence of autonomy on the language learning process, we highlight the following perspectives:

> [5] Being aware of my own difficulties, I can focus on activities that help me overcome the areas of English that I need to focus on (Student 5).
>
> [6] It helps because you decide how you want to learn, how you will organize yourself and use motivation as the main factor (Student 6).
>
> [7] Encouragement and freedom (Student 16).

Given the answers, it is possible to observe in excerpt [5] that student 5 understands the influence of autonomy in becoming aware of his/her difficulties. From this awareness, he/she develops autonomous behaviors to focus on overcoming his/her difficulties.

On the other hand, in excerpt [6] student 6 understands autonomy in the learning process as decisive for the way he/she wants to learn, which influences his/her motivation in the process.

Finally, in excerpt [7] through students 16's response, we can see autonomy itself as the factor that encourages the student learning

When asked what it means to be an autonomous learner, the act of looking for tools, means and ways of learning were some of the frequent answers among participants. To this question, we highlight the following answers:

> [8] It means having the power to decide on the learning process according to your own limitations (Student 10).
>
> [9] One who does not assimilate knowledge passively (Student 13).
>
> [10] Walking in your own shoes. Independence (Student 15).

With these answers, it is possible to identify that in excerpt [8] student 10 points out that being an autonomous learner implies having the power to decide on his/her own learning, in addition to having the possibility of recognizing his/her own limitations. While in excerpt [9] student 13 highlights the non-passive character of autonomy.

Finally, in excerpt [10] student 15 uses a metaphor to highlight the independent nature of an autonomous learner, who, according to him/her, is capable of "walking in your own shoes".

Asked if they consider themselves to be autonomous learners, the majority of students say yes, which is in line with the answers to question 10, in which, upon becoming aware of their difficulties, students try to do something to reduce them, such as practice, review and dedicate more time to studying the language.

Only three students say they do not consider themselves autonomous. However, according to the answers to question 10, these students state that they try to practice and study the language more when they become aware of their difficulties, which indicates an autonomous character even without their own awareness. To the question about consider themselves autonomous, we highlight the following answers:

> [11] No! Despite studying outside of class hours, I feel that my learning is still robotic, largely because I don't have contact with other people who speak the language. So, I feel dependent on the classes, the teacher and the books. I don't question the reason for the grammar rules and I still don't feel that learning English is something natural and pleasurable (Student 1).
>
> [12] Yes, because I want to learn the language in old age (Student 11).

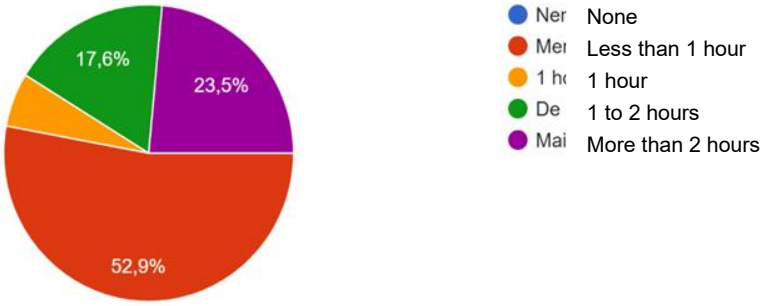
Given this, it is possible to observe in excerpt [11] that student 1 does not consider him/herself an autonomous learner due to the lack of communication in the language. Furthermore, the student demonstrates a dependence on the teacher and materials and emphasizes that he/she does not enjoy language learning, which highlights the absence of major motivational factors in his/her learning process. While in excerpt [12] student 11 shows, in his/her response, a great motivation pertinent to this process.

Based on this, the data indicates that students are aware of the concept of autonomy in learning, in addition to knowing what leads them to have autonomous behaviors and the important factors in this process, such as motivation and the teacher's role.

NON-AUTONOMOUS LEARNERS

The analyzed data shows that most students have the habit of practicing and studying the language outside the classroom environment. Only two students said they did not have this custom. However, we can see in the graph below that most students have the habit of practicing and studying the language outside the classroom for only less than 1 hour.

Figure 5 – Distribution of language study hours by students outside the classroom.



Source: Data collected. Created by Google Forms.

This indicates that, even though the majority have the habit of studying outside the classroom, the time they dedicate to this practice is minimal.

Furthermore, these data point to a contrast with the students' answers to question 10. When they become aware of their difficulties, one of the attitudes to try to reduce them concerns time. The students' responses indicate that they try to dedicate more time to studying and practicing the language, though the data indicates that this time is minimal.

DISCUSSION

Based on the data, students tend to focus language practice on the skills in which they are good at, not practicing that skill they consider more difficult. In this sense, the methods they use to practice the language are almost always focused on those skills they are good at, so we can infer they are motivated by their affinities.

It was possible to observe, according to Borges (2022), the influence of the motivational subsystem present in the complex system of autonomy. Learners tend to be autonomous with things they feel motivated to do.

In addition, this result is at the same time, in line and contrary to what White (2008) points out, that learners need to create, select and use tasks according to their needs and preferences. In this sense, data shows that students focus only on their preferences, what they like and find easy to study, leaving aside their necessities, what they need and have difficulty with.

Furthermore, it is evident that most students are tied to the teacher's role in identifying their strengths and weaknesses. Although they acknowledge their limitations, they rely heavily on the teacher to validate their capabilities. This highlights a gap in their progression toward full autonomy, as emphasized by Scharle and Szabó (2000).

Regarding learners' perceptions, while many students understand and articulate definitions of autonomy that align with established theories (Freire, 1996; Holec, 1981;

Paiva, 2006), the data reveals inconsistencies in their self-assessment and reported behaviors. Students often demonstrate autonomous behaviors without fully recognizing them, suggesting a need for better awareness and reflection on their learning strategies.

Finally, although motivation is a key factor driving autonomy, as per Dörnyei and Ushioda (2011), its application remains limited by minimal engagement in extended practice. This minimal dedication to autonomous learning activities, coupled with their reliance on the teacher, highlights the complexity of autonomy as a socio-cognitive system (Paiva, 2006), involving internal and external factors that shape learners' behaviors and attitudes toward language learning.

CONCLUSION

This research was developed in English first-level classes at the language cour-ses at the Universidade Federal do Pará. The instrument used was a questionnaire with questions about students' learning, which aimed to survey the procedures that students use to seek knowledge of the language autonomously and to identify factors that en-courage or discourage the development of autonomous learning.

Thereby, in response to our first research question, about how students seek language knowledge autonomously, the data shows that they do it by studying outside the classroom through entertainment, such as music, series and movies. In addition, they also have a preference for reading texts in English, doing grammar activities and most of them using the review of previously studied content as a method of studying the language outside the classroom. However, the time they dedicate to this study is minimal, which thus compromises the development of autonomous learning.

Moreover, the data shows that most students tend to study the language based on the skills they have affinity and ease with. This answers our second research questi-on, about factors that encourage or discourage the development of autonomous lear-ning. Such easier skills are the factors that encourage them, as they seek to practice and focus their studies on what they like. Consequently, the skills in which they have diffi-culty are the factors that discourage them from studying the language, as they do not prioritize studying what they have to struggle with.

Additionally, the data indicates that students need the teacher to point out, eva-luate and develop their language skills, thus placing the teacher at the center of their learning, giving him/her most of the responsibility in this process. This is also a factor that discourages them from developing autonomous behaviors.

The limitations of this study lie in the lack of interviews with some representa-tive students. Based on the answers, it would be interesting to talk to the students, through an interview, to learn more about their autonomous learning. However, due to the research execution time, it was not possible.

Furthermore, an intervention in the class could also be relevant for the research, in the sense of encouraging autonomous behaviors through this intervention. To com-ply with this, in the last classes feedback was given on the results so that students can learn to walk in their own shoes, study things they do not know or have difficulty with for longer and, thus, develop their autonomy in learning.

Therefore, the present research opens a window of opportunities for future sci-entific investigations in the field of autonomous learning of beginners in a foreign lan-guage. Learning a language, especially when you are a beginner, requires numerous factors, such as time, motivation, encouragement, and autonomy. Through theory, we know that the development of these factors is not an easy task, neither for students nor for teachers. For that reason, continuous scientific research in this field of study is ne-cessary in the search for meaningful learning.

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QUEEN OF THE AGRESTE: FROM COTTON PRODUCTION TO THE PROVISION OF SERVICES

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Isadora Duarte da Silva[1] and Diego Salomão Candido de Oliveira Salvador[2].

ABSTRACT

The objective of this work was to analyze the progression of the services offered in the city of Nova Cruz, from the 1950s to the present day. The methodology used was the theoretical and historical review regarding the evolution of the services provided in the municipality of Nova Cruz-RN, as well as field visits, to map the main services of the city, photograph and observe the urban dynamics generated by them. In addition, the REGIC methodologies were revisited and analyzed to understand the centrality of Nova Cruz. The results showed that cotton was the economic activity that gave visibility to the city, however, with its decline, the space was used by other services: supermarket chains, retail and wholesale segment, universities, federal institutes, national institute of social security, regional directorate of education and culture, banks and others. It is concluded that the absence of these services and their concentration in Nova Cruz, reinforce their importance in the region.

Keywords: Nova Cruz. Cotton. Services. Centrality.

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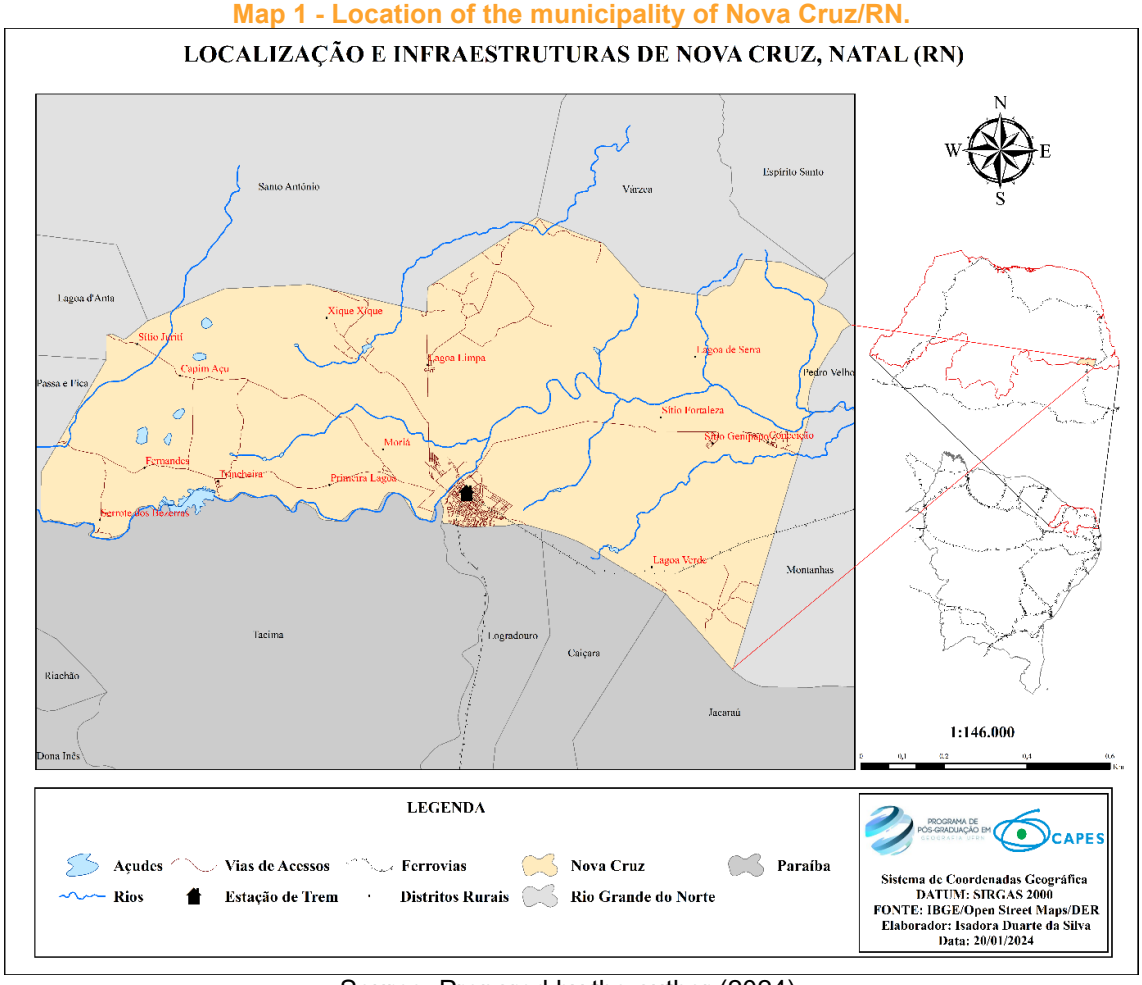
INTRODUCTION

The municipality of Nova Cruz is inserted in the microregion and mesoregion of Agreste Potiguar. Its territorial extension is 277,658 km², limited to the north by the municipalities of Santo Antônio, Várzea and Espírito Santo, to the south, by Tacima, Logradouro, Caiçara and Jacaraú, located in the state of Paraíba, to the west, by Lagoa d'Anta and Passa-e-Fica, and to the east, by Montanhas and Pedro Velho as shown in Map 1. The seat of the municipality is about 114 km from the capital, and its access, from Natal, is made by the BR-226, RN-160 and RN-120 highways (BELTRÃO et al., 2005).

Map 1 - Location of the municipality of Nova Cruz/RN.



Source: Prepared by the author (2024).

Cattle raising and agriculture were the economic activities that established the conditions for the formation of the Northeast, as Nova Cruz extends, in constant, Andrade (1998, p.36), states that the agreste region, although it was colonized by cattle breeders, today agriculture is more relevant. In the middle of the twentieth century, the cultivation of cotton was the main economic activity of the municipality, occupying a prominent place in production, in view of this, Nova Cruz achieved a relative economic expressiveness in

relation to the surrounding municipalities, contributing to the well-known "Queen of the Agreste" (AZEVEDO, 2005).

The production of cotton and oil were responsible for leveraging the economy of Nova Cruz until the 1970s, with 2 cotton processing industries, 1 oil production factory, 4 gins and 3 tanneries (AZEVEDO, 2005). One of the last companies to operate in the municipality was the Consorcio Algodoeiro de Nova Cruz LTDA, founded in 1966 with the function of preparing and spinning cotton fibers.

However, with the cotton crisis in the 1970s caused by the boll weevil plague, Nova Cruz "reduced its cultivation area and lost the cotton processing industries that had been installed there" (LIMA, 2010, p. 100). As a result, there was an intensification of the rural exodus, increasing the urban population, demand for jobs and services. In this way, Nova Cruz starts to develop commerce and services, becoming a city with significant influence for the municipalities around it.

During the 1950s, Nova Cruz was characterized by an essentially agrarian economy, with basic services and limited infrastructure. Over the years, especially during the 1970s and 1980s, there were significant investments in urban infrastructure, which allowed the expansion and diversification of public and private services in the city. There was a remarkable growth in the service sector, driven by the economic development and modernization of the city.

The city of Nova Cruz has experienced several transformations over the decades, which have directly impacted the variety of services provided to the population. Thus, this article aims to analyze the urban formation of Nova Cruz and the progression of the services offered in the city, from the 1950s to the present day.

This study seeks to contribute to the existing literature by offering a detailed and contextualized view of the particularities and dynamics of Nova Cruz, which is constantly evolving. In addition, it is hoped that the results of this research can serve as a reference for future studies, contributing both to science and to the planning of development policies in the field of research.

METHODOLOGY

The research was developed from a bibliographic review develops from "the available record, resulting from previous research, in printed documents, such as books, articles, theses, etc." Severino (2013, p. 106), as well as websites, journals and dissertations. The secondary data surveys were carried out in electronic databases of the IBGE (IBGE cities), the National Institute of Educational Studies and Research Anísio

Teixeira (INEP) and analysis of the surveys developed by the IBGE on the Regions of Influence of Cities (REGIC) in order to characterize the object of study, as well as to understand the numerical indicators of tertiary activities.

In addition, on-site visits were carried out in order to observe the equipment that characterizes the third sector. These visits aimed to understand the dynamics of operation, in addition to cataloging and photographing the equipment to include this information in the work. The inclusion of tabulated data and photographs in the work aims to provide a visual and quantitative representation of the observations made, facilitating the understanding and interpretation of the results.

THEORETICAL FRAMEWORK

The perception of the city permeates several theoretical-methodological perspectives, so there is no single path to be taken, nor is there a current of thought with the absolute truth. The city is a complex and dynamic space, which can be understood in different ways. According to Souza (2005, p. 25), the "city is a very complex object and, therefore, very difficult to define".

We understand the city as a product of society, which is not a mere agglomeration of people and equipment, but a social space, with its own logic and dynamics. Thus, we will work on this concept based mainly on the conceptions of the philosopher Henri Lefebvre and the geographer Ana Fani. The city is seen "as a human construction, a historical-social product, a context in which the city appears as materialized labor, accumulated over a series of generations, based on the relationship between society and nature" Carlos (2007, p. 20).

Initially, Lefebvre distinguishes the city from the urban. The city is the physical place, the concrete space, while the urban is the social form that manifests itself in the city. A “(...) city, present, immediate reality, practical-sensitive, architectural data – and on the other hand the "urban", social reality composed of relations to be conceived, built or rebuilt (...)" Lefebvre (2007, p. 54). Thus, the city is a social product, which refers to the notions of agglomerations and sedentary lifestyle, being the matrix of the urban, while the urban is the process of the mode of production, of organization of space, that is, the urban is a way of life.

For the spatial analysis of the city, Carlos (2007) shows that there is an inseparability between space and society, since social relations are concretized in a real and concrete territory, thus, the socio-spatial practice is the way society produces and reproduces space. For Carlos (2007), the city is a product of capitalist society, controlled by the logic of

exchange value, being valued from its appropriation and commodification, however, the city should be destined to the realization of life, that is, use value.

The city is the result of the action of certain historical and social "agents", which according to (LEFEBVRE, 2001), contributes to differentiate the action and the result, the group and its product. Lefebvre (2001) states that the city has always maintained intrinsic relations with society, encompassing its composition, functioning and constituent elements, such as the countryside, agriculture, political and military powers, and states, so cities change as society transforms. However, urban changes are not passive to global social transformations, as they also depend on the direct and immediate relationships between people and groups that make up society. (LEFEBVRE, 2001).

In the meantime, the city is understood as a transforming agent of society, which influences its spatial organization and functioning, being an active agent in the production of these changes. Therefore, the transformations of the city are the result of a complex interaction between global and local factors. Thus, Lefebvre adds that:

> the city is transformed not only as a result of relatively continuous "global processes" (such as the growth of material production over the ages, with its consequences in exchanges, or the development of rationality) but also as a result of profound changes in the mode of production, in the "city-country" relations, in class and property relations (LEFEBVRE, 2001, p. 58).

Transformations in cities are not a phenomenon of a single dimension, being linked to various social, economic and political aspects. Thus, Carlos (2007) notes that in the modern world, the city is articulated and inseparable in three planes: economic, political and social. In the economic plan, the city is characterized as the production of capital, being fundamental for the generation of profits and accumulation of wealth; the political dimension, the city is the space of domination by the State, being a standardized body; and the social the city is considered a socio-spatial practice, where social life is experienced and reproduced. Carlos (2007, p.21) emphasizes that "(...) These three planes reveal dimensions, such as those of local and global; against the backdrop of the process of globalization of society, as the constitution of urban society / world space."

The city, in addition to being the space for the coexistence of social life, culture and values, is also a center for the management of the territory, as stated by Souza (2005). The city plays an important and central role in the administration, organization and power of space, being the headquarters of several public and private institutions. Thus, Souza (2005) states that the city does not only act as a center of territory management due to the presence of companies and seats of religious and political power, but also as a space where goods are produced, marketed and consumed and where work activities are

developed, in this way, the city is a place of organization and social interaction, guided by diverse interests and values, forming affinity groups.

Cities are articulated with each other in different ways, intensities and functions, so there are no cities isolated from each other. "In a very variable way with regard to the type of flow and, above all, the intensity of the flows, all cities are connected to each other within a network - within the urban network" Souza (2005, p.50). Thus, there is an interconnection between cities, forming a dynamic and complex urban network.

The urban network is a social product built throughout history through different processes, such as globalization, colonization, etc. It articulates all cities with each other, forming webs of interactions allowing the circulation of people, goods, information and services. In this context, the urban network is "(...) a social product, historically contextualized, whose crucial role is, through spatialized social interactions, to articulate the whole of society in a given portion of space, guaranteeing its existence and reproduction Corrêa (2001, p. 93).

Over time, the urban network undergoes several modifications, gaining new meanings and functioning. Thus, the urban network is not homogeneous, with divergent characteristics in each place, being the result of its historical, social and economic characteristics.

In order to configure an urban network, Corrêa (1994) emphasizes that it is necessary to have three stages, the first being: to have a market economy, which produces or sells objects that are not produced locally and/or in the region; second: to have fixed offices in the territory that generate flows for business operation; and third: to have a minimum of articulation between the aforementioned stages, enabling a distinction between urban centers. This differentiation is based on the various characteristics, interactions and functions that urban centers play in the regional dynamics, producing central and hierarchical locations.

Corrêa (1994) asserts that this distinction characterizes the territorial division of labor:

> The urban network is simultaneously a reflection of and a condition for the territorial division of labor. It is a reflection to the extent that, due to differentiated locational advantages, there is an urban hierarchy and functional specialization that define a complex typology of urban centers (CORRÊA, 1994, p.48).

Therefore, we understand that the urban network works as a reflection as a condition for the territorial division of labor. This division is configured with the productive specialization of a region, based on its locational advantages. The urban network, as well

as a reflection, also establishes an interdependence between urban centers and economic activities, both at the local and global level.

In the urbanization process, the urban network is materialized from production, circulation and consumption, being linked to distant regions, instituting a world economy (CORRÊA, 1994).

Globalization intensifies interconnection at a global level, enabling cities, even small ones, to participate in the production chain and attract investments from foreign companies. In the perception of Corrêa (2001), the large "multifunctional and multilocated" companies establish an important attribution in the (re)definition of the functions of urban centers and vehemence of integration, causing differentiations between urban centers and new actions aimed at the accumulation of capital. Thus, the urban network is configured as a reflection of the results of the accumulation of the various social agents.

The capitalist logic is driven by the search for locations that maximize its profits, with access to the consumer market, infrastructures and cheap labor, making it attractive for new business investments. Thus, Corrêa (1994, p.49) certifies that in this logic, there is "(...) the valorization of certain locations to the detriment of others (...) as a consequence, some cities lose importance, while others are valued; new urban centers are created". These new centers undergo significant reconfigurations, responding to the demands of the global market, in contrast, to the decentralization of some cities, with the weakening of their traditional activities.

In this way, the centrality of a city is inherently associated with its degree of importance and ability to offer goods and services to other urban centers, creating an area of influence, therefore, the centrality of a city assumes a mainly economic nature (CORRÊA, 1994), composed of its productive and commercial activities. Central cities offer a complex and diverse set of specialized services in numerous areas, leading to an urban hierarchy and at the same time new interactions. This division and articulation, it is associated with development and structuring "(...) of a wide urban network, covering various types of centers located in various territories (...)" Corrêa (1994, p.53).

In this context, we can understand the urban network, according to Corrêa (2001, p. 93), as a "(...) set of urban centers functionally articulated with each other. It is, therefore, a particular type of network in which the vertices or nodes are different nuclei of settlement endowed with urban functions, and the paths or connections the various flows between these centers". However, Souza (2005) points out that the urban network is not "innocent", it is not an apolitical structure, in fact it reflects the procedures of economic exploitation and exercise of power.

THE IMPORTANCE OF COTTON IN THE ECONOMY OF RIO GRANDE DO NORTE AND NOVA CRUZ: A HISTORICAL ANALYSIS

Until the mid-1920s, the integration of Rio Grande do Norte with the national market was limited (CLEMENTINO, 1990). This restriction was the result of infrastructure and transportation challenges that hindered trade and the connection of RN with other regions, as well as the dependence on traditional activities, with little economic diversification. Thus, Azevedo (2013) concludes that the economy of Rio Grande do Sul in this period was mainly rural, with emphasis on agricultural and livestock production activities in the region, highlighting sugarcane in the Zona da Mata and part of the Agreste, cotton farming in the other regions, associated with subsistence food crops such as corn, beans and cassava.

Since the colonial period, rural activities dominated the economy of RN, with emphasis initially on cattle raising and sugarcane, later the production of cotton. The occupation of the Potiguar territory and the emergence of the first cities were consolidated from the raising of cattle in the hinterland and the cultivation and export of sugarcane on the coast (CLEMENTINO, 1990). The cattle farms or "corrals" were a way of organizing the space in order to populate the hinterland and, at the same time, to be "support for the dynamics of the northeastern sugar economy" Clementino (1990, p.76).

Thus, the logic was to occupy the lands considered vacant, that is, without formally recognized property, with areas of pastures and large corrals, with the aim of supplying meat, as well as its derivatives such as leather, for consumption in the cities of the coast (MEDEIROS FILHO, 2001). These two activities established a relationship of complementarity in the economy of Rio Grande do Norte, in which they generated flows of resources and people between the regions of the state.

For Clementino (1990) cattle were the basis of the urban system of Rio Grande do Sul and its old paths became the roots of the main regions of the state, such as the Coast, Seridó and West, which defined the first selections among the urban centers, forming an embryo of the urban network of the state, which is part of the northeastern system of cities, In this way:

> The main villages (elevated to towns in 1775), along the cattle paths define their areas of influence. On the coast, except for the city of Natal, it is Goianinha with 6,661 inhabitants that emerges as the main sugar center. In the Sertão, to the west, the locality of São Francisco da Várzea (in Apodi) with 4,091 people and in the Seridó, Vila do Príncipe (Caicó) with 3,147 (Clementino, 1990, p.77).

The cattle path made it possible to connect cattle ranches to other urban centers, generating integration and development in the regions, thus, several cities stand out in this period. Clementino (1990) points out that until the eighteenth century, RN had eight

municipalities, of which, Extremoz, Arês, São José and Vila Flor were sugar producers and Porto Alegre, Açu and Caicó stand out with cattle raising, in addition to the municipality of Natal. Thus, it generated development poles and cities along the paths traveled

Another prominent and important economic activity in the production of the northern Rio Grande do Norte space was cotton production. With the crisis caused by the Civil War, there was an increase in cotton prices, giving rise to new markets, thus, RN had great prominence in cotton production, surpassing the sugarcane industry, which suffered from technological delays (GALVÃO, 2012). The expansion of cotton farming in the "*cotton hunger*" period promoted the rapid growth of some rural areas, such as Caicó, Apodi, Açu, Martins and Mossoró (CLEMENTINO, 1990).

Cotton production was also responsible for promoting a greater flow of population, increasing the demand for food, "(...) being, however, a crop that allowed other intercropping, such as beans and corn, corn and broad beans and even cassava, it also made these areas producers of food crops" Andrade (2017, p. 109). In addition, it contributed to the construction of railroads by the state, allowing the integration of the capital with the cities and with other states, reducing its isolation.

In this way, the industrialization of cotton was one of the engines responsible for the advance of urbanization in RN, as well as other activities, such as mining, commerce and the service sector (AZEVEDO, 2013). The mined activity stands out in the Seridó region, with a focus on the extraction of scheelite, with Caíco being the largest producer of the ore in the state. Another important production for the formation of the Potiguar urban network is the exploitation of salt, which "dates from the beginnings of Portuguese occupation" Tavares (2020, p.67) standing out in the municipalities of Macau and Areia Branca on the north coast of the state.

The cotton economy made the construction of the first railroad in RN possible. According to the official website of the Brazilian Company of Urban Trains (CBTU), it reports that the construction of the railroad was authorized in 1873, however, its construction only began in 1878 (BRASIL, 2015). The urban train was intended to transport cargo and means of transportation from neighboring communities, bringing transitions to the provincial way of life in Rio Grande do Norte (BRASIL, 2015).

Thus, after the 1880s, the railroad that connected Natal to the then village of Nova Cruz was built and inaugurated, with the objective of connecting the city to sugar-producing regions in the states of Paraíba and Pernambuco by a faster route, as well as for the flow of cotton (MEDEIROS, 2017). In 1901, the stretch that connected Natal/Nova Cruz was leased by the English company *The Great Western of Brazil Railway Company*, the railroad

connected the states of Rio Grande do Norte, Paraíba and Pernambuco, the city of Nova Cruz to the city of Brum, in Pernambuco, developing the local commerce and industries of the time (BRASIL, 2015).

The railway line and cotton production offered the municipality development and visibility in relation to neighboring municipalities, attracting a considerable flow of merchants, farmers and travelers. People sought in the city of Nova Cruz new services, goods, infrastructures and jobs that were not served in their own cities, boosting the local economy, thus becoming an important city in the Agreste Potiguar region.

However, with the cotton crisis in the 1970s caused by the boll weevil plague, Nova Cruz "reduced its cultivation area and lost the cotton processing industries that had been installed in it" Lima (2010, p. 100). As a result, the "(...) passenger train stopped running in 1977 and the freighter in the late 1990s (...)" Azevedo (2005, p. 156), negatively impacting the economy of the region, the transport of goods and people.

Nova Cruz is undergoing transformations in its centrality according to the REGIC documents, with its peak in 1966, as shown in table 1, being classified as a sub-regional center, "the level 3 centers or sub-regional centers are subordinated to the level 2 centers (regional centers) or are directly linked to the metropolises" (REGIC, 1972, p. 16). They are cities characterized by less complex activities and with smaller areas of influence than regional capitals.

Table 1 - Centrality of the municipality of Nova Cruz, between 1966-2018

Year	Levels	Denomination
1966	3B	Sub-regional centers
1978	4B	Zone Center
1993	2	Weak
2007	5	Local Center
2018	5	Local Center

Source: IBGE (1972, 1987, 2000, 2008 and 2018).

Based on the analysis of the methodologies of the five REGIC documents, a reduction in the centrality exercised by Nova Cruz in the state urban network is observed from the REGIC of 1978. This is due to the decrease in the importance of the variable of agricultural flows, which previously had a strong presence in the municipality and boosted its relevance in the Agreste Region. In addition, the decline in cotton production and the extinction of the railroad resulted in the reduction of Nova Cruz's connections with other cities and states, reducing the number of flows of people and goods in the municipality.

For Tavares (2019), the territory of Nova Cruz was not used by new productive circuits, significantly reducing its role in the urban network. However, despite the reduction of influence in REGIC, Nova Cruz enjoys several instruments that allow interactions with

other municipalities, Tavares (2019), points out that the permanence and installation of new urban equipment in the city maintain its importance in the state urban network, especially in terms of centrality on a local and regional scale.

In this way, the presence of equipment and the insertion of new ones enable connections and interactions with other cities in the region, even though it is characterized by the 2018 REGIC as a Local Center, that is, a city that does not have "any other city linking to these as the main connection", according to REGIC (p. 77, 2018). Local Centers are cities that exert influence restricted to their own territorial limits, and can attract the flow of people to specific topics such as services in the education, health and banking sectors, responding to the demands of neighboring cities and the state of Paraíba.

A CURRENT OVERVIEW OF SERVICES IN NOVA CRUZ

The diversity of tertiary services indicates that Nova Cruz is an intra-urban reference center as well as at the inter-regional level. According to Coutinho (2020), the centralization of certain urban functions is influenced by spatial selectivity, which is determined by locational factors, market size, product supply, and meeting other needs, resulting in the concentration of commerce and services in places with greater consumption potential. Therefore, the articulation between cities and the variation in demand play a crucial role in defining the areas that stand out as commercial and service centers.

The city of Nova Cruz has three bank branches, namely the branch of Caixa Econômica Federal, Banco do Brasil and Bradesco, as shown in Figure 1, in addition to the bank correspondents and two 24-hour banks and during the period of cotton production there was the Itaú branch. The presence of banks in small towns contributes to local development, attracting new activities, as well as flows of people.

Figure 1 - Bank branches in Nova Cruz



Org. Author (2024)

The lack of bank branches in inland cities is largely due to the lack of population and the low economic dynamics of the place. Thus, at the national level, Dias (2017) emphasizes that the distribution of bank branches takes place in the largest regions of the country, stating that from the second half of the 1980s, banks began to plan and carry out strategic movements, with the objective of maintaining favorable positions for future actions. In addition, the author emphasizes that these movements were driven by external and internal constraints that altered the trajectory of the banking system, with the retraction of bank branches within the macro-regions and, at the same time, by the expansion in the largest regions of the country.

The banking concentration in the largest regions is the result of a strategic restructuring that would guarantee the survival, profit and growth of the banks. Even with this movement, small cities receive bank branches, as Contel (2011) states, they are of fundamental importance for small municipalities, as they are fixed geographically that dynamizes local life and generates new services. From this perspective, Tavares (2017) alleges:

> despite still being quite concentrated, the location of bank branches in Rio Grande do Norte, in 2015, is no longer restricted to intermediate cities, as in previous periods. Cities at different levels of urban centrality have these fixed banks, even local centers. However, it is notorious that, in addition to those that are considered centers of territorial management, the agencies are located in local cities that we have identified as presenting greater urban dynamics, either because they house important productive spatial circuits for the state economy or because they are urban centers that, in the last IBGE study, were considered as local centers, but

> which in previous studies exercised some level of centrality (TAVARES, 2017, p.124).

Thus, the banking service expands in the context of its productive restructuring, creating new hierarchies in the state network, as well as its installation occurs in a city that already had a certain centrality in the state's urban network (TAVARES, 2017).

Due to the various robberies of branches in Rio Grande do Norte, the cities that have banking services acquire considerable population attraction. In accordance with (SILVA, 2021), it reports that the banking system in the State of RN has undergone a reorganization in the face of the problem, reducing the number of branches and considerable expansion of banking correspondents, with the offer of simpler services.

In the field of health, the municipality has dental, gynecological, ophthalmological clinics, polyclinics, etc. The precariousness of the public health service in Brazil gives rise to the need to use private services, seeking quality and accessibility of health services. Another factor that strengthens the private sector is the great demand from the public network, which is often overcrowded.

The establishments that receive the largest contingent of people from other municipalities are the clinics and laboratories that work with medical care and laboratory tests. The institutions that stand out are the São Sebastião Laboratory and Clinic, Fêmine Clinic, Vicente Abreu Clinic, Florence Clinic and Maria Vitória Medical Clinic with DNA Center laboratory, responding to the need and demand of health services in the municipality, as well as in neighboring municipalities.

The city has a vast number of establishments linked to the retail and wholesale segment, as well as franchised stores such as Americanas, Pague Menos, Drogarias FarMelhor, Br-moto Honda, Ótica Martins, Loucos por Coxinha etc. The establishments offer a variety of services, such as clothing, footwear, appliances, electronics, furniture, optics, perfumery, stationery, toys and printing stores. The supermarket and wholesale sector is one of the most prominent, offering variety and attractiveness to consumers in surrounding areas, such as the Rede Mais, Rede Supercop and Curimataú establishments.

These supermarket chains innovated in physical structure, with a large physical environment, in addition to having a bakery and café. Rede Mais and Rede Supercop have 24-hour banks, open from 7 am to 8 pm. In addition to generating additional flow and greater economic dynamics, these companies brought together a greater amount of formal work. The installation of supermarket chains is an indication of the role of the municipality in the role of the state urban network.

Nova Cruz also stands out with the provision of government services, Figure 2, with service to the public to solve various issues. It provides a Municipal Forum, for civil proceedings and administrative functions; Citizen's Central, being the only one in the Immediate Geographic region of Santo Antônio-Passa and Fica-Nova Cruz. The citizen's center works with the services of the Technical-Scientific Institute of Expertise (ITEP) with the issuance of identity cards and as the body of the State Department of Traffic (DETRAN), with medical examinations, Issuance and Renewal of the National Driver's License (CNH), vehicle registration, etc.

We have the Brazilian Micro and Small Business Support Service (SEBRAE), in RN we total 8 units spread across the regions of the state, offering courses, events and training for entrepreneurs. In addition, we took advantage of the Social Security agencies and the Ministry of Labor (Figure 2).

Figure 2 - Citizen's Center, Forum, Electoral Forum and Social Security in Nova Cruz



Org. Author (2024)

The use of the aforementioned services is intensified on Mondays and Thursdays, due to the municipality's free market. The Nova Cruz street market was founded in the nineteenth century and represents one of the largest in the Agreste Region, providing various products such as clothing, footwear, meat, vegetables, household equipment, agricultural instruments, among others (Figure 3). Coutinho (2010) emphasizes that the street market serves the customers of the municipality, as well as consumers and market stallholders in the cities of Montanhas, Passa e Fica, Santo Antônio, Canguaretama, Lagoa

D'Anta, Pedro Velho, Goianinha, Brejinho and Monte Alegre, as well as in the cities of Jacaraú and Logradouro in the State of Paraíba.

The open market is configured as a commercial space, which plays an important role in the generation of informal jobs, representing opportunities for economic survival of several families, especially those who are not involved in typically urban activities. Finally, the fair is characterized as a vector of local development and regional integration.

Figure 3 - Products sold at the Nova Cruz street market



Org. Author (2024)

In the field of education, RN provides 16 Regional Directorate of Education (DIRED) throughout the state, it is an organ of the State Secretariat of Education and Culture (SEEC) that acts in the management of state public education, being responsible for coordinating educational activities in their respective cities. Nova Cruz has the 3rd DIRED, being the director of supervision and guidance of the cities in the immediate region of Santo Antônio-Passa and Fica-Nova Cruz.

The DIREC network has headquarters in urban centers considered to be local, "this situation breaks the rigid hierarchy, given that the regional management of state education will also be concentrated in cities that do not exercise the same centrality as the centers of

territorial management" Tavares (2019, p. 159). However, they stand out with the centrality exercised and flows resulting from this service.

Educational services have been expanded and consolidated, attributing new flows to the city of Nova Cruz. According to INEP data (2024), the municipality has 53 active schools that offer basic education (Early Childhood Education, Elementary School, initial and final years and High School). Federal and private high schools play an important role in the flow of students from other municipalities, contributing to greater articulation with the cities in the region.

The private network is composed of 3 institutions, Colégio Nossa Senhora do Carmo (CNSC), Model School that offer from Kindergarten to High School and EPOC - Education by Principles with Kindergarten and Elementary School early years. The search for quality education is a factor of attraction for students, since in their place of origin, private education is largely not offered, especially high school.

Higher Education is marked by the installation of the Advanced Center for Higher Education at the Federal University of Rio Grande do Norte (UFRN), which offers courses in the distance learning modality. In addition to private colleges, such as UNOPAR, Faculdade Três Marias, Estácio and Uniasselvi offering undergraduate and specialization courses.

IFRN's Integrated Technical Education is a highlight in the region, as it is an excellent opportunity to obtain quality and technical training for free. The IFRN offers, in addition to the integrated technical course, the modalities of subsequent course and graduation. The courses are in the area of administration, computer science, chemistry and technology in systems analysis and development. The IFRN attracts students and civil servants from the surrounding municipalities and even from other mesoregions, generating a daily or non-daily flow, creating a centrality in the perspective of education (TAVARES, 2019). Other educational services that stand out are the technical and vocational courses, offered in the private network.

From the facilities of the educational fixtures, they generate a considerable movement of students between the city of Nova Cruz. Thus, the fixed elements provide actions that modify the places, creating and recreating environmental and social conditions that lead each place back. Thus, the flow of people daily in the city contributes to access to various services, as it can present new functionalities in the urban network, contributing to interactions between cities due to the various functions offered in the municipality.

CONCLUSION

In view of its historical process and economic importance for the Agreste Region, especially until the middle of the twentieth century, due to the cotton activity, Nova Cruz is characterized as an area with a concentration of infrastructure and population. Although Nova Cruz lost its influence with the decline of cotton cultivation, the city reinvented itself through other activities that gave it importance in the Agreste Potiguar region.

The service sector, especially in commerce, education and public services, has become one of the pillars of the local economy. These activities attract several people to the city and generate various economic and social flows, as well as generate an urban-regional dynamic referring to the interrelations that occur between urban areas and adjacent cities. Thus, the absence of these services and their concentration in Nova Cruz, reinforce the centrality of the municipality in the region.

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THE CONSTRUCTION OF A SUSTAINABLE DIGITAL ENVIRONMENT THROUGH PUBLIC POLICIES TO COMBAT CYBER RISKS AND PROTECT CONSUMERS

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ABSTRACT

The digital environment, or cyberspace, is an immaterial dimension that integrates social, economic, and technological aspects, being challenged by the excessive exploitation of data and hyperconnection. These factors generate significant risks for individuals and society, especially with regard to the protection of fundamental rights, such as privacy and security in the digital environment. This study investigates how to address these risks, focusing on the normative articulation between the Consumer Protection Code (CDC), the General Data Protection Law (LGPD) and the National Environmental Policy (PNMA). The proposed hypothesis is that, through this integration, combined with the promotion of cyberdemocracy, it is possible to restructure public policies that protect digital rights and promote the responsibility of the agents that cause harm. The methodology adopted is hypothetical-deductive, based on bibliographic research, with analysis of theoretical concepts about the digital environment, risks and the role of information and communication technologies (ICTs). The research also explores digital democracy as a way to overcome normative fragmentation and broaden public debate on digital environmental issues. The objective is to contribute to the strengthening of cyberspace governance and promote balanced socio-environmental development.

Keywords: Digital environment. Sustainability. Public Policies. Cyber Risks. Consumer Protection.

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INTRODUCTION

The digital environment, also described as cyberspace or techno-biosphere, represents an immaterial dimension of the environment that transcends physical borders and integrates social, economic, and technological aspects. In this context, unique challenges arise related to the balance of this digital ecosystem, marked by excessive data exploitation and hyperconnection, which generate significant risks for both individuals and society. The central problem that guides this study is how to face the risks that cause imbalance in the digital environment, which affect individuals simultaneously as consumers, data subjects and holders of diffuse rights related to a balanced environment.

The hypothesis raised is that the dialogue of the sources between the Consumer Protection Code (CDC), the General Data Protection Law (LGPD, Law 13.709/2018) and the National Environmental Policy (PNMA, Law 6.938/1981), combined with the promotion of effective cyberdemocracy, can contribute to the restructuring of public policies aimed at facing these risks. This normative articulation not only enables the accountability of agents that cause damage, but also encourages the creation of concrete solutions that promote the protection of fundamental rights, such as privacy (it should be noted that the concept of privacy in this context transcends the consumerist relationship and encompasses other legal relationships (Misugi et al. 2016, p. 432) and security in cyberspace.

The methodology adopted in this work is of a hypothetical-deductive-deductive order, supported by bibliographic research. Initially, theoretical concepts and legal foundations related to the digital environment, risk theory and the role of information and communication technologies (ICTs) were analyzed. From this theoretical basis, practical and integrated solutions were deduced, focusing on normative articulation and social participation.

The research also seeks to explore the role of digital democracy as an instrument to overcome normative fragmentation and broaden the public debate on digital environmental issues. In this sense, it is discussed how ICTs can promote participatory digital citizenship, essential for the formulation of public policies that balance technological advancement and the protection of rights.

This work intends, therefore, to contribute to the legal and political field by proposing strategies that articulate norms, technologies and citizenship to face the challenges of the digital environment. From this approach, it is expected to foster a critical and purposeful discussion that strengthens the governance of cyberspace and promotes a balanced and sustainable socio-environmental development.

DIGITAL ENVIRONMENT AND RISKS

CONCEPT OF DIGITAL ENVIRONMENT

At the turn of the century, Pierre Lévy (2008, pp. 59-67) already visualized a deep connection between nature and technology, conceiving the "technobiosphere", in which language, as a technique, functions as a catalyst for both cultural and biological evolution, allowing the biosphere to expand into cyberspace, an intangible plane. In this sense, cyberspace is understood as an extension of the environment, here called the digital environment, endowed with legal recognition.

This perspective on the digital environment presents a broad vision, integrating living and non-living elements into ICTs, which amplify their functions and impacts. With the emergence of Digital Law, a legal field dedicated to the intersections between Law and technology, it has become imperative to formulate principles that incorporate values of this microsystem into the legal system, extending to the digital environment the protections granted to the natural environment. In this context, the adoption of the principle of a digitally balanced environment in Digital Law, analogous to the principle of ecological balance in Environmental Law, becomes essential for the analysis of this new phenomenon and its peculiarities.

However, the mere definition of a principle, or simple analogies, is insufficient for an effective understanding of the subject, and it is imperative to incorporate concepts from the classical environment, such as sustainability. Hoffmann-Riem (2021), in this sense, considers Digital Law an autonomous legal branch, highlighting the fundamental role of ICTs in the construction of a new social and legal paradigm. The Internet, as a communicational instrument, affects all spheres of human interaction, from interpersonal relationships to the professional and political spheres (Campos, 2022, p. 257), even transforming the very conception of corporeality, by creating a digital dimension for fundamental rights (Sarlet, 2022, p. 22).

The recognition of fundamental rights in the digital environment, in turn, requires adaptations in Brazilian Law. Thus, Koskenniemi (2022, p. 78) points out that legal fragmentation highlights the need for specialized branches, such as Digital Law, which addresses emerging issues in information technologies and, furthermore, that less exotic compared to other fields, it requires attention, as it deals with social and institutional issues mediated by technology.

In this scenario, Digital Law is consolidated as an autonomous field, focused on emerging technologies and their implications. In this scenario, Coutinho (2014, p. 223) describes the digital environment as a human creation and intangible heritage, symbolized

by the electromagnetic spectrum, whose use should promote sustainable development. Castells (2003, p. 87) reinforces that the Internet, as the main expression of the digital environment, represents a culture that values creative freedom, directed to progress and continuous improvement of this environment, but which are operated by entrepreneurs who often aim only at profit and do not pay attention to the possible consequences of abusive data processing, as follows from the paradigm of surveillance capitalism, addressed by Zuboff as "a logic of single accumulation in which surveillance is a foundational mechanism in the transformation of investment into profit" (2020, p. 69).

Although the environment is indivisible, encompassing all species in a balanced system, its didactic classification facilitates the organization of knowledge and more effective protection in practical situations. Based on this view, the digital environment is an immaterial dimension of the environment, highlighted in this article.

Its intangible and immaterial nature makes it possible for the digital ecosystem to overcome physical barriers, encompassing many individuals who become an integral part of this environment. In this regard, Castells (2003, p. 87) defines Internet culture as a technocratic belief in human progress, materialized by hackers and entrepreneurs who aim to reinvent society and boost the modern economy.

Capra (2006, p. 8), in turn, points out that technological advances have transformed capitalism, attributing a central value to information, which has profoundly altered the digital environment as a space in which this new form of economy manifests itself. However, this integration has also brought negative impacts, such as regional recessions derived from hasty decisions and systemic unpredictability (Capra, 2006, p. 10).

Fluidity, characteristic of digital technologies and commonly observed in this context, is described by Bauman (2001, p. 7) as an intrinsic quality, marked by the ease of adaptation and change. This liquidity translates the digital essence of the Internet, a central element of this study, as the main expression of the digital environment.

The connectivity provided by the Internet has made it ubiquitous in contemporary society. As observed by Cavedon, Ferreira and Freitas (2015, p. 201), "by enabling the storage, transmission and processing of information in digital media, information technology becomes ubiquitous in people's daily lives, bringing together a variety of risks that cannot be easily perceived or identified".

In this way, it is observed that the digital environment is intimately connected to human life in modernity, and, as an ecosystem, it is extremely vulnerable to imbalances resulting from interventions by the agents that operate in it. These induced oscillations can take the form of risks, significantly and negatively affecting cyberspace.

RISK THEORY AND THE DIGITAL ENVIRONMENT

From the advent of computing and the creation of the ARPANET in the 1960s, to the spread of the World Wide Web in the 1990s, the Internet has developed to become a global network that has revolutionized communication, access to information, and interaction between individuals. This advance was driven by technical advances such as digitization and digitalization, as described by Gartner (2024),[4] in addition to the development of accessible communication protocols and interfaces, which democratized access to information and profoundly transformed contemporary society. However, this expansion has also entailed specific challenges related to hyperconnection, resulting from the ubiquity of the Internet and ICTs.

The specialized literature points out that data are fundamental components of this ecosystem. According to Doneda (2011, p. 94), data are the basis of this immaterial structure, acting as primary elements in the digital environment. In addition, Freitas (2022, p. 238) classifies data and its inherent system as follows: "the term 'data' is so broad that it can even be used conceptually as a policy and social phenomenon, and one can even consider the existence of a data ecosystem", so as to involve "complex organizations of dynamic social relations through which data and information move and transform."

In line with the idea that data is essential for the digital environment, Davenport (1998, p. 19) defines data as "observations about the state of the world", for example: "there are 697 units in the warehouse", so that the "observation of these brute facts, or quantifiable entities, can be done by people or by an appropriate technology". The author adds that "from an information management perspective, it is easy to capture, communicate and store data. Nothing is lost when represented in bits." In its analysis, data can be processed to become information, which, in turn, can be refined and transformed into knowledge, establishing a hierarchy where data is at the base, followed by information and knowledge, until it reaches the level of wisdom, all based on data.

Therefore, data are indispensable elements in the digital environment, providing the basis for the practices carried out in this environment, being constantly collected, stored, and processed, regardless of economic purposes, in a licit or illicit way, constituting a true digital ecosystem. Similar to natural resources, often targets of extractivism, of the physical

[4] "Digitization" is the process of moving from analog to digital form, also known as digital enablement. In other words, digitization transforms an analog process into a digital form without any change in the type of the process itself. In turn, unlike "digitization", the phenomenon of "digitalization" is the use of digital technologies to change the business model and provide new opportunities for generating revenue and value. It is the process of migrating to a digital business.

environment, data are economically exploited, often excessively, which impacts the balance of the system, as will be addressed in subsequent items.

By analyzing the authors' contributions together, it is evident, therefore, that data are essential components of the digital environment. Based on this information, it is concluded that the digital environment, currently represented by the Internet, has the following characteristics: a) immateriality, as it is configured in a physically intangible space; b) fluidity, since, due to the connection, it allows the rapid traffic of information and is in constant transformation; and c) data as essential components, consisting of the smallest unit of this system, continuously injected in large volume.

Once it is established that the digital environment is a complex and well-structured system, with unique characteristics and properties, it becomes necessary to explore its complexity. Cyberspace is a chaotic system, not in the common sense, but in the scientific context, that is, according to the Science of Chaos. For Gleick (1987, p.16-17), some systems are extremely sensitive to changes in initial conditions, which implies that a small change can cause a significant deviation in the observed results, making prediction practically impossible or leading to unexpected results. Chaos, in this context, does not equate to disorder, but rather the opposite of simplicity. Examples of this include the increase in data traffic by "free" services such as social networks and streaming platforms, which keep users connected for hours, generating widely exploited data for marketing purposes, and resulting in unexpected social phenomena, such as the viralization of content. The relationship between the human mind and the digital environment, social networks and the psychology of memetics demonstrate that even the slightest excitement in the digital environment generates unpredictable and exploitable effects (Capra, 2006, p.26).

This chaotic character is reflected in the oscillations that can be interpreted as risks, originating from human actions, either by the use of technologies created for these purposes, or by decisions made about the treatment of data. Considering that these risks emerge from the intention to exploit data excessively, the applicability of Beck's risk theory, generally applied to the physical environment and global catastrophes, is perceived.

Thus, by recognizing the digital environment as a facet of the broad concept of environment, it becomes evident that it is also subject to risks induced by human action, such as excessive exploitation of data. To correlate digital risks to risk theory, some of Beck's concepts are pertinent. First, the author (2002, p. 78) distinguishes "dangers" from "risks", stating that the former do not result from deliberate choices, while risks are the consequence of decisions for economic and technological purposes that ignore associated threats. Thus, the factors mentioned are not to be confused with natural hazards. In

addition, Beck (2002, p. 84) states that risks are not restricted to time and space, becoming events with a beginning, but without an end. Finally, Beck (2002, p. 86) observes that people do not perceive the risks that surround them, trusting "experts", which, according to the author, generates a feeling of constant uncertainty.

In this way, Beck's conceptions of risk can be applied to the digital environment. Considered a dimension of the environment, the digital environment has its own complex data ecosystem, composed of globally connected devices and subject to human interventions. Beck's theory of risk applies to the digital environment by finding that: a) risks are generated by human actions, often for economic purposes, mainly by companies and even States, as Freitas (2022, p. 228) observes; b) the risks transcend time and space due to the global Internet connection; and c) the risks are almost imperceptible to users, who often have their data collected without knowledge, exposing them to sensory deprivation. Therefore, the characterization of the cyber risks that plague the digital environment is observed.

Considering that the digital environment is subject to risks, it is imperative to adopt measures to mitigate them, especially with regard to the protection of personal data. Freitas (2022, p. 244) states that "the protection of personal data can be an event within the risk analysis [...]". Laws such as the General Data Protection Law (influenced by the European Union's GDPR) seek to provide this protection, but they still have gaps, as will be discussed in subsequent items.

In addition, the imbalance in the digital environment can negatively affect the mental health of users, as demonstrated by the experiment promoted by Facebook (Presse, 2014), in which people were impacted by oscillations in the digital environment. From this interrelationship between technology, mental health, and increased risks, it is understood that the protection of the digital environment is relevant to people's quality of life.

SYMBOLISM OF LAW IN THE FACE OF IMBALANCE IN CYBERSPACE

The analysis of symbolism in Law and Politics is essential to understand how these spheres shape the perception and approach of risks in the context of the digital environment, thus making it possible to analyze ways of effective coping. Symbolism, in this case, refers to the use of norms and policies that, although they appear to address complex problems, often lack practical effectiveness, creating a cycle of superficial legitimacy. In the legal and political sphere, this phenomenon takes on specific contours, especially in relation to the confrontation of risks in the digital environment and their implications for fundamental rights and socio-environmental balance, since these risks, in the sense of Beck (2002), are

mainly consequences of the symbolic functions of Science, Politics and Law that allow the materialization of risks due to bad practices arising from surveillance capitalism, as covered in Kobe et al. (2024).

In this sense, Ferreira (2016, p. 136-143) details three symbolic functions that interconnect Science, Politics and Law in the construction of an organized irresponsibility: a) symbolic function of science, which breaks scientific neutrality by producing biased knowledge that normalizes risks; b) symbolic function of politics, which adopts government measures that are ineffective or deliberately incapable of achieving its objectives; and c) symbolic function of the Law, which creates legal norms aimed at legitimizing the failures of the other two instances, completing a vicious cycle that perpetuates the normalization of risks through organized irresponsibility.

In the digital environment, these symbolic functions can be clearly observed. Science, represented by the evolution of ICTs, often operates under the discourse of neutrality, promoting technological advances without adequately addressing their negative impacts, such as the abusive use of personal data or hyperconnection that often violates the right to privacy. In turn, politics responds with legislation or programs that often lack technical robustness or effective enforcement, such as the partial implementation of data protection regulations, resulting in gaps that exacerbate digital risks. Finally, the Law, closely linked to political practices, legitimizes these practices, either through normative omissions, or by creating insufficient rules to contain abuses in the digital environment, leaving loopholes for excessive economic exploitation and structural imbalances, or by pronouncing, in the judicial sphere, decisions that prejudge the right of the injured parties (Efing, 2011), often under inopportune discourse, such as predatory litigation.

In view of this panorama, it is imperative to highlight that Beck (2002, p. 123) observes that the contemporary risk society transfers to individuals the responsibility for decisions made without adequate knowledge of their consequences. This phenomenon is amplified in the digital environment, where the risks associated with the use of data are often invisible to ordinary users, who depend on experts to interpret them. This deprivation of essential information perpetuates a culture of technological fatalism, in which decisions seem inevitable and consequences uncontrollable.

However, confronting this symbolism requires more than simple normative reforms, so that Beck (2002, p. 110) suggests overcoming technological fatalism and the abstraction of risks through the creation of new forms of organization that promote independence and transparency between science, politics, law and society. He defends an expansion of the

public sphere and a democratic debate based on scientific and informed arguments, capable of separating what is legitimate from what is symbolic and ineffective.

In the digital environment, this implies articulating public policies that transcend symbolism and promote concrete measures, such as effective inspection of data collection and use practices, digital education of consumers, and strict accountability of economic agents that unbalance the system. Thus, from a legal point of view, the dialogue of sources presents itself as an indispensable tool, allowing the integration of regulations such as the CDC, the LGPD and the PNMA, harmonizing their provisions and enhancing their application in the face of digital risks.

In this scenario, overcoming symbolic functions in Law and Politics is essential to build a balanced digital environment, where economic and technological interests are compatible with the protection of fundamental rights and sustainability. For this, it is necessary that society, the State and the productive sectors take an active role in the formulation of innovative solutions, committed not only to the appearance of protection, but to their effectiveness in facing the challenges of cyberspace.

Social participation is fundamental to deliberate on the direction of a society, including in terms of risk prevention and ways to deal with such problems. However, in order to make deliberations of this order feasible, it is necessary to have the contribution of the scientific community, including the legal community, which, in turn, must also respect internal dialectics to issue unbiased positions. Thus, the role of the Law is indispensable to regulate the deliberations and provide a form of conflict resolution, requiring more effective means to solve the problems, which can be provided based on the dialogue of the sources.

THE ROLE OF THE DIALOGUE OF SOURCES IN ADDRESSING DIGITAL RISKS

INTEGRATION OF LEGAL NORMS

The integration of legal norms represents an essential element for facing the risks that emerge in the digital environment. The complexity of this ecosystem, characterized by immateriality and fluidity, requires a normative approach capable of transcending the boundaries of specific legislation, articulating several legal diplomas in a harmonious way, since, without prejudice to other applicable legal relationships, the main relationships observed, for the purposes of this article, are both of a consumerist nature, of a data subject, and of a diffuse right to a healthy environment. In this sense, the dialogue of sources, as conceived by Claudia Lima Marques (2003, p. 6-11), offers a robust theoretical basis for integrating different regulations, allowing a more efficient and coherent application of principles and rules that affect digital relations.

In the context of the digital environment, as mentioned, three regulations stand out for their relevance: the CDC, the LGPD and the PNMA. The interaction between these laws is essential to build a legal system that offers effective protection for both consumer rights and environmental balance, including in its digital dimension.

The integration between the CDC and the LGPD is a clear example of the possibility of normative dialogue in facing digital risks. The CDC, as a legal framework that protects the most vulnerable party in consumer relations, can complement the LGPD in the protection of personal data (De Oliveira & Freitas, 2021. p. 5-8). The LGPD, in turn, reinforces the right to clear and accessible information, already provided for in the CDC, expanding its application in the digital context by establishing specific rules for data processing. This complementarity is evidenced in article 7 of the CDC, which provides for the possibility for consumers to benefit from other legislation that is more favorable to them, ensuring greater protection for data subjects in situations of informational imbalance.

In addition, the concepts of vulnerability and objective good faith, central to the CDC, find correspondence in the provisions of the LGPD, which aim to ensure the responsible and proportional use of personal data. The harmonization of these instruments allows, for example, to hold accountable agents who, by processing data negligently or abusively, simultaneously violate consumer rights and data protection principles (De Oliveira & Freitas, 2021. p. 8).

Nevertheless, it is also seen that the National Environmental Policy (Law 6.938/1981) presents itself as another norm that can be integrated into the digital context, especially by recognizing the environment as a diffuse good that encompasses not only physical aspects, but also immaterial dimensions, such as the digital environment. This conception expands the application of environmental principles to cyberspace, allowing the LGPD and the PNMA to act jointly to ensure a balanced and sustainable digital environment, and may also make use of effective accountability institutes such as the duty of full reparation provided for by the CDC in its article 6, item VI.

The principle of environmental preservation, central to the PNMA, can be adapted to the digital context to support the need for mechanisms that anticipate and mitigate risks associated with data processing. Likewise, the polluter-pays principle, widely applied in cases of environmental damage, can be transposed to hold economically responsible the agents who unbalance the digital ecosystem through abusive or illegal practices, such as non-compliance with the duty of data protection (articles 6, 9, 11, 33, 46, 50 and others of the LGPD) which, in more serious cases such as data leakage, it may give rise to collective compensation for damages, in addition to the parties directly involved in the relationship,

under the terms of article 17 of the CDC and Special Appeals No. 2124701-MG and No. 2.005.977-RS, so that the simultaneous legal relationships, arising from sources such as LGPD, CDC and PNMA, allow for the reconciliation and compatibility of their normative provisions so that the damage is repaired both at the individual level (LGPD), and in the collective (CDC), at the same time that it is possible to demand the solution of the cause of the problem, through impositions of obligations that seek to reestablish the environmental balance in cyberspace (PNMA).

However, the integration of legal norms is not limited to the cumulative application of legislation; it requires the articulation of principles and values underlying these norms. Ecological balance, essential to Environmental Law, can be incorporated into Digital Law as a guiding principle for the preservation of the digital environment. Similarly, the dignity of the human person, a constitutional commandment that also makes up the core of the CDC and the LGPD, reinforces the need to protect fundamental rights in the digital environment, such as privacy, security, and access to information. Such integration, in addition to ensuring greater coherence to the legal system, promotes a systemic approach, recognizing that the problems of the digital environment are not isolated, but interdependent, requiring comprehensive and interdisciplinary solutions, since complex problems, arising from complex systems, also demand complex solutions (Capra, 2004, p. 14-20).

However, despite the advantages of this integration, there are inevitable challenges, such as normative fragmentation and the resistance of economic and institutional actors, which is why overcoming these barriers requires coordinated efforts between the Legislative, Executive and Judiciary Branches, in addition to the active participation of civil society and the committed productive sectors. Therefore, the integration of legal norms to face the risks of the digital environment demonstrates that Law, by articulating different normative microsystems, can offer more complete and effective responses to the challenges of the digital age, while this approach not only strengthens the protection of rights, but also contributes to the construction of a fairer digital environment. balanced and sustainable, for the benefit of current and future generations.

DIGITAL DEMOCRACY AND SOCIAL PARTICIPATION

Furthermore, it is observed that, combined with the need for dialogue between sources, democracy and social participation emerge as one of the fundamental pillars to face the challenges and risks associated with the digital environment since, in a context marked by hyperconnection and the growing influence of ICTs, the expansion of spaces for deliberation and the strengthening of digital citizenship become essential to promote a more

inclusive governance, transparent and effective in cyberspace, seeking to clarify the risks, their extent and discuss means of solution, especially within the legal community. In this sense, concepts such as cyberdemocracy, formulated by Pierre Lévy (2002, p. 31-32), offer a relevant theoretical basis for understanding the articulation between technology and democracy, as instruments of emancipation and collective intelligence.

Lévy (2002) defines cyberdemocracy as a modern extension of democratic practice, in which the digital environment acts as a diffuser of ideas, knowledge and debates, creating a "planetary metatext" that transcends physical and institutional limitations. This digital environment, characterized by the deterritorialization of interactions, enhances global cooperation and expands the space for citizen participation. However, the effectiveness of this digital democracy requires the strengthening of moral reciprocity and the recognition of competences among the participants, essential elements for the formation of a truly autonomous and plural public opinion, and the Law, by integrating its sources, can assist in the construction of these rules that govern this space. According to Lévy, cybernetics, in the informational context, is redefined as a foundation for citizenship, by demanding an inclusive communication environment accessible to all. This environment favors democratic debate and the deliberation of ideas. With the emergence of cyberspace supported by ICTs, this communicational flow reaches a global scale, allowing democracy to overcome physical limitations and become more fluid and deterritorialized, enabling information and decisions to be within the reach of all virtual communities (Souza, 2024, p. 172-175). Thus, cyberdemocracy is described by Lévy (2010, p. 135) as a space characterized by free interaction and cooperation, enabling a truly participatory democratic practice, which is corroborated by Han (2022. p. 47-53).

In this context, ICTs play a central role in democratizing access to information and creating more accessible communication channels. Tools such as digital platforms, social networks, and *Blockchain technologies*, for example, offer unprecedented possibilities for the exercise of political and social rights. A practical example of this is shown in the application of *Blockchain* in voting systems, which ensure greater transparency and security in electoral processes, as discussed by Souza, Nora, and Kobe (2024). However, the use of these technologies also presents challenges, such as the spread of disinformation, algorithmic manipulation, and the deepening of digital inequalities. For digital democracy, as a means of combating risks, to be effective, it is necessary to overcome these obstacles through public policies aimed at digital inclusion, technological education and responsible regulation of platforms, once again evidencing the essential role of Law in the legislative structuring that encourages, or obliges, these practices.

Social participation in the digital environment goes beyond mere access to information, implying the active involvement of citizens, exercising conscious consumption (Efing, 2016), in the formulation and deliberation of public policies that impact both the digital environment and society as a whole. Beck (2002, p. 110) asserts that, in a society of risk, the expansion of the public sphere and the redistribution of decision-making power among different actors are fundamental to overcome technological fatalism and promote a more responsible and democratic governance. In the context of the digital environment, this participation should be guided by the protection of fundamental rights, such as privacy (with a special focus on the impact of new technologies, as highlighted by Misugi et al. 2016), freedom of expression, and equitable access to technology. The articulation between these rights, as provided for in the Consumer Protection Code and the General Data Protection Law, reinforces the need for a constant dialogue between norms and values that guarantee the dignity and security of individuals in cyberspace.

Cyberdemocracy also presents itself as a means of promoting sustainability in the digital environment, enabling public debate on the impacts of ICTs and the inappropriate treatment of data that causes environmental imbalance, encouraging the creation of collaborative solutions to problems such as excessive data exploitation and informational imbalance. In addition, by integrating different voices and perspectives, digital democracy contributes to the formulation of fairer and more inclusive policies, which consider both individual and collective interests. In this context, education for digital citizenship is indispensable, insofar as, only through the development of critical and technological skills will it be possible to strengthen social participation and ensure that technological advances are directed to the common good, being the combination of an informed civil society and a harmonious normative environment, supported by the dialogue of sources, one of the bases for an effective and sustainable cyberdemocracy that can protect the digital environment.

Thus, digital democracy and social participation, combined with the full dialogue of normative sources, are crucial elements for facing the risks and challenges of the digital environment, justified by the fact that the expansion of the space for deliberation and integration of different perspectives promote not only the governance of cyberspace, but also the protection of fundamental rights and the strengthening of citizenship. both in the dimension of conscious consumption (Efing, 2016), of the data subject, and in the holder of the diffuse right to a healthy environment. However, for this potentiality to materialize, it is necessary to overcome the structural and symbolic barriers that limit digital inclusion and the transparency of democratic processes, seeking to ensure that digital democracy is not

only a reflection of the information society, but an engine for its ethical and sustainable transformation.

PROPOSALS FOR POSSIBLE IMPROVEMENTS IN PUBLIC POLICIES

It has been observed so far that the complexity of legal relationships in the digital environment requires a significant effort to harmonize specific legislations, promoting a normative approach that integrates different legal diplomas. In this scenario, the dialogue of sources plays a fundamental role in articulating rules such as the CDC, the LGPD and the PNMA, aiming at the creation of a more cohesive and efficient legal system. Miranda (2014, p. 182-187) points out that the Brazilian normative evolution is linked to the need to reconcile economic, social and environmental interests, requiring, for this, measures that strengthen the articulation between the Legislative, Executive and Judiciary branches.

In this context, it is proposed the adoption of complementary legislation that explains the interactions between the different legal diplomas, reducing normative conflicts and ensuring greater coherence in the confrontation of digital problems, even reducing any ambiguities during the application of normative commands by the Executive and Legislative Branches. In addition, the creation of interinstitutional commissions involving the National Data Protection Authority (ANPD), the Ministry of the Environment, and the National Consumer Secretariat (Senacon) can be an effective strategy to monitor abusive practices in the digital environment. Finally, it is suggested to review and extend the statute of limitations for environmental and digital liability actions, ensuring that victims of harmful practices have greater reach and access to justice.

The protection of the digital environment, however, cannot be limited to legal instruments; it must be complemented by public policies aimed at social and technological inclusion. According to Miranda (2014, p. 187-193), it is crucial to align consumer rights with the demands of sustainability and innovation, since awareness and education play central roles in strengthening digital citizenship. To this end, it is proposed the development of educational programs that enable consumers to understand the risks associated with data processing, promoting a conscious use of digital technologies, being able to use cyberspace itself, which currently has a robust streaming culture and social networks that exponentially disseminate information, and this diffusing power should be used to propagate consumer and data subject education.

In addition, another essential point is the formulation of policies that encourage transparent and sustainable business practices in the use of data, linking, for example, tax incentives to the adoption of measures that minimize environmental impacts resulting from

digital operations, complemented by information campaigns, as mentioned above, aimed at the general population, using digital and traditional platforms, can disseminate knowledge about consumer rights in the digital environment, especially with regard to privacy, security, and redress mechanisms in cases of imbalances in the digital environment.

As highlighted by Miranda (2014, p. 193-194), overcoming the culture of normative and symbolic negligence is a challenge that demands the implementation of public policies based on cooperation between economic actors, civil society and the State. This integrated approach not only strengthens the protection of fundamental rights in the digital environment, but also contributes to the preservation of human dignity and socio-environmental balance in an increasingly digitized and complex context.

CONCLUSION

The present study highlighted the challenges imposed by the digital environment and the contemporary risk society, highlighting the need for legal, social and political responses compatible with the complexity of this scenario. From the socio-environmentalist perspective, as pointed out by Beck, it is recognized that human action, by promoting changes that are often harmful to the environment, both natural and digital, generates significant risks that undermine not only the sustainability of the environment, but also the healthy survival of humanity. This awareness, as observed by Morin and Kern (2003, p. 64), is fundamental to recognize the human condition as a citizen of the Earth, assuming responsibilities for the preservation of a balanced and healthy environment by all those involved and, above all, those who cause the ecological imbalance.

In this context, full digital democracy and the dialogue of sources is presented as one of the crucial tools for addressing environmental imbalances. By creating an inclusive space for debate and social participation, it is possible for experts and citizens (consumers, data subjects, and holders of diffuse rights) to identify problems in cyberspace and propose solutions that integrate technical knowledge and varied perspectives. Thus, the digital environment can be converted into an ally in the construction of more sustainable and transparent practices, overcoming the symbolic functions of science, politics, and law, which often perpetuate organized irresponsibility and normative ineffectiveness.

In turn, the dialogue of sources was identified as an essential element for overcoming the challenges of the digital environment. The normative articulation between the Consumer Protection Code (CDC), the General Data Protection Law (LGPD) and the National Environmental Policy (PNMA) expands the protection of citizens' rights and allows for an integrated approach, capable of holding accountable agents who adopt harmful

practices. Some emblematic cases, such as Special Appeals No. 2124701-MG and No. 2.005.977-RS, demonstrate the applicability of this dialogue, by showing that consumer protection by equivalence can be extended to digital disasters, such as data leaks, which generate risks similar to environmental disasters in cyberspace.

Thus, inspired by Capra (2004, p. 14-20), it is observed that problems related to the digital environment must be understood as interdependent and systemic, requiring equally complex solutions. Measures such as the extension of the statute of limitations, the strengthening of the joint action of public agencies, such as the ANPD, and the promotion of digital education of consumers/data subjects were identified as concrete strategies to contribute to the socio-environmental balance in this environment.

Finally, it is concluded that the protection of the digital environment, as an extension of the natural environment, cannot be achieved through fragmented approaches. It is necessary to foster an integrated and sophisticated legal system, as well as a robust social engagement, capable of facing the globalized digital risks that characterize contemporary society. Only through an effective dialogue between norms, institutions and participatory democracy will it be possible to build a sustainable and fair future, both physically and digitally.

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PROFILE OF SUICIDE CASES IN A PENITENTIARY IN THE PERNAMBUCO HINTERLAND

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ABSTRACT

The research seeks to present the profile of suicide cases in a penitentiary in the hinterland of Pernambuco. For this, it was necessary to understand triggering factors of suicide; to identify precipitating factors for the commission of suicide and to propose protective factors for the development of a suicide prevention policy. The research addressed legal aspects related to penal execution, contextualizing suicide in the prison environment, through the proposal of a qualitative, exploratory and descriptive cross-sectional methodology, with the survey of information on completed suicides recorded in a prison settlement, from 2007 to 2019, based on documentary analysis, with quantification and tabulation procedures as a form of data systematization. As the main result of the study based on the profile, 07 cases were found, and it was observed that in most of the events (4 cases), the individuals had arrived at the prison by recent transfer from another distant unit, located in the same state.

Keywords: Death. Suicide. Penitentiary.

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INTRODUCTION

The occurrence of suicide has always been an intriguing and important topic for society, since it affects not only the victim's family, but can also influence other people who experience problems that are difficult to be faced by the human psyche.

When addressing the topic of suicide in the prison context, there is much in terms of complexity due to the institutional dynamics involved. Likewise, the issue of suicide is propitious in this same context.

It is observed that, nationally, there are 748,009 re-educates, of which 362,547 are in a closed regime. In the state of Pernambuco, the region of the survey carried out, there are 33,641 in total, 16,185 (48.11%) in a closed regime (SERES, 2020). As for the research location, Petrolina-PE, with regard to the structural aspect of accommodation, 830 re-inmates are possible, but it has, on average, the occupancy is around 1,214 inmates, data presented by the Executive Secretariat for Resocialization of Pernambuco, at the Doutor Edvaldo Gomes Penitentiary (SERES, 2020). The reality presented in statistics, at the three federative levels, represents a contextual reality of overcrowding. When we look at the cases of suicide in the general population, according to the latest data released by the WHO, 11,000 deaths per year are observed, with Brazil occupying the 8th position in the world in relation to this episode and adding this to the prison context, studies reveal inmates as groups of greater vulnerability to such an occurrence.

It is believed that conducts guided by normative precepts and practical management of the institutional routine can promote aspects that prevent or prevent the occurrence of suicide within the prison system. For the development of the study, several observations were necessary to the state penal norms (Pernambuco), to the federal ones, such as the Penal Execution Laws, to the related bodies, such as the National Council of Justice.

The definition of suicide considered in the study, according to the World Health Organization (WHO), "[...] is any act in which the individual causes injury to himself, whatever the degree of lethal intent and knowledge of the true motive of the act".

The WHO also points out that the average suicide rate in penitentiaries, that is, with people already sentenced in a closed regime, is three times higher when compared to the general population. And, in systems that serve sentences in a shorter time, the rate becomes up to ten times higher, again compared to that of the general population. It is worth mentioning that the WHO has already carried out studies on suicide in different types of imprisonment, including an investigation of the period of imprisonment to analyze the possible implicators of such a phenomenon in this type of context (SERES, 2020).

The study in question refers to the analysis of the profile of suicide cases in a penitentiary, in addition to comparing the data collected in this institution located in a Pernambuco hinterland to the national average, analyzing the possible implicators for such occurrence and pointing out the possible protective and preventive aspects to the occurrence of suicide in the place object of the study.

The proposal of this study, therefore, also involved the desire to understand the related factors and the situation in which the occurrence occurred, in order to be able to instrumentalize future intervention and prevention actions.

DISCUSSION

To understand the entire framework presented so far, two dimensions that surround the theme of suicide in the prison system are below, starting with the very basis that is the normative and related to the moment of penal execution when in a closed regime, which characterizes institutional coexistence, the focus of the research, along with the second point that refers to the need to contextualize suicide in the prison system.

LEGAL ASPECTS RELATED TO PENAL EXECUTION

As seen in the history of the institution, presented by the Executive Secretariat for Resocialization of the State of Pernambuco (SERES, 2020), the Penitentiary System emerged as the grouping of the various existing penal establishments, so it is started, from the beginning, from the idea of precariousness in terms of organization, especially in terms of functional and structural aspects.

The Secretariat (SERES, 2020), curiously, states that one of the first prison units was the Agricultural Penitentiary of Itamaracá, which was inaugurated on October 19, 1940, with the shelter of convicts in open and semi-open regimes. In the temporal sequence, regulatory devices were created, such as the Private Court of Criminal Executions and the Superintendence of the State Penitentiary System (SUSIPE), the latter through Decree-Law No. 299 of May 19, 1970 (SERES, 2020).

Decree No. 2,340 of 1971 brings the content that regulates the functioning of the penitentiary system of the State of Pernambuco, with the aim of integrating and standardizing the administration and management conducts of the system. Then, decree No. 2,341 (State Penitentiary Regulation) came with the goals to be established (SERES, 2020).

Along with the evolutionary process of political and normative assistance aimed at the penitentiary system, there are actions of a destitutive nature, such as the deactivation of

the Recife House of Detention, in 1973, with the necessary transfers already carried out to environments that were adequate, as stipulated for the time (SERES, 2020).

In continuity with the normative aspects, Law No. 7,698 (State Penitentiary Code) was presented in 1978, with the perspective of humanizing the technical-administrative processes of the penitentiary. As for the structural aspect, the Superintendence of the Penitentiary System (SUSIPE) was created through Decree No. 7,420 of 1981 and in 1985 the Deputy Superintendence, the Psychology Division, the Nutrition services, the Department of Administration and the Casa do Albergado were created (SERES, 2020).

The nomenclature of the current Executive Secretariat for Resocialization (SERES) has already had other names, such as Superintendence of the Penitentiary System (SUSIPE); Directorate of the Penitentiary System, with the acronym DISIPE; Secretariat of Justice and Human Rights (SJDH), but with the perspective of resizing practices for the improvement of management. As SERES (2020), its mission is to comply with the Penal Execution Legislation (LEP) in the institution's area of competence, with the priority of social integration of the re-educated.

The daily practice of social reintegration activities is observed in multiple spheres, such as: social, economic, academic, religious, professional and others, given in practice by encouraging and investing in workshops, lectures, teaching and other general activities.

As for the presentation, the structure of the Executive Secretariat for Resocialization (SERES, 2020), is composed of the following sectors: Chief of Staff; Intelligence and Organic Security Management; Planning and Monitoring Management; Electronic Monitoring Center for Re-educandos; Chief of Staff Secretariat; Chief of Staff; Head of Press Office; Permanent Bidding Committee; Special Bidding Committee and Permanent Disciplinary Committee.

In this second part, the managements and supervisions are observed, as follows: Technical Support Manager; Ombudsman; General Administrative-Financial Management; Information Technology Management; Architecture and Engineering Management; Management of Projects and Agreements; Logistics and Production Management; Contract supervisor; Planning and Budget Supervisor, as well as Financial Supervisor.

The third part includes the superintendencies and managements, including those of a technical nature, namely: Superintendence of Training and Resocialization; Technical-Legal and Criminal Management; Technical-Legal and Administrative Management; Management of Education and Vocational Qualification; Management of Psychosocial Support, Health and Nutrition, in addition to the Penitentiary School of Pernambuco.

The last part includes the most specific axis, such as: Superintendence of Prison Security; Security Operations Management; Prison Management; Prof. Everardo Luna Criminological Observation and Screening Center.

The three axes complement each other due to a whole system of operation, but when viewed by the parties, it becomes possible to verify the specialized areas, whether technical or administrative, which can enable a complexity that aims to encompass the demand presented and the effectiveness of the resolutions.

Also of a structural nature, SERES includes the Rehabilitation Centers, penal colonies, Custody and Psychiatric Treatment Hospitals, prisons and penitentiaries throughout the state of Pernambuco. The units that make up the Executive Secretariat for Resocialization are: Agreste Resocialization Center; Women's Penal Colony of Abreu e Lima; Women's Penal Colony of Buíque; Women's Penal Colony of Recife; Custody and Psychiatric Treatment Hospital; São João Agroindustrial Penitentiary; Dr. Edvaldo Gomes Penitentiary; Dr. Ênio Pessoa Guerra Penitentiary; Juiz Plácido de Souza Penitentiary; Penitenciária Professor Barreto Campelo; Lawyer Brito Alves Prison; Igarassu Prison; Salgueiro Prison; Prison of Santa Cruz do Capibaribe; Vitória de Santo Antão Prison; Judge Augusto Duque Prison; Dr. Rorinildo da Rocha Leão Prison; ASP Marcelo Francisco de Araújo Prison; Frei Damião de Bozzano Prison; Judge Antônio Luiz Lins de Barros Prison (SERES, 2020).

The aforementioned Secretariat has the following mission: To control and maintain the State penitentiary system in operation, through the custody and administration of prison establishments, seeking the rehabilitation of the convict, aiming at their protection and the guarantee of their fundamental rights, being one of the organs that is part of the Secretariat of Justice and Human Rights - SJDH, manages 21 Prison Units and 58 Public Jails (SERES, 2020).

Law No. 15,755, of April 4, 2016, establishes the Penitentiary Code of the State of Pernambuco. The code, logically, follows the precepts of the Penal Execution Law (LEP) and the Federal Constitution (1988), according to article 1, as an objective.

Still on the Penitentiary Code of the State of Pernambuco, Law No. 15,755, of April 4, 2016, states that measures depriving liberty have axes, such as: social reparation, reintegration of the person deprived of liberty into society and the conduct of life in a socially responsible manner. Next, the paragraphs, § 1 and § 2, respectively, state that the deprivation of liberty also serves as a way to contain, in defense of society, certain violence and prevent crimes, in the sense of breaking, sometimes, a cycle of criminal incidence.

Paragraph 2 emphasizes that the deprivation of liberty maintains, even with limitations, the fundamental rights, except for what is necessary for the execution of the sentence.

According to this same law, on the institution of the Penitentiary Code of the State of Pernambuco, article 4 expresses, precisely, the person, in the private sense, which recalls, in a developed way, the process of individualization of the penalty, so that the identity recognition of that individual deprived of liberty to serve a sentence in a closed regime is preserved. In the items of article 4, the execution includes the care governed by the defense of the prison community, stimulation of reintegration and promotion of the co-responsibility of the re-educated, including on matters of general interest.

Finally, it is worth mentioning that the Penitentiary Code of the State of Pernambuco follows the precepts of the Penal Execution Law (LEP) and the Federal Constitution (1988).

In items I, II, III, V and VI of article 6, there are: the individualization, security and custody of persons deprived of liberty; the promotion of social reintegration, through educational, professional, religious, therapeutic and many other activities; the assistance extended to the families of the inmates and any other activities that are pertinent to these perspectives.

Article 55 of Law No. 15,755 of 2016 refers to the psychosocial study of the person deprived of liberty, with the use of an appropriate methodology, so that, according to article 56, the individual readaptation plan is approved, which must contain: I - The objectives to be achieved and the actions to be developed for this purpose, mentioned; II - The type of psychological support, professional training and health care to be made available; and III - The insertion and family relationship to be developed; the schooling to be attained and the work and cultural, recreational and sports activities to which the person deprived of liberty will be assigned. The sole paragraph of this same article provides:

> Sole Paragraph. The Technical Classification Commission will propose to the manager of the penal establishment an individual rehabilitation plan.

By way of emphasizing, article 57 presents the members of the Technical Classification Commission, which is composed of the following members: I - manager of the establishment, as president; II - security supervisor; III - one physician; IV - a psychologist; V - a social worker; and VI - a lawyer.

Regarding assistance to persons deprived of liberty, articles 61 and 62 enter with the perspective of compliance, but allied to that of assistance, observe:

> Article 61. The care of the person deprived of liberty, the patient in compliance with a security measure and the ex-offender is the duty of the State, aiming to prevent crime and guide the return of the person deprived of liberty to live in society.

> Article 62. The material, legal, health, educational, social, psychological and religious assistance provided to the person deprived of liberty and to the ex-prisoner shall comply with the procedures established by the legislation in force, observing the complementary provisions of this Penitentiary Code.

What is provided for during the execution of a sentence in a closed regime, also creates expectations for the re-educating when he regains his freedom, so they must be offered assistance to the ex-offender, such as work and social assistance.

The issue of visitation is another point that is recognized as crucial and should allow the contact of the family, which can serve as one of the components of social reintegration, with exceptions to the minor, who can only enter accompanied by the legal representative or by written court order. The code also presents the other exceptions such as cases of interruption of visits or visits on non-regulatory days and times and the regulation of conjugal visits, all under the cloak of the perspective of social reintegration.

In this regard, it is essential to understand the transfer process, according to article 106 of Law No. 15,755 of 2016, which would take place the removal of the person deprived of liberty from one prison unit to another, by court order and in the following circumstances: I - by decision of progression and regression of regime; II - for judicial presentation inside and outside the district; or III - in any circumstance more appropriate to the execution of the judgment, in another State of the Federation.

According to the law, it is the responsibility of the executive secretary of rehabilitation or superintendent of prison security to determine, on an exceptional basis and by a duly justified act, the removal of the person deprived of liberty from one prison unit to another, within the State, according to the following items and paragraphs:

> I - In the case of illness, which requires hospital treatment of the person deprived of liberty, when the prison unit does not have adequate infrastructure, and the request must be made by the medical authority and ratified by the unit manager;
> II – To guarantee the life and physical integrity of the person deprived of liberty, in cases of threats founded and passed on by the security and intelligence organs of the State;
> III – In cases in which the security and intelligence organs of the State inform of the possibility of escape of the person deprived of liberty or when his participation in rebellion or riot movements within the prison is confirmed.
>
> Paragraph 1 - The removal shall be communicated within twenty-four (24) hours to the competent criminal execution court and/or to the prosecuting court.
> Paragraph 2 - The decision to transfer shall be preceded by the hearing of the person deprived of liberty,
> unless there are objections based on security reasons.
> Paragraph 3 - Transfer without a prior court order shall only be allowed between prison units belonging to the same jurisdiction, in accordance with the division of the Code of Justice.
> Judicial Organization of the State.

Article 113 of the law deals with situations of death and other accentuated situations such as serious accidents or transfer of the re-educating person to another institution and, preferably, the spouse or closest relative will be immediately informed.

Depending on the context in which the situations mentioned above occur, a disciplinary process may be incurred, if there is any disciplinary transgression or infraction in the institution's environment.

If there are several conducts in the same episode that the person deprived of liberty may commit in the institutional sphere, the following are observed:

> Sole Paragraph. In the event of committing more than one fault on the same occasion, the penalty must correspond to the most serious sanction.

Regarding the adaptation of the inmate, it is worth remembering that, according to the Law of Penal Executions, the individualization of the sentence must be observed in three moments: in the commutation of the sentence made by the Legislator; at the time of the application of the penalty made by the Judiciary; and at the time of criminal execution. According to the following article, regarding the purpose of the Technical Classification Commission:

> Article 6. The classification will be made by the Technical Classification Commission that will prepare the individualizing program of the appropriate custodial sentence for the convicted or provisional prisoner.

It is worth mentioning that the classification exam differs from the criminological exam. Article 8 of the Penal Execution Law states that:

> The person sentenced to serve a custodial sentence, in a closed regime, will be submitted to a criminological examination to obtain the necessary elements for an adequate classification and with a view to the individualization of the execution.

CONTEXTUALIZATION OF SUICIDE IN THE PRISON SYSTEM

Foucault's (2009) work, Discipline and Punish, starts with a critical-analytical description of modern institutions, about the modulation of norms and rules, imposing restrictions or even impediments to the subject's freedom. These aspects are common to prisons, as well as to asylums (a term used at the time), schools and others, with the objective of "training", "domestication" of subjects and instrumentalization of their bodies for the exercise of work.

Suicide in the prison system, when deepened, in terms of discussion, makes it possible to observe the importance of public policies as ways of providing care, without

ignoring the qualification and organization with which professionals work to correspond to these policies (CFP, 2009).

The normative proposals consider the most relevant social issues, in line with public policies. Political guidelines aim at actions that try to correspond to social demands and, therefore, have social relevance as forms of contribution (CFP, 2009).

It is common to ask about the challenges and difficulties faced in this field and in relation to all those involved, not only the re-educating students, but also the professionals and other actors who deal with it (CFP, 2009).

Some observations of the prison context and institutional routine mention the importance of observing some essential relationships, such as: the type of professional bond established that can affect the degree of commitment and the motivational aspects intrinsic to the performance of functional activity; the care of the families of the re-educated; the treatment of chemical dependency; the performance of individual and group activities, in addition to the performance of psychological evaluation.

The joint action between professionals from the technical, administrative and security areas, in addition to management, is effective, not least because it promotes a diversity of actions in its multiple dimensions, such as emergency care and the holding of technical and administrative meetings and understanding or participation in the reception process (CFP, 2009).

There are many aspects of the institutional routine itself that provide a restricted view of the performance of professionals, due to the very mechanism that engenders the containment of violence when confused with care, this occurs with the intervention of mental problems of re-educating students, but these become the impediments themselves, since they believe that they will have losses in terms of compliance with the sentence if problems of this order are exposed, while serving time in deprivation of liberty, mainly (CFP, 2009).

The activities offered and the diversity of proposals that provide the interest of the re-educating students, according to their profile and order of interest, also have a satisfactory repercussion, even if it naturally does not mobilize the total number of re-educating students, but provides opportunities, through the specialty, for genuine interest (innovative practices) in participation (CFP, 2009).

As an institutional framework, material and human resources are used, combined with an adequate physical structure, in terms of accommodation, with the use of adapted spaces, for the development of activities. Otherwise, the reality of unhealthy and dangerous conditions, with the occurrence of acts of violence, resulting from overcrowding, morbidities,

especially infectious diseases, family abandonment, among others, can make it impossible to seek a physically and psychologically healthy environment.

The organization of work must dispense with an ethical-professional training that conjectures the possibility of re-educating the person preparing him for the return to social life, starting with his own socio-family interaction.

It is known that the process of institutionalization promotes a redimensioning of the daily life that was external until then, that is, in society, which due to the commission of crimes, this type of socio-family bond was broken (NEGRELLI, 2006).

The physical structure can also promote or can also compromise the educational and resocializing aspects, depending on how the practices can intervene in this process or because this physical structure does not support group activities, or any other convenience for people who serve sentences in a closed regime, mainly (NEGRELLI, 2006).

It is known that mental disorders are part of the scenario of institutions, especially in the prison context, due to the high incidence that can cause many inmates to enter the system promoted by uncared for psychiatric conditions. This reality can even lead to the execution of crimes, even due to the vulnerability of confinement. Both situations suggest a high risk of suicide, including the combination of a series of factors, such as institutional and peer conflicts, personal history and experiences in general (NEGRELLI, 2006).

It is pertinent to work with themes that surround the daily challenges of re-educates, such as prejudice, chemical dependency and others. The male re-educating students, as is the case of this research, also verify the social construction of which the man, culturally, believes that he should not expose emotional difficulties. Therefore, preventive and interventional actions are necessary, as well as with emphasis on the community, so that the actions do not only surround institutionally, because acting in a community network is fundamental, especially in moments of regime progression, conditional release or even freedom itself.

The authors Bogo and Almeida (2019) emphasize the importance of organizing and maintaining records, with systematization of information. In the research, this same importance was also recognized since the information was physically recorded, which can lead to the loss of some information or case due to non-compliance. In addition, complete and correctly manipulated data can more easily make issues of public interest visible (BOGO; ALMEIDA, 2019).

There is no doubt that, in obedience to the legal precepts and in order to standardize procedures, the State has full responsibility for keeping all records regarding the prisoner,

since he has the guardianship of the individual in compliance with the sentence of deprivation of liberty (BOGO; ALMEIDA, 2019).

The National Policy for Comprehensive Health Care for Persons Deprived of Liberty in the Prison System and Standards for its Operationalization, aims to allow the population deprived of liberty access to comprehensive care in the Unified Health System, in addition to promoting access of inmates to comprehensive care; guarantee the autonomy of health professionals; promote intersectoral relations; qualify and humanize health care; foster and strengthen social control (CONASS, 2013).

The National Health Plan in the Penitentiary System, Interministerial Ordinance No. 1,777 of 2003, refers to actions aimed at health care for people deprived of liberty who are serving sentences in a closed regime. Note that the perspective is not reductionist, but integrative, the Ministry of Health with the Ministry of Justice in the main logic of the Unified Health System (SUS). The specialty applied to health policy in the prison system seeks to correspond to the contextualized demands and recognized as the responsibility of the State.

For a better understanding of specialized care, the environment of Brazilian prisons is revealed as vulnerable to the development of infectious diseases, especially, for this reason, they need to contribute to the control and/or reduction of these diseases (BOGO; ALMEIDA, 2019).

The profile of the inmates who committed suicide is fundamental information to verify the risk conditions, both due to the vulnerability of isolation and exposure to the unhealthy and violent environment, in this case, the prison system.

It should be noted that, due to the need for secrecy of the research and the preservation of the identity of the individuals, their names were replaced by letters, following the chronological order of occurrence.

Chart 1 - HISTORY OF THE RE-EDUCATED.

CONSTANT HISTORY IN THE PRISON SETTLEMENT			
PERSON	INTER TIME. APPROXIMATE (YEARS)	RECIDIVISM	DATE OF THE ACT INF. FACT
The	3	YES	28 / 11 / 2017 Asphyxiation / hanging
B	1 Sentenced to 12 years in prison.	NO	30 / 09 / 15 28 / 09 / 15 Transferred from Petrolândia - PE
C	Not listed	YES	10 / 07 / 14
D	2 12/11/11 – Arrested	YES	11 / 10 / 13 Asphyxiation by Hanging 27/11/12 –

			Transferred from Pesqueira PE
And	2 26/06/06 Arrested	YES	29 / 12 / 08 12 / 11 / 08 Transfer
F	2 05/08/2005 Arrested	YES	08 / 03 / 07 09 / 02 / 07 Progression of Semi-open regime
G	Not listed	Not listed	31 / 07/ 07 28 / 07 / 07 Transfer by security measure

Table 1. Produced by the authors.

The table presented above indicates that of the seven re-educating inmates, five are recidivists, which demonstrates that these inmates had already experienced living in some prison for a certain period of time. According to IPEA (2015), the vast majority of them are recidivists, in the face of the Brazilian reality, which, regarding the theme of suicide, refers to an already known context, with the possibility of having or not the adaptation. Therefore, it is possible that the transference episode was one of the factors that led to the occurrence of suicide, since four of the seven cases presented went through this condition, some even with the fatal conduct that occurred very close to the event. This event, added to other factors, including those implicit in the condition of suffering inherent to the transference, may have been of significant influence of the violent act.

Of all the seven re-educates, only one of them was in regime progression, in compliance with a semi-open regime, which is in line with the national average, which points out that compliance in a closed regime favors the occurrence of suicide, when compared to other forms of sentence compliance regime.

The role of forensic examination to verify the cause of death is highlighted, by differentiating suicide from simulation, and the latter would bring responsibility as to authorship. The two forms naturally have repercussions, according to their specificities, from the emotional point of view to the other inmates and their families, if there are links with them, as well as the civil liability of the State. It is worth mentioning that only the cases that were forensic and that were found to be suicide were considered for inclusion in the research.

Another issue that involves the method used to commit suicide is the profession, according to the Ministry of Health (2017), for example, the use of medication for this purpose used by health professionals or firearms by security professionals. In the case of the prison context, the most frequent method occurs through hanging, due to the

improvisation with which they intertwine sheets and the use of the bars themselves for hanging.

When mentioning the issue of physical structure, the place where the research took place can have a brief description that allows emphasizing the aspects of greater covered space, with the possibility of some mobility on the part of the inmates. It also allows for a coexistence that prioritizes, to a large extent, the collectivity and, according to the routine, spaces of time for more restricted coexistence in cells, with a smaller number of people. This contrasts, once again, with the national scenario, where the situation of overcrowding is commonly observed, according to Negrelli (2006), which is pointed out as one of the factors that influence the increase in the number of suicides, as it increases the deficiencies and precariousness of the prison system.

Chart 2 – PSYCHOSOCIAL CHARACTERISTICS OF THE RE-EDUCATED.

CONSTANT IN THE PRISON SETTLEMENT						
PERSON	AGE	PROFESSION	MARITAL STATUS	NUMBER OF CHILDREN	NATURALNESS	SCHOOLING
A	22	Not listed	Stable union	1	Petrolina	Illiterate
B	57	Not listed	Not listed	0	Ibimirim	Not listed
C	28	Driver	Not listed	0	Petrolina	Fundamental
D	36	Contador	Stable union	1	São Paulo	Medium
E	35	Farmer	Stable union	1	Not listed	Fundamental
F	48	Farmer	Married	3	Not listed	Literate
G	34	Not listed	Not listed	0	Not listed	Not listed

Table 2. Produced by the authors.

There is a significant difference in the age group of the inmates who committed the act, when compared to each other and compared to the general national average in relation to suicide, which is from fourteen (14) to twenty-four (24) years old (BRASIL, 2017), but it is known that the context of imprisonment has peculiar and aggravating characteristics.

Due to the multiplicity of education levels of the individuals surveyed, this information cannot be verified as a relevant characteristic in relation to this occurrence.

It is observed that, although the prisoner researched offers school activities in its own structure, where there is the possibility of continuing studies, operating a state school internally, in addition to the existence of technical courses, such as carpentry, baking and others, the re-educating person himself, by his own choice, ends up not opting for education, probably due to the feeling of incapacity and lack of stimulus from the State.

As for the professions most related to suicide risk, the Ministry of Health (2017) presents, in the result of the general panorama, as health and security professionals, but it is again observed that, in the prison context, it is not possible to establish a relationship of significance linked to this information

Regarding marital status, it is noted that the majority, 3 out of 4 cases (two cases did not have information), had some marital bond, and it can be interpreted that the fact of the existence of the family bond may have influenced the occurrence of the act. In relation to the general population, research by the Ministry of Health shows that people with some type of bond, whether married or in a stable union, have protective aspects against suicide, when compared to single people or widows (BRASIL, 2017). In the prison context, in the face of inmates who committed suicide, it should be noted that family life is weakened or even broken in most cases, enhancing the complexity of the variables involved in the context of imprisonment.

As observed, three inmates are in the group that did not have a child or that was not registered, three of them had one child and one had three children, even so, the protective factor "having a child", according to the Ministry of Health (BRASIL, 2017), was not enough, within a context of non-interaction, but rather of isolation and confinement.

As for place of birth, two inmates are from Petrolina – PE, one from Ibimirim – PE, one from São Paulo – SP, and three who do not have recorded data. There is no significance in this information, since there is a variation in the places of origin of the individuals who practiced the act. When incarcerated, the inmates take their cultural identity with them, however, in the internal scope of this context, there is interaction with other cultural identities and, above these identities, institutional identities stand out, incurring the process of acculturation.

The existence of conflicting power relations is undeniable, because while the re-educating person is in the institution, there is a process of acculturation, where he is subjected to a process of modeling or exchange of two different cultures, which ends up suffering or exerting influence on each other, because of their coexistence. It is worth noting that this process of acculturation is foreseen not only by the interaction of the re-educated with each other, but also by legislation that imperatively guides the individual's procedure within the penitentiary service, dictated by the institutional power.

It is common to observe in prisons a higher incidence of crimes involving drug trafficking, followed by crimes against property and against the person (INFOPEN, 2016). In the context in which the research was carried out, it can be seen that the highest incidence refers to property crimes, followed by the incidence of crimes against sexual freedom and,

finally, drug trafficking. When dealing with suicide, usually related to factors such as impulsiveness and aggressiveness, cases of people who have committed crimes against the person are common, as pointed out by the research carried out by Negrelli (2006), but which can also turn into self-violence. It is noteworthy that in relation to the characteristic of recidivism, for the most part, it is possible to infer that other crimes may have already been committed, and it is not possible to verify which type of crime was committed before the apprehension that the inmates were responding to until the culmination of the suicide.

The discussion of the information collected was accompanied by the lack of data that are not included in the records, but one cannot fail to recognize the importance of these records, not only for conducting research, but mainly for the institutional analysis of the occurrence of suicide, in addition to other relevant issues. The standardization of information is also essential to make it possible, with this standardization, to understand several institutional phenomena that can be confirmed by the reiteration of data.

It should be noted that research on suicide in the prison system is still incipient, for a number of reasons, including the issue mentioned above, sometimes regarding the gap in data in existing records. The general characteristics of the distribution of suicide in prison populations can be presented differently, as can be observed even by the information presented here, which confirms this.

FINAL CONSIDERATIONS

In view of the exhibitions made during the development of this research, several reflections arose about all the actors present in this scenario in which the prison is a place conducive to psychic suffering. Not only to the re-educated, but also to all the professionals involved in such a complex institutional dimension.

Although the study involves the inmates and the incidence of suicide, it also ends up involving the performance of these professionals, from understanding to appropriate technical management, and must undergo constant improvements. The other inmates, the family and the professionals involved with the person who committed suicide may present ambivalent feelings, such as anger, guilt, impotence or the loss of socio-family ties, and may even be involved, in some way, with the very influences of the occurrence of such an act.

The study was able to perceive that the moment of arrival of the re-educated, in compliance with the transfer determination, may mean the need for more effective psychosocial monitoring, probably due to some factors, such as family distancing or the real difficulty of adapting to another reality, sometimes completely different.

Consequently, it can be concluded that the most relevant result of this research is to draw the attention of the authorities involved, as well as the family and society as a whole, to the real need for psychosocial monitoring of convicts who may be transferred from prison units, in order to prevent the occurrence of this aggressive and violent phenomenon.

Therefore, by returning to the objectives of this research, it is believed that it was possible to understand the psychosocial phenomenon, and it was possible to verify, from the institutional point of view, possible triggering factors, precipitating factors and possible protective factors for the development of a prevention policy, including as proposed by Negrelli (2006).

Finally, it is interesting to highlight the limitations of the research, both in relation to the lack of some data, and in relation to the short period of study, perceiving the need to extend the same type of research to women's institutions, mainly because they have a high rate of occurrence in the national average on suicide, as well as to encourage scientific studies related to the theme of suicide and the prison system.

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STATISTICAL MODEL FOR ESTIMATING ELECTRICITY CONSUMPTION BY THE AGRICULTURAL SECTOR IN SÃO PAULO

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ABSTRACT

Electricity is a fundamental and essential input for the socioeconomic development of a region. Until 2016, the main energy resource used in the agricultural sector of São Paulo was diesel oil. However, in the last six years (2017 to 2022), electricity has become the most widely used energy source for this sector. In this context, it is vital to make a future projection of load demand in order to support deliberations in the planning and expansion of the state's electricity supply system. The objectives of this study are to create a statistical model capable of predicting the consumption of electricity in the rural sector of São Paulo, as well as to recognize the variables that influence the projection of this consumption. Based on quantitative information collected on the website of the Department of Environment, Infrastructure and Logistics of the state of São Paulo, the multiple linear regression model was used. For the construction of the model, six independent variables were selected, three of which came from agribusiness in São Paulo: number of consumers, electricity tariff and consumption of diesel oil; two related to the state: installed power of biomass thermal plants and photovoltaic plants and one of national agribusiness: GDP. Due to the lack of statistical significance, two variables were rejected: power of thermal biomass plants and GDP. Therefore, with the proposed mathematical model, built with four significant variables (with different levels of influence), it is possible to make future predictions of the energy consumption of the researched sector. The installed power of photovoltaic plants had a significant impact, while the number of consumers, the energy tariff and the consumption of diesel oil showed a strong influence on the forecast of energy consumption in the sector. The highlight was the confirmation, by the adjusted statistical model, of the transition from the consumption of diesel oil to electricity as the main source of energy used by the agricultural sector in São Paulo.

Keywords: Mathematical Model. Forecast. Tendency. Rural Sector. Linear regression.

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INTRODUCTION

In Brazil, the presence of oil and its derivatives in the domestic energy supply grew from 34% in 1970 to 46% in 2000 and is estimated to decrease to 31% in 2030 (BRASIL-MME, 2007).

In the 1970s, firewood was the dominant energy source, representing about 46% of total consumption, but it quickly gave way to the use of petroleum products, which, in the aforementioned period, reached a share of 37.85%, while hydroelectricity reached the mark of 5.5% (BRASIL-MME, 2007).

According to Brasil-MME (2007), between the 80s and 2000s, the presence of oil and its derivatives was established in the range between 40 and 50%, while firewood had a reduction to 8% and hydroelectricity was consolidated around 16%.

Electricity contributes to the progress and prosperity of a society. Electricity is a basic and fundamental input and, as such, socially excludes the portion of the population that has restrictions on its access (BISOGNIN; WERNER, 2020).

According to Brasil-EPE (2024), the total installed electricity power in Brazil in 2023 reached the mark of 226 Giga watt (GW). Allocating this amount among the four main generating sources in the country, it can be seen that hydroelectric plants (HPP) were responsible for 48.6% of this power, followed by thermoelectric plants (UTE) with 20.0%, solar plants with 16.7% and wind farms with 12.7%. The highlight was the growth of close to 55% in the capacity of photovoltaic plants, compared to 2022, with an installed capacity of 37,843 GW.

As for the production of electricity at the national level, contrasting the years 2022 and 2023, according to Brasil-EPE (2024), there were two highlights. The first was the 68.1% increase in photovoltaic generation, from 30,126 GWh to 50,633 GWh and the second was the 19.3% reduction in the generation of UTEs, which use petroleum products, from 7,485 GWh to 6,041 GWh.

During the campaign for the presidency of Brazil, the government then elected for the 2023-2026 quadrennium made available a document called "Letter for the Brazil of Tomorrow" containing proposals and commitments in which the resumption of the "Light for All" program is included (MELLO, 2022). The objective of this program is to provide access to the public electricity distribution service to residents of distant and needy rural areas.

The total consumption of electricity by all areas in the state of São Paulo in 2021, also including self-producers, was 151,729 Giga watt-hours (GWh), an increase of 4.32% compared to the previous year , which was equal to 145,451 GWh. The industrial (9.2%) and commercial (3.8%) areas showed the largest increases in electricity use for the period.

The residential (0.5%) and agricultural (0.2%) sectors showed very low growth, almost stability, in the consumption of this energy source (SÃO PAULO-SIMA, 2022).

As reported by Bisognin and Werner (2020), accurate forecasts of electricity demand and consumption are essential for correct decisions to be made in the allocation of resources, construction, and improvement of a region's electrical infrastructure. The need to plan ahead results from the fact that electricity is an input that cannot be stocked.

For the purposes of estimation and forecasting, one of the most used techniques in the area of management and in universities is regression analysis, whose main point is the presence of a statistical relationship between a variable called dependent, or explained, or predicted, with one or more variables designated independent, or predictors, or explanatory (CUNHA; COELHO, 2014).

According to Cunha and Coelho (2014), the purpose of regression analysis is to predict the amounts of the dependent variable based on the known amounts of the independent variables.

Also according to Cunha and Coelho (2014), regression is understood as the formation of a functional relationship between variables involved in the explanation of a phenomenon.

As for the classification of energy types, according to Brasil-MME (2024), primary and secondary energies are categories within the general classification of energy sources.

Primary energy is the energetic result of resources that are extracted from nature in their original form, such as: firewood, oil, natural gas, coal, and others (BRASIL-MME, 2024). Some agro-industry waste, such as coffee grounds and rice straw, are primary sources used in steam generation (SÃO PAULO-SEMIL, 2024).

Secondary energy is the result of industrialized products that undergo modifications in one or more transformations. Secondary energy sources are diesel oil, fuel oil, liquefied petroleum gas (LPG), kerosene, electricity, and others (BRASIL-MME, 2024).

For the above, the research of statistical prediction of electricity consumption in the agricultural sector of São Paulo is justified, since, in addition to being a diagnostic tool, it is also capable of generating a mathematical model to estimate the energy consumption of this sector, contributing with regional information to meet the needs of improvements and expansion of the entire infrastructure of transmission and distribution of electricity due to the growing trend in the use of this type of energy. It also contributes to the creation of public policies for the agribusiness sector in favor of the social well-being of the rural population and the development of the economy.

The general objective of this research was to generate a statistical model that estimates the electricity consumption of the agricultural sector in São Paulo. The specific objective was to identify the variables that contribute to the prediction of this consumption.

METHODOLOGY

The tool used in this work is regression analysis, which, according to Martins and Domingues (2014), is used mainly for the purpose of prediction. The objective is to construct a statistical model for the prediction of responses of a dependent variable (Y) depending on the value of a variable (X) or more variables (X1, X2, ... and X_n) independent(s), establishing a mathematical relationship between these two types of variables (MARTINS; DOMINGUES, 2014).

The response variable (dependent) must be quantitative, while the predictor variable(s) can be quantitative or qualitative.

In the survey, the dependent variable is the annual forecast of electricity consumption by the agricultural sector in São Paulo, based on a statistical model.

The regression model is called simple, that is, when there is only one independent (explanatory) variable. In the existence of two or more of these variables, the regression model is called multiple (MARTINS; DOMINGUES, 2014).

BUILDING A SIMPLE LINEAR REGRESSION MODEL

The relationship between the two types of variables can take several forms, among them, a simplified model, which is the simple linear relationship containing only one independent variable, such as the equation of the line, according to the Equation (1).

$$Y = \beta_0 + \beta_1.X + \varepsilon \quad (1)$$

where:

- β0: linear coefficient (line intercept);
- β1: slope coefficient or regression coefficient (slope of the line);
- Ɛ: regression error or residue.

Based on sample data, we have $\hat{Y}$, which is the result of the prediction Y for an observation X, according to the adjusted model of the simple linear regression enunciated by the Equation (2).

$$\hat{Y} = b_0 + b_1.X \quad (2)$$

where:

- b0: the β0 estimator; and
- B1: or β1 estimator.

The values of b0 and b1 will be collected in the "Coefficients" column of the Data Analysis tool of the Microsoft Excel® spreadsheet editor from samples of ordered pairs of two variables.

CONSTRUCTING A MULTIPLE LINEAR REGRESSION MODEL

The relationship between the two types of variables can take several forms, among them, a multiple model that aims to better predict and explain the behavior of the researched dependent variable (Y). In this way, other explanatory variables can be incorporated (X1, X2, ..., X_n) to the model, according to the Equation (3).

$$Y = \beta_0 + \beta_1.X_1 + \beta_2.X_2 + \ldots + \beta_n.X_n + \varepsilon \quad (3)$$

where:

- β0: linear coefficient (intercept/intersection of the line);
- β1, 2, ..., n: slope or regression coefficient (slope of the line);
- Ɛ: experimental error of Y (pontos fora da reta).

Cunha and Coelho (2014) clarify that the coefficient β0 symbolizes the value of the intersection of the regression graph with the ordinate axis; therefore, β0 portrays the value of Y when X is zero.

Multiple regression analysis is used to study the relationship between a single dependent variable, chosen by the researcher, with numerous independent variables of known values (GIL, 2021).

Based on sample data, we have $\hat{Y}$, which is the result of prediction Y for X observations, according to the fitted model provided by the Equation (4).

$$\hat{Y} = b_0 + b_1.X_1 + b_2.X_2 + \ldots + b_n.X_n \quad (4)$$

where:

- b0: β0 estimator;
- b1, 2, ..., n: respective estimators of β1, 2, ..., n.

Using the tool called "Regression", available in "Data Analysis" of the Microsoft Excel® spreadsheet editor, from samples of ordered pairs of three or more variables, the values of b0, b1, b2, ..., and b n will be collected in the "Coefficients" column.

TESTING THE SIGNIFICANCE OF THE REGRESSION COEFFICIENTS

In the spreadsheet called "ANOVA", created by the "Regression" tool of Microsoft Excel® Data Analysis, the individual amounts of "P-value" of the coefficients (parameters) are present.

The importance of one or more independent variables (individually) is tested. The information contained in the individual "P-values" allows us to determine whether each explanatory variable is statistically relevant or not.

Chance:

- H0: $\beta i = 0$, consists of checking whether each parameter βi of the regression is equal to zero;
- H1: $\beta i \neq 0$, if P-value $\leq \alpha$, hypothesis H0 is rejected, concluding that $\beta i \neq 0$ for a risk (significance level) α.

TESTING THE EXISTENCE OF LINEAR REGRESSION

Also in the "ANOVA" spreadsheet, described in the previous item, is the value of "F for meaning". This index indicates whether the linear regression model as a whole is statistically relevant or not. It indicates whether the combination of explanatory variables has a statistically significant association with the response variable.

For the condition of descriptive level or probability of significance (p-value: F for significance) $\leq \alpha$ (level of significance) adopted in the research, it can be concluded that there is regression, that is, the model can explain and predict Y (response variable).

TOOLS FOR ANALYZING RESULTS

Quality of Fit

Linear Correlation Coefficient

Applying the "Regression" tool contained in the Excel® Data Analysis, from samples of ordered pairs of two or more variables, the so-called Linear Correlation Coefficient (multiple R) present in the table called "Regression Statistics" is obtained. This coefficient symbolizes the level of connection (association) between the autonomous and dependent variables (CUNHA; COELHO, 2014).

Coefficient of Determination or Explanation

In the table "Regression Statistics", there is also the so-called Coefficient of Determination or Explanation (R2).

R2 is a measure of the proportion of variation in Y (response), which is explained by X (explanatory) by the fit of the linear model, thus being a descriptive measure of the quality of the fit. The value of this coefficient is between 0 < R2 < 1, and the closer to the unit value, the better the quality of the fit of this linear model.

Adjusted Coefficient of Determination

The Adjusted Coefficient of Determination (adjusted R2) is listed in the "Regression Statistics" table, and is used in the comparison between regression equations that contain different amounts of independent variables or sample sizes (WEDGE; COELHO, 2014).

The regression equation that best explains the dependent variable studied is the one whose amount of the adjusted R2 coefficient is the closest to the unit value.

Standard Error

The "Standard Error" is the average value, in the unit of the dependent variable, that the adjusted equation is missing more or less; In other words, it is the average distance between the observed amounts and the linear regression line.

Also present in the table mentioned above, the "Standard Error" is an indicator of regression accuracy, and the lower its value, the better the model estimate (CUNHA; COELHO, 2014).

Comparing Regression Equations

Regression equations can be compared, using the Adjusted Coefficient of Determination (adjusted R2) of both, and the regression that best explains the dependent variable is the one whose amount of the adjusted R2 coefficient is the closest to the unit value.

Another factor of comparison, between regressions that explain the same dependent variable, is the "Standard Error" which, the lower its value, the more accurate the model estimate will be.

Residual Analysis (ε)

It is suggested to verify some attributes of the distribution of waste, such as:

a) To ascertain whether the mean probability distribution of the variable Ɛ is zero;

b) Test for homoscedasticity. In analysis of variance (ANOVA), errors must have common variance;

c) To verify the normality of the probability distribution of the variable Ɛ using the Shapiro-Wilk test.

Chance:

– H0: the variable under study is normally distributed;
– H1: the variable under study is not normally distributed.

If the p-value ≤ α, hypothesis H0 is rejected for a risk (significance level) α.
If the p-value > α, hypothesis H0 is not rejected for a risk (significance level) α.

d) Absence of serial autocorrelation. According to Cunha and Coelho (2014), the model should assume that the correlation between the residuals along the entire spectrum of independent variables is null; this means that the impact of an observation on a given variable X does not affect subsequent observations. Therefore, there is no causal relationship between the residuals and the variable X and, consequently, the variable Y is affected only by the variable X in question, and not by lagged effects of X1 on X2 and, consequently, on Y.

Multicollinearity between independent variables

Multicollinearity occurs when two or more independent variables, present in the model and that try to explain the same phenomenon, have similar information. Consequently, the high correlation between two or more independent variables can make it difficult to distinguish their individual effects on the dependent variable, causing an overlap of information in the explanation and estimation, which can lead to the loss of significance of one of them in the elucidation of the behavior of the phenomenon (CUNHA; COELHO, 2014).

According to Cunha and Coelho (2014), multicollinearity has the effect of distorting the calculated angular coefficients of the affected variables, impairing the predictive accuracy of the model and the understanding of the true impact of the independent variable on the behavior of the dependent variable.

The implications of the above are presumed and listed below:

- Increase in standard errors;
- Reduction in the efficiency of estimators;
- Less accurate estimates;

- Increased sensitivity to small fluctuations in data.

These inferences described above make it difficult to separate the effects of each variable.

The multicollinearity between the independent variables will be investigated, using Pearson's Correlation Test in order not to use redundant variables.

Chance:

– H0: p = 0 (there is no linear correlation between the variables under study);
– H1: p ≠ 0 (there is a linear correlation between the variables under study).

If the p-value ≤ α, hypothesis H0 is rejected for a risk (significance level) α.

If the p-value > α, hypothesis H0 is not rejected for a risk (significance level) α.

Next, the application of the proposed method is presented, as well as the exploration and discussion of the results.

RESULTS AND DISCUSSION

The data collection was mainly based on the annual digital report entitled Energy Balance of the State of São Paulo (BEESP) made available by the Secretariat of Environment, Infrastructure and Logistics (SEMIL) of the São Paulo government, in which the agricultural sector is included in the class called "other" (along with public services, public authorities, public lighting and own consumption) in the tables of this document.

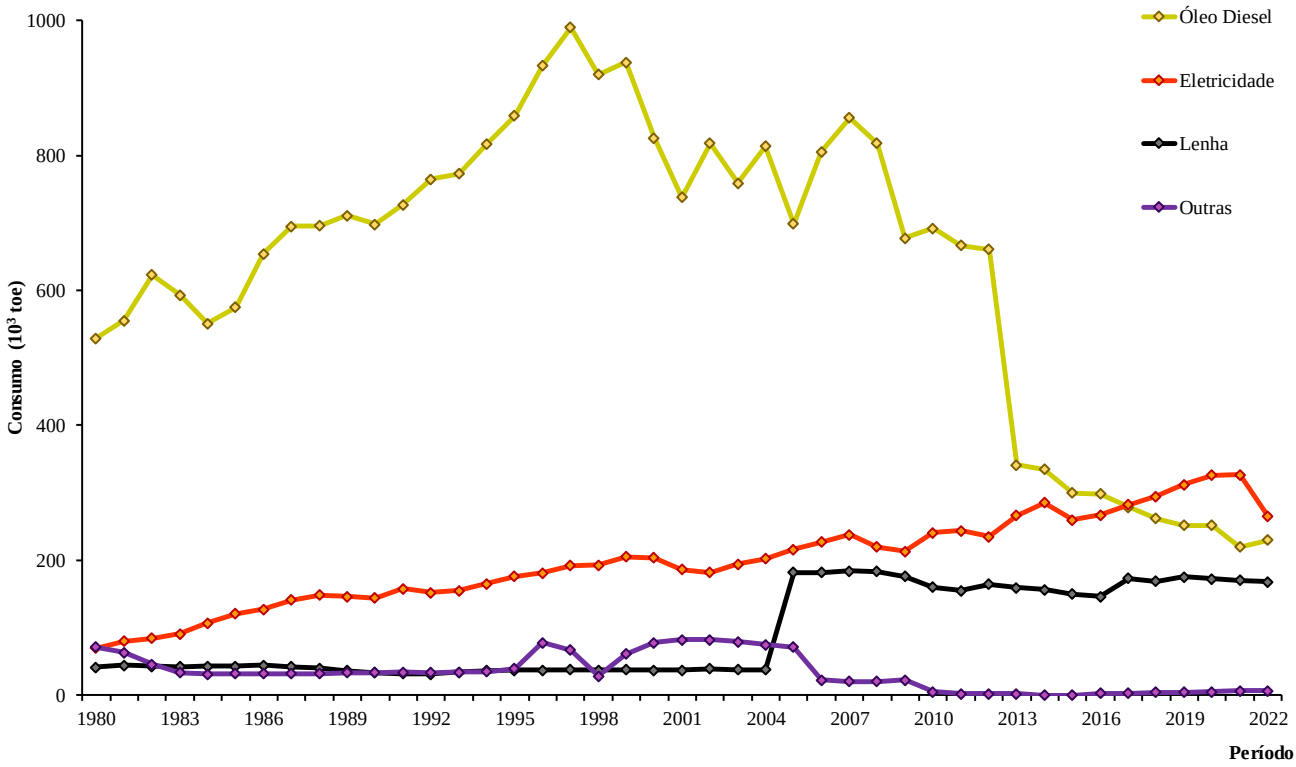
In this research, the approach is quantitative due to the nature of all the variables involved. And these variables – dependent variable Y and independent variables X1 to X6 – are related and detailed below.

– The dependent variable Y – electricity consumption, in Megawatt-hour (MWh), of São Paulo agribusiness – had its historical series (2000 to 2023) collected from the SEMIL website (https://dadosenergeticos.energia.sp.gov.br/portalcev2/intranet/Eletricidade/index.html) in "Energy Data/Distribution System/Annual Consumption".
– Independent variable X1 (number of consumers in São Paulo agribusiness). The information was gathered from the same SEMIL website mentioned above (https://dadosenergeticos.energia.sp.gov.br/portalcev2/intranet/Eletricidade/index.html) in "Energy Data/Distribution System/Annual Consumption".
– Independent variable X2 – electricity tariff, in reais per Megawatt-hour (R$/MWh), of the rural sector of São Paulo, with the values of conventional electricity tariffs

[Distribution System Use Tariff (TUSD) + Energy Tariff **(**TE)], between the years 2000 and 2009, was determined by the arithmetic average, year by year, of three subgroups, which are: B2-Rural, B2-Rural Electrification Cooperative and B2-Public Irrigation Service, contained in the "History prior to 2010/History of Homologatory Resolutions", published by the National Electric Energy Agency (ANEEL) on the *website* (https://portalrelatorios.aneel.gov.br/luznatarifa/basestarifas) of the following energy distributors: Companhia Paulista de Força e Luz (CPFL Paulista), Companhia Piratininga de Força e Luz (CPFL Piratininga), Companhia Luz and Força Santa Cruz (CLFSC) and Elektro – Eletricidade e Serviços S/A. As for the amounts of energy tariffs (TUSD + TE), as of 2010, in the *link*: https://portalrelatorios.aneel.gov.br/luznatarifa/basestarifas in "TUSD and TE/Approved Tariff Data", they were also calculated by the arithmetic average, year by year, of the three B2 subgroups mentioned above of the subsequent distributors: CPFL Paulista, CPFL Piratininga, CPFL Santa Cruz, Energias de Portugal (EDP) São Paulo, Enel Distribuição São Paulo, Energisa Sul Sudeste (ESS) and Neoenergia Elektro.

- Independent variable X3 (diesel fuel consumption). From BEESP 2019 (base year 2018), associated with BEESP 2023 (base year 2022), information was obtained on the energy sources consumed by the aforementioned sector, from which Graph 1 was plotted in order to evaluate the evolution of the consumption of each energy source and its dependence by the sector. The highlight was electricity, diesel oil and firewood. The other energy sources consumed (denominated in the graph as "others") are composed of the sum of three energy sources: LPG, kerosene and fuel oil. In Graph 1, it is possible to observe the decrease in the consumption of diesel oil from 2007, which, until 2016, is the most used energy source by the rural sector of São Paulo. On the other hand, there is the growing use of electricity, being the most consumed energy in the last six years.

Graph 1 - Evolution of energy drink consumption, in toe[3], by the agricultural sector of São Paulo



Source: Prepared by the author from São Paulo-SIMA (2019) and São Paulo-SEMIL (2023).

In view of the above, the independent variable X3 was assigned to the consumption of diesel oil, in one thousand (103) cubic meters (m3), of São Paulo agribusiness, and its volumes were obtained in two stages. The first, between the years 2000 and 2012, of BEESP 2019 (base year 2018) available at the *link*: https://smastr16.blob.core.windows.net/2001/2023/12/BEESP2019ab2018.pdf. The second, from 2013 to 2022, was collected from BEESP 2023: Base Year 2022 (https://smastr16.blob.core.windows.net/2001/2024/02/BEESP2023ab2022-2a-edicao-2.pdf).

– Independent variable X4 [Biomass TPP[4], in kilowatt (kW), from the state of São Paulo]. It is the sum of the installed electrical power of the thermoelectric generating plants in São Paulo that use the following energy compounds: sugarcane bagasse; biogas; biogas-AGR[5]; biogas-UK[6]; coal-UK; rice husks; firewood; black liquor (lye[7]); wood waste and forest residues. This information was collected from the digital files "Executive Summary: Energy production data from renewable sources" from the years 2013 to 2023

[3] According to São Paulo-SEMIL (2023), the unit of energy used in some energy balance reports is the ton of oil equivalent (toe), with one toe being equivalent to 10x109 calories or 10 Giga calories (10 Gcal).
[4] Generating units that use renewable sources for the production of electricity.
[5] AGR: agricultural waste.
[6] RU: municipal solid waste.
[7] Liquid waste from the pulp & paper sector.

(https://dadosenergeticos.energia.sp.gov.br/portalcev2/intranet/BiblioVirtual/renovaveis/resumo_executivoRE.pdf).

- Independent variable X5 (Photovoltaic Generation, in kW, in the state of São Paulo): the same source cited in the previous variable (X4) was used to gather the information on the sum of the installed electrical power of the solar plants in São Paulo.
- Independent variable X6 [Gross Domestic Product (GDP) of Brazilian agribusiness]: information on the GDP of Agribusiness in the State of São Paulo is not yet available in the *site*; for this reason, the values of the Brazilian Agribusiness GDP were collected in the *link*:https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fcepea.esalq.usp.br%2Fupload%2Fkceditor%2Ffiles%2FPlanilha_PIB_Cepea_Portugues_Site%2520(1)(4).xlsx&wdOrigin=BROWSELINK in the "GDP" tab of the spreadsheet Center for Advanced Studies in Applied Economics (CEPEA). The result of this GDP is the sum, in millions of current reais, of four factors, which are:

- Inputs used in agriculture;
- Basic agricultural production;
- Agro-industrial production;
- Agricultural services.

The data collected produced historical series for the target sector of the study, between 2000 and 2022. The amounts related to energy expenditures in the years 2020 and 2021 may have been affected by the COVID-19 pandemic.

The dependent variable Y (electricity consumption), as well as the independent variables X1 (number of consumers), X2 (electricity tariff) and X3 (diesel oil consumption) are pertinent to São Paulo agribusiness, while the independent variables X4 (electricity generation by thermoelectric plants that use biomass) and X5 (electricity generation by photovoltaic plants) refer to the state of São Paulo; finally, the independent variable X6 (gross domestic product) is allusive to national agribusiness.

TESTING THE SIGNIFICANCE OF THE COEFFICIENTS

In "Data" (ribbon tab) within the Microsoft Excel® spreadsheet editor, the "Data Analysis" add-in is chosen and, subsequently, the "Regression" analysis tool is selected, where the variable Y is inserted, as well as from X1 to X6, thus obtaining Table 1.

Table 1 shows the independent variable X4 with a high amount of approximately 81.81% for a P-value, much higher than the significance level (α) of 5%. In addition, in the 2nd part of Table 1, in "Coefficients", the lower and upper limits of the confidence interval are presented in the columns "lower 95%" and "upper 95%", which can be expressed as: P(-0.192 ≤ β_4 ≤ +0.240). The test described in item 2.3 indicates the non-rejection of hypothesis H0: β4 = 0. The non-rejection of this hypothesis is confirmed by the confidence interval that covers the value zero.

Considering the above, it is admitted that there is no regression in the electricity consumption of the São Paulo agribusiness sector on the installed capacity in the Biomass TPPs in the state of São Paulo. Therefore, X4 is not statistically significant for this regression model, and is discarded.

Table 1 - Evaluation of the P-values of the six independent variables

Coeficientes		**valor-P**	95% inferiores	95% superiores
Interseção	358.982,066	0,692462	-1.530.548,003	2.248.512,135
X1: Quantidade de Consumidores	13,674	0,003160	5,320	22,029
X2: Tarifa de Energia Elétrica (R$/MWh)	-5.017,753	0,011741	-8.758,809	-1.276,696
X3: Consumo de Óleo Diesel (10^3 m^3)	-807,850	0,222354	-2.156,661	540,961
X4: UTE Biomassa (kW)	0,024	0,818148	-0,192	0,240
X5: Usina Fotovoltaica (kW)	1,783	0,043915	0,055	3,511
X6: PIB (milhões R$)	0,536	0,270721	-0,460	1,531

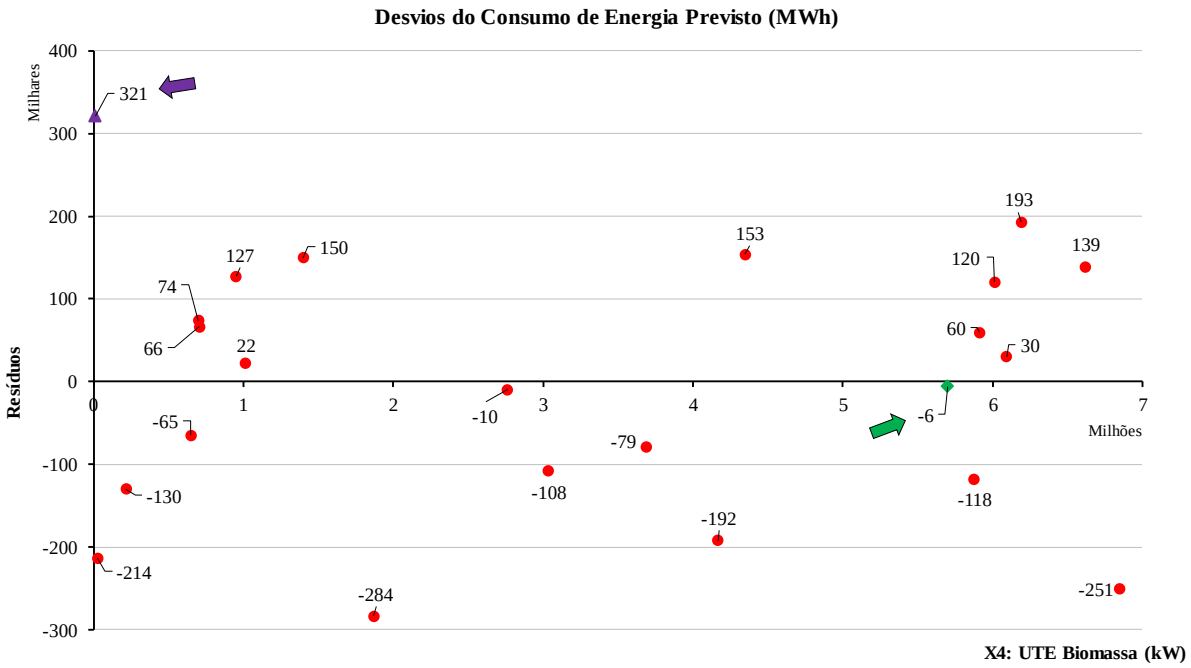
Source: Prepared by the author.

Graph 2 plots the Waste (MWh) in relation to the installed capacity (kW) of the São Paulo TPPs that use biomass as fuel. Residuals are the differences between the actual values of energy consumption and the values estimated by the adjusted model.

There was an alternation between the positive points (12) and the negative points (11), in a total of 23 points (years collected), signaling the absence of a pattern, which allows them to be considered random.

The farthest point (in purple), shown in Graph 2, has an estimated consumption of approximately 321,000MWh lower than the actual one, while the closest point (in green) between the actual and estimated consumption is negative 6,000MWh, that is, the expected consumption, in this case, is higher than the actual one.

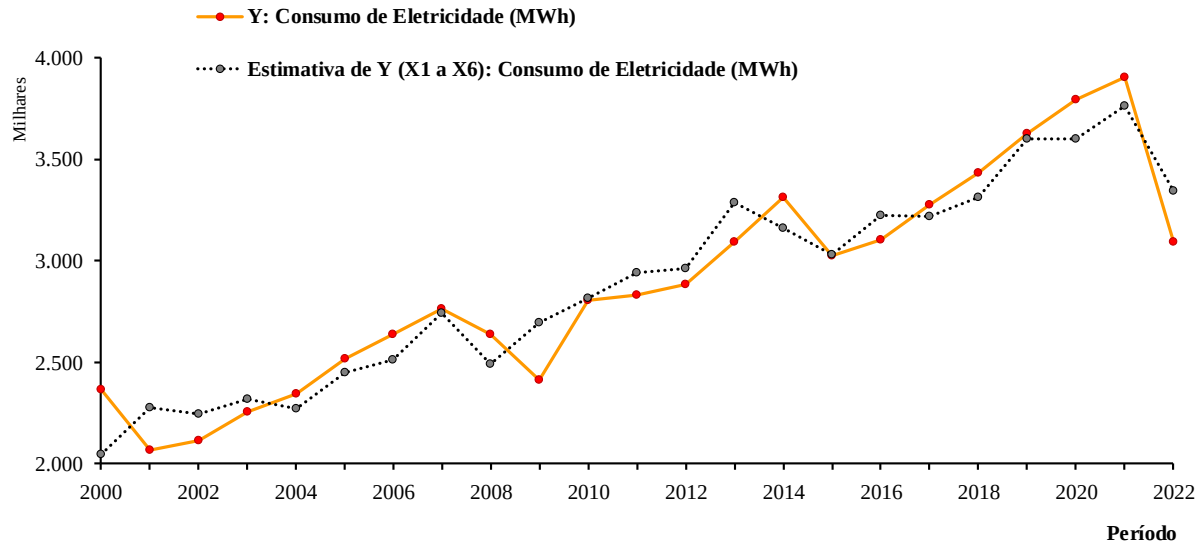
Graph 2 - Dispersion of waste from energy consumption with the power of the Biomass TPPs



Source: Prepared by the author.

Graph 3 shows two graphic lines for the same time interval of 23 years, with the continuous graphic line (in orange) being the actual or observed energy consumption by the rural sector of São Paulo, in MWh, in contrast to the dotted line (in black), which is an estimate of consumption in this sector, as a function of the six independent variables surveyed (X1 to X6), using the multiple linear regression technique. You can observe errors between the points of the actual line and the estimated line.

Graph 3 - Graphs of actual and estimated energy consumption for six variables



Source: Prepared by the author.

The "Regression" analysis tool was again performed for variable Y, as well as all independent variables, with the exception of X4, which was discarded, generating Table 2. In it, described in red, is the variable X6 with an approximate value for a P-value of 11.48%, which is higher than the significance level of 5%.

Also observing the limits of the "bottom 95%" and "top 95%" columns for the confidence interval of X6 equal to P(-0.162 ≤ β_6 ≤ +1.367), this means that β6 passes through zero, indicating the non-rejection of the hypothesis H0: β0 = 0, described in item 2.3.

For the reasons listed above, it is conceivable that there is no regression of the electricity consumption of São Paulo agribusiness on the GDP of Brazilian agribusiness.

Table 2 - Evaluation of the coefficients for five independent variables

Coeficientes		**valor-P**	95% inferiores	95% superiores
Interseção	353.073,910	0,688524	-1.473.692,129	2.179.839,948
X1: Quantidade de Consumidores	14,102	0,000660	6,945	21,259
X2: Tarifa de Energia Elétrica (R$/MWh)	-5.053,089	0,008820	-8.658,034	-1.448,145
X3: Consumo de Óleo Diesel (10^3 m^3)	-921,762	0,033122	-1.760,465	-83,058
X5: Usina Fotovoltaica (kW)	1,696	0,027905	0,208	3,185
X6: PIB (milhões R$)	0,602	0,114887	-0,162	1,367

Source: Prepared by the author.

The model was reconstructed for the last time, this time, inserting variable Y, as well as all variables X, with the exception of variables X4 and X6, which were excluded because they were not statistically significant.

The program generated Table 3, whose P-value amounts are highlighted in orange, with approximate values equal to: 0.014% for X1, 3.124% for X2, 0.264% for X3 and 1.169% for X5. These four variables were statistically accepted, considering a margin of error (significance level) of 5%, recognizing the existence of regression of energy consumption on these four variables.

Table 3 - Data analysis with four independent variables

RESUMO DOS RESULTADOS

Estatística de regressão	
R múltiplo	0,9465
R-Quadrado	0,8958
R-quadrado ajustado	0,8726
Erro padrão	185.374,5251
Observações	23

ANOVA

	gl	F de significação
Regressão	4	1,31415E-08
Resíduo	18	
Total	22	

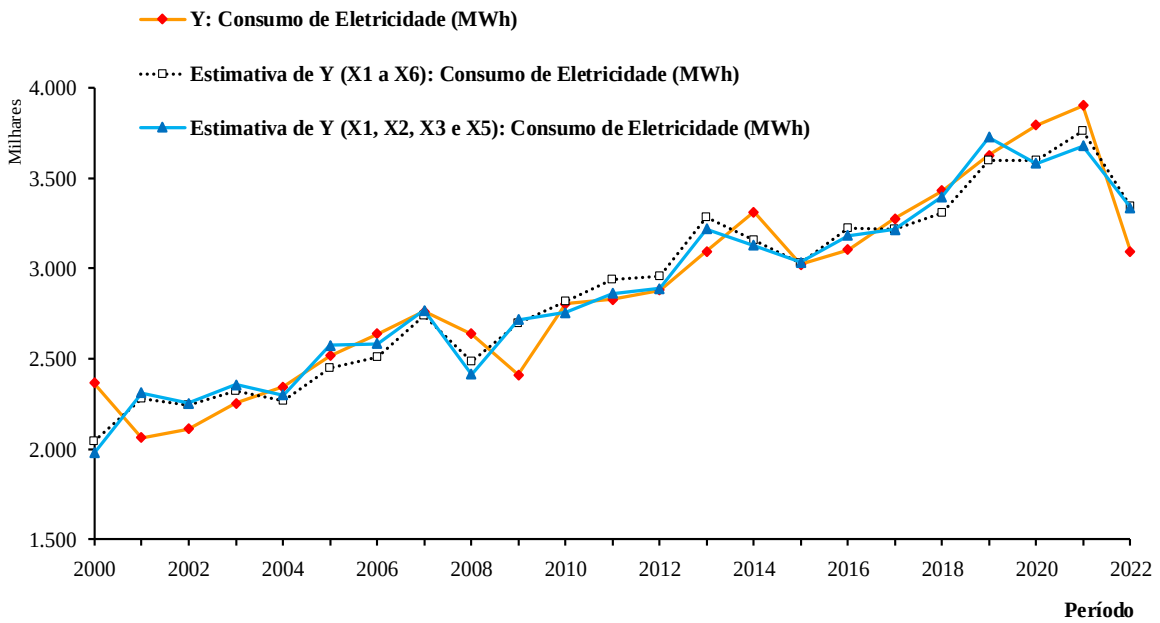
Coeficientes		valor-P
Interseção	319.305,420	0,728883
X1: Quantidade de Consumidores	16,044	0,000141
X2: Tarifa de Energia Elétrica (R$/MWh)	-3.529,563	0,031241
X3: Consumo de Óleo Diesel (10^3 m^3)	-1.254,294	0,002643
X5: Usina Fotovoltaica (kW)	2,002	0,011692

Source: Prepared by the author.

In Graph 4, three graphic lines are plotted for the period from 2000 to 2022 (23 years). The graphic line in orange reveals the variation in the actual or observed electricity consumption (MWh) of the agricultural sector in São Paulo, while the dotted line in black is a forecast of the sector's consumption, in MWh, as a function of all the independent variables selected (X1 to X6).

The blue line in the graph is the forecast of electricity consumption (MWh) of the agricultural sector in São Paulo, for the same period in question, considering four independent variables (X1, X2, X3 and X5). The plotted points, both on the dotted line in black and on the solid line in blue, were obtained using the statistical technique of Multiple Linear Regression.

Graph 4 - Graphs of actual and projected energy consumption



Source: Prepared by the author.

GENERATION OF THE MULTIPLE LINEAR REGRESSION MODEL

The intersection coefficients (b0) and the independent variables X1 (b1), X2 (b2), X3 (b3) and X5 (b5) were collected from Table 3 (in blue), as follows:

- b0 = + 319,305.420 = > estimated energy consumption, not associated with the independent variables;
- b1 = + 16.044 => estimated increase in energy consumption for each additional consumer, keeping the other independent variables constant;
- b2 = - 3,529.563 = > estimated decrease in energy consumption for each increase in the electricity tariff, in R$/MWh), keeping the other variables unchanged;
- b3 = - 1,254.294 => estimated decrease in energy consumption for each additional 103 m3 of diesel oil, keeping the other independent variables constant;
- b5 = + 2.002 => estimated increase in energy consumption for each kilowatt (kW) of additional power in the photovoltaic plants in São Paulo, keeping the other independent variables constant.

Substituting the above five coefficients into the Equation (4), we have the Equation (5):

$$\hat{Y} = 319305{,}42 + 16{,}044 \,.\, X_1 - 3529{,}563 \,.\, X_2 - 1254{,}294 \,.\, X_3 + 2{,}002 \,.\, X_5 \qquad (5)$$

The Equation (5) is the adjusted statistical model of multiple linear regression for the prediction of electricity consumption in the agricultural sector of São Paulo, considering the variables selected in this research.

This multiple linear regression model predicts for the sector researched:

- Approximate increase of 16.044MWh in electricity consumption for each increase of 1 (one) consumer;
- Reduction of about 3,529.563MWh in energy consumption for each increase of R$ 1.00 per MWh in the electricity tariff;
- Reduction of around 1,254.294MWh in energy consumption for each increment of 1 (one) 103 m3 of diesel oil used;
- An increase of close to 2.002MWh in energy consumption for each unit of kW, plus power in the photovoltaic plants in São Paulo.

TESTING THE EXISTENCE OF REGRESSION

Table 3 (in green) shows the approximate value of "F for significance" of 1.314x10-6 %. As "F for meaning" is less than α (significance level adopted at 5%), it is concluded that there is regression, that is, the explanatory variables (X1, X2, X3 and X5), together, have a statistically relevant association that can explain and predict Y (electricity consumption), according to the description of item 2.4.

ANALYSIS OF THE RESULTS OF THE MULTIPLE LINEAR REGRESSION MODEL

Quality of Fit

Linear Correlation Coefficient

The Correlation Coefficient (R multiple) is highlighted in pink in Table 3, with a value equal to 0.9465. This amount suggests a great similarity in behavior between the variables, pointing in the same direction. In other words, there is a considerable positive correlation between the variables (MARTINS; DOMINGUES, 2014).

Coefficient of Determination or Explanation

Extracting from Table 3 the Coefficient of Determination or Explanatory Power (R-Squared), in violet, with a value equal to 0.8958, and using the rounding to one decimal place, the amount of R2 becomes 0.9.

It is found that the proportion in Y (electricity consumption), which is explained, together, by X1 (number of consumers), X2 (electricity tariff), X3 (diesel oil consumption) and X5 (electricity generation by photovoltaic plants) through the linear regression model obtained, has a high explanatory power ($0.9 \leq R2 < 1.0$), according to Martins and Domingues (2014).

Therefore, the variables X1, X2, X3 and X5, together, through the model, explain 89.58% of the changes or modifications that occurred in Y. The remainder (10.42%) can be attributed to other eventual variables (not included in this model).

Standard Error of Estimation

Table 3 shows the value of the "Standard Error" close to 185,374MWh (highlighted in gold). In this research, the actual values (observed) are on average 185,374MWh away from the linear regression line of this model.

Table 4 describes the percentage errors of consumption estimated by the Equation (5) of the adjusted model compared to the actual (observed) energy consumption values in the sector.

Table 4 - Errors between actual consumption and those estimated by the model

Observation	Error (%)
1	-16,26
2	12,04
3	6,73
4	4,61
5	-1,83
6	2,34
7	-2,03
8	0,15
9	-8,50
10	12,63
11	-1,81
12	1,17
13	0,37
14	4,05
15	-5,55
16	0,40
17	2,56
18	-1,80
19	-0,96
20	2,77
21	-5,56
22	-5,69
23	7,82

Source: Prepared by the author.

The standard error is another way to measure the accuracy of the calculation, being a kind of standard deviation with respect to the regression line. The lower the standard error of the estimate, the more accurate the forecast model will be.

And finally, in the "Observations" line, the number 23 is verified, which refers to the size of the sample surveyed (23 years).

Residual Analysis (ε)

The period covered by the research is 23 years (23 observations), and the information in the "Residuals" column, highlighted in brown (Table 5), was taken from the "Regression" tool of Microsoft Excel®.

Table 5 - Teste de Shapiro-Wilk

Observation	Waste	Teste de Shapiro-Wilk	
1	384.528,969	Sample size	23
2	-248.358,280	Average	0,000
3	-142.160,421	Standard deviation	167.677,567
4	-103.973,389	In	0,9725
5	42.852,549	p	0,7206
6	-58.843,459		
7	53.570,456		
8	-4.245,696		
9	224.231,042		
10	-304.571,083		
11	50.691,540		
12	-32.989,903		

13	-10.712,205		
14	-125.362,612		
15	183.952,766		
16	-12.102,422		
17	-79.460,857		
18	59.001,669		
19	32.973,947		
20	-100.334,068		
21	210.936,122		
22	222.182,276		
23	-241.806,940		

Source: Adapted by the author of the BioStat® software.

The Shapiro-Wilk test, using the BioEstat® software, version 5.3[8], is performed to calculate the mean probability distribution of the variable Ɛ (item 2.5.3, part a), as well as to verify its normality (item 2.5.3, part c).

The result of the mean probability distribution of the variable Ɛ is equal to zero (highlighted in red) in Table 5.

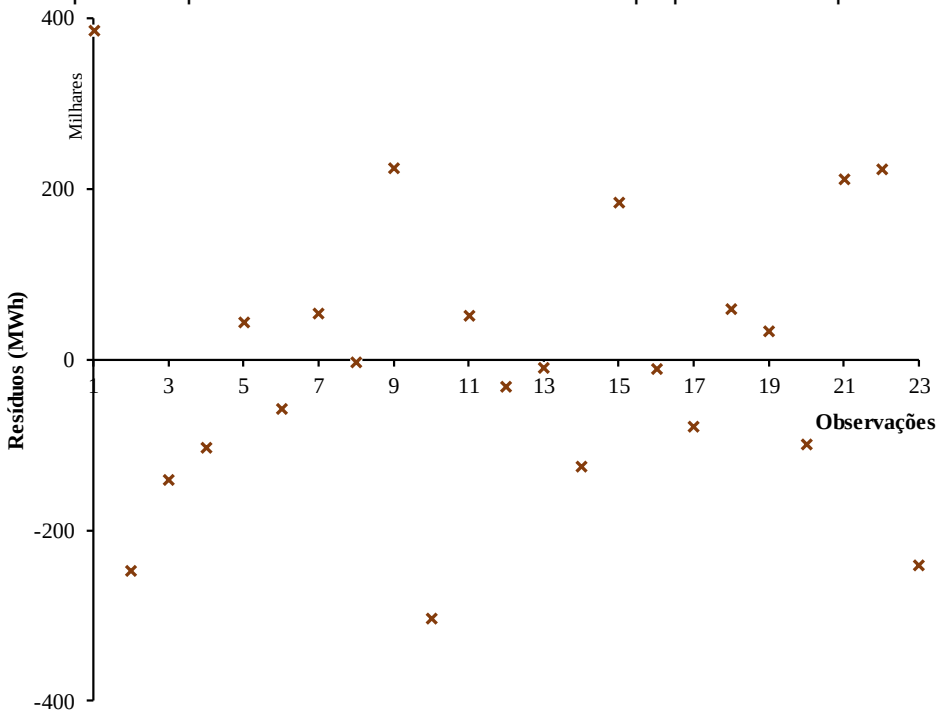
Regarding the verification of the normality of the probability distribution of the variable Ɛ, according to Table 5, the amount of p-value is 0.7206 (highlighted in green), i.e., 72.06%. As a > α-value for a significance level (α) of 5%, hypothesis H0 is not rejected. Therefore, there are indications that the distribution of errors or residues is normally distributed.

It is also noticed, according to Table 5 (in brown), the alternation of positive (ten) and negative (thirteen) signs of the "Residuals", confirming a good fit of the model.

In Graph 5, the residual values are randomly plotted around the Observations axis (23 years), without showing any type of pattern. Therefore, it is deduced that the residuals are independent of each other, noting only the effect of the independent variables on the dependent variable, which means the absence of residual autocorrelation.

[8] https://www.mamiraua.org.br/downloads/programas/

Graph 5 - Dispersion of the Residuals of the model proposed for the period



Source: Prepared by the author.

Ascertaining the Existence of Multicollinearity Between the Dependent Variable and the Selected Independent Variables

The information of variables Y, X1, X2, X3 and X5 were transported to the Microsoft Excel® spreadsheet editor, where the configuration of the following menu was used: Data => Data Analysis => Correlation => *OK,* creating Table 6.

Analyzing the table, it is noted that the dependent variable (Y) has, in decreasing order of correlation intensity (in module), a strong correlation with the variable X3 of 87.28%, followed by the variable X1, with 80.87%, X2, with 75.63% and, finally, the lowest correlation, with a percentage of 60.89%, with the variable X5.

According to Martins and Domingues (2014), the ordering of the independent variables described in the previous paragraph will be the same in terms of the level of importance of contribution to a good response of the regression analysis under study, i.e., the variable X3 is the most significant, followed by X1 and X2, determining X5 as the lowest participation in the regression.

According to Gil (2021), the correlations in Table 6 can be described by phrases, such as:

– The correlation between Y and X3 of 87.28% (negative) is characterized as a very strong negative correlation because it is in the range between -70% and -99%;

- The positive correlations between Y and X1 of 80.87% and between Y and X2 equal to 75.63% are portrayed as very strong positive correlations because they are inserted between 70% and 99%;
- The correlation between Y and X5 of 60.89% (positive) is specified as a substantial positive correlation because it is between 50% and 69%.

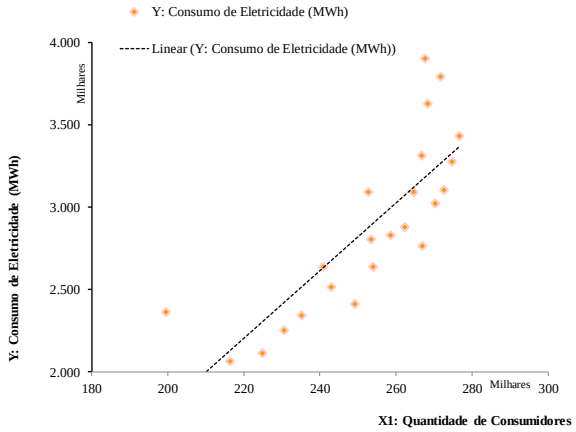
Table 6 - Correlation between the dependent variable in relation to the independent variables

Correlation	Y: Electricity Consumption (MWh)
Y: Electricity Consumption (MWh)	1
X1: Number of Consumers	+ 0,8087
X2: Electricity Tariff (R$/MWh)	+ 0,7563
X3: Diesel Oil Consumption (103 m3)	- 0,8728
X5: Photovoltaic Power Plant (kW)	+ 0,6089

Source: Prepared by the author.

Graph 6, which represents the energy consumption of the São Paulo agribusiness sector relative to the number of its consumers, can be seen as a positive correlation, i.e., the variables are positively related and grow in the same direction (MARTINS; DOMINGUES, 2014), with a few scattered points around the black dotted linear trend line.

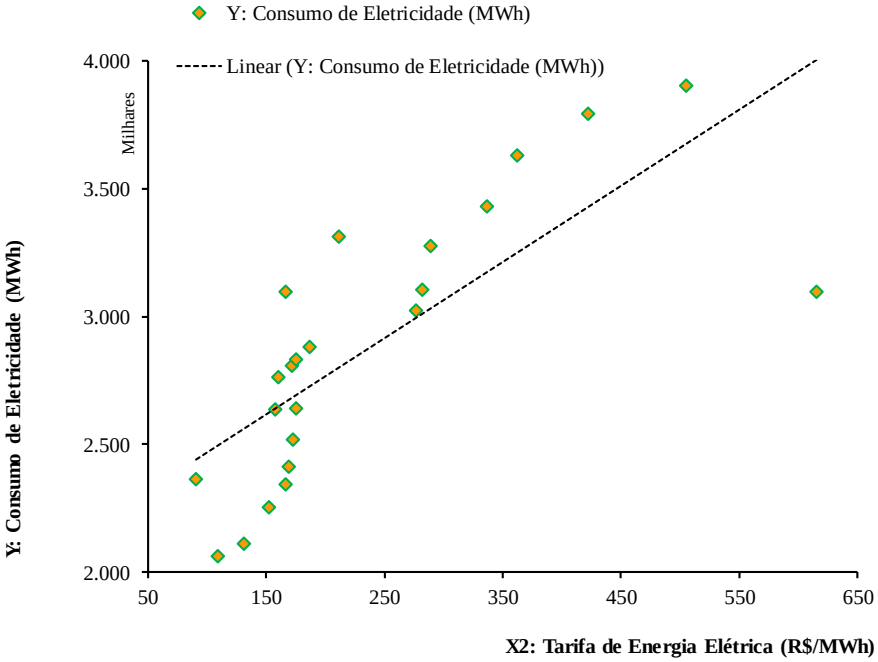
Graph 6 - Y dispersion relative to X1



Source: Prepared by the author.

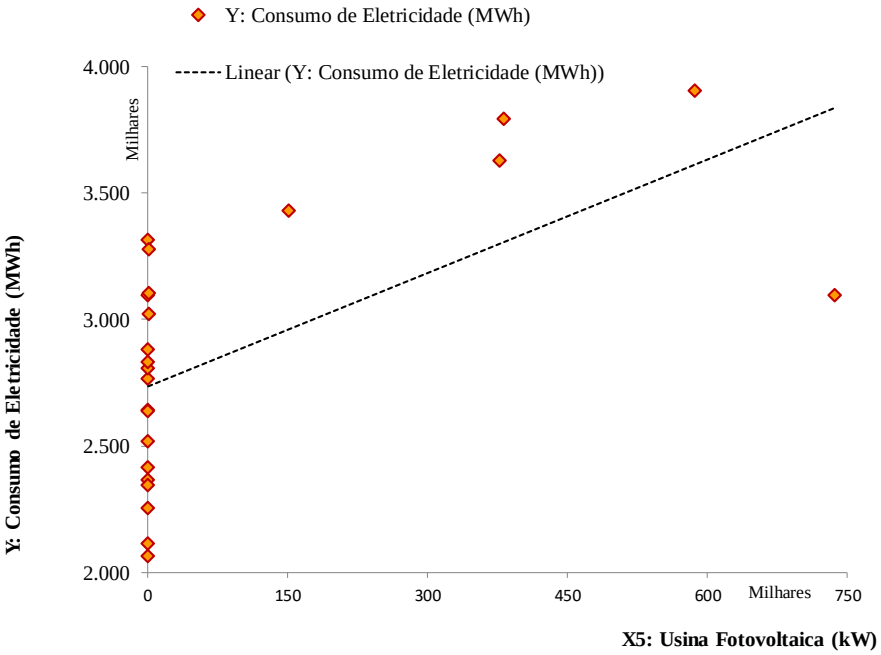
As for Graph 7, which illustrates the energy consumption of the rural sector in São Paulo in relation to the electricity tariff, and Graph 8 on the energy consumption of this sector in relation to the installed capacity of photovoltaic plants, both have a positive correlation, but with many scattered points in reference to the dotted linear trend lines (SPIEGEL; STEPHENS, 2009).

Graph 7 - Dispersion of Y with respect to X2



Source: Prepared by the author.

Graph 8 - Dispersão de Y about X5

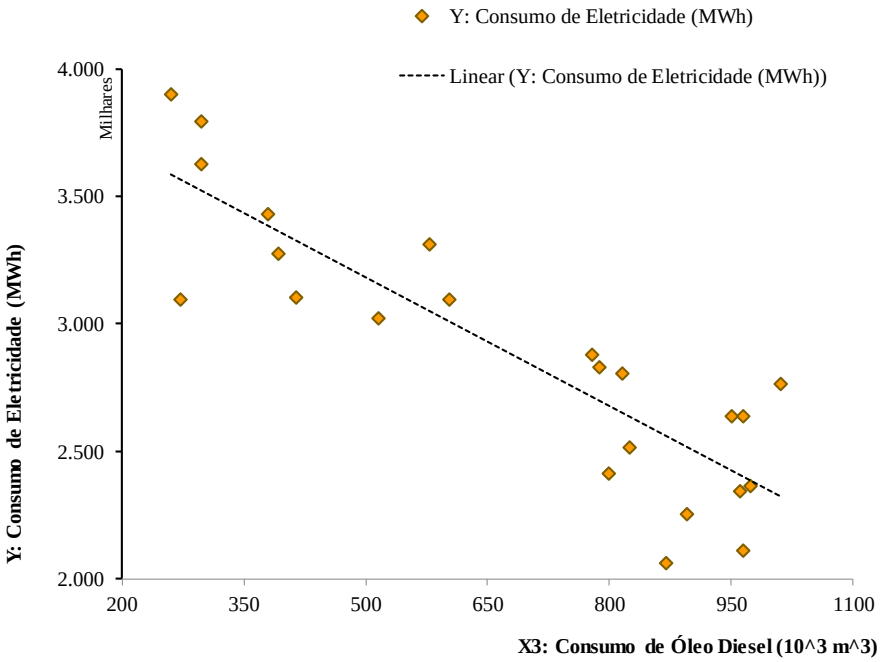


Source: Prepared by the author.

In the case of Graph 9, which deals with the consumption of electricity by the São Paulo agribusiness sector related to the consumption of diesel oil in this sector, the correlation is negative. This means that the growth of one variable occurs with the decrease of the other (SPIEGEL; STEPHENS, 2009).

There is dispersion of the dots in reference to the dotted black linear trend line.

Graph 9 - Y dispersion in reference to X3



Source: Prepared by the author.

Verifying the Existence of Multicollinearity Among the Independent Variables

Running the "Correlation" analysis tool again, on this occasion, with only the information of the independent variables X1, X2, X3 and X5, Table 7 was reproduced.

According to Gil (2021), the variable X2 has a very strong positive correlation with X5 equal to 92.34%, as it is inserted between 70% and 99%, while the values of the correlations between X2 and X3 (-87%) and between X3 and X5 (-70.53%) are characterized as very strong negative correlations because they are located between -70% and -99%.

From the above, it can be seen that X2 is strongly correlated with X3 (87%) and, mainly, with X5 (92.34%). This flaw is called Multicollinearity, which, according to Martins and Domingues (2014), presents an extra obstacle in the analysis, since the final results are masked, especially the hypothesis tests due to the influence of one independent variable on the other. In addition, this distortion also leads to the violation of the premises of the model.

Variable X1 has a substantial negative correlation with X3 (-67.90%) and a substantial positive correlation with X2 (53.20%), as observed in Table 7, as its values are in the range of -50% to -69% and 50% to 69%, respectively (GIL, 2021).

Regarding the 26.07% correlation between X1 and X5 (Table 7), Gil (2021) reports that it is a low correlation because it is between 10% and 29%.

Table 7 - Correlation between independent variables

Correlation	X1:	X2:	X3:	X5:
X1: Number of Consumers	1			
X2: Electricity Tariff (R$/MWh)	+ 0,5320	1		
X3: Diesel Oil Consumption (103 m3)	- 0,6790	- 0,8700	1	
X5: Photovoltaic Power Plant (kW)	+ 0,2607	+ 0,9234	- 0,7053	1

Source: Prepared by the author.

Pearson's Correlation Test, using *the BioStat*® software, was also used to investigate the correlation between the independent variables.

Evaluating the correlation between variables X1 and X2, Pearson's correlation coefficient, r (Pearson), with a value equal to 0.5320, was highlighted in green (Table 8). Since the coefficient is in the range 0 < r < 1, it means that it is a positive linear correlation, in which the variables change in the same direction.

Since the value of r (Pearson) is within the range of 0.50 < r < 0.69, it is possible to conclude that this is a substantial correlation. Regarding the p-value (in light blue in Table 8), it is as follows: 0.0089 < 0.05, rejecting hypothesis H0 for a risk (significance level) of 5%, as described in item 2.5.4; therefore, there are indications that the variables X1 and X2 are correlated.

Table 8 - Correlation between the number of consumers and the electricity tariff

X1	X2 (R$/MWh)	Linear Correlation Test	
199.539	90,30	n (parents)	23
216.269	109,45	r (Pearson)	+ 0,5320
224.846	130,92	(p)	0,0089
230.601	152,55		
235.127	166,19		
243.022	172,67		
253.998	175,00		
266.882	160,58		
240.722	158,03		
249.125	169,32		
253.394	171,71		
258.543	174,96		
262.243	186,66		
264.528	166,73		
266.735	211,42		
270.180	276,62		
272.649	281,68		
274.610	288,71		
276.707	336,77		
268.339	362,69		
271.668	421,97		
267.680	505,28		
252.614	615,37		

Source: Adapted by the author from the *software* BioEstat®.

Regarding the correlation between variables X1 and X3, according to the purple highlight in Table 9, the correlation coefficient r (Pearson) is 0.6790 (negative). In this case, the coefficient is in the range -1 < r < 0, showing a negative linear correlation, in which the variables change in the opposite direction.

The amount of r (Pearson) is between -0.50 < r < -0.69, showing that this is a substantial correlation. Considering the p-value (in light pink in Table 9) equal to 0.0004, where 0.0004 < 0.05, hypothesis H0 is rejected for a risk of 5%, as specified in item 2.5.4; therefore, there are indications that the variables X1 and X3 are correlated.

Table 9 - Correlation between the number of consumers and the consumption of diesel fuel

X1	X3 (103 m3)	Linear Correlation Test	
199.539	974	n (parents)	23
216.269	870	r (Pearson)	- 0,6790
224.846	965	(p)	0,0004
230.601	895		
235.127	960		
243.022	824		
253.998	950		
266.882	1.010		
240.722	965		
249.125	799		
253.394	816		
258.543	787		
262.243	779		
264.528	602		
266.735	578		
270.180	515		
272.649	414		
274.610	392		
276.707	379		
268.339	297		
271.668	297		
267.680	260		
252.614	271		

Source: Adapted by the author from the *software* BioEstat®.

Checking the correlation between variables X1 and X5, the correlation coefficient r (Pearson) of 0.2607 is highlighted in orange (Table 10). As the coefficient is in the range of 0 < r < 1, there is a positive linear correlation and, consequently, the variables convert to the same path.

The value of the coefficient is in the range of 0.10 < r < 0.29; Therefore, this is a low correlation. Table 10 highlights the p-value of 0.2294, i.e., 0.2294 > 0.05; therefore, hypothesis H0 is not rejected for a risk (significance level) of 5%, indicating that the variables X2 and X3 are not correlated.

Table 10 - Correlation between the number of consumers and the power of photovoltaic plants

X1	X5 (kW)	Linear Correlation Test	
199.539	0	n (parents)	23
216.269	0	r (Pearson)	+ 0,2607
224.846	0	(p)	0,2294
230.601	0		
235.127	0		
243.022	0		
253.998	0		
266.882	0		
240.722	0		
249.125	0		
253.394	0		
258.543	0		
262.243	0		
264.528	0		
266.735	0		
270.180	1.100		
272.649	1.100		
274.610	1.100		
276.707	151.217		
268.339	377.426		
271.668	382.426		
267.680	587.064		
252.614	736.887		

Source: Adapted by the author from the *software* BioEstat®.

The amount of the correlation coefficient r (Pearson), highlighted in marine in Table 11, is 0.8700 (negative) and is in the range -0.50 < r < -0.69, proving a very strong negative linear correlation (the variables move in opposite directions).

With a p-value (in green in Table 11) lower than 0.0001 and, therefore, less than 0.05, hypothesis H0 is rejected for a risk of 5% (detailed in item 2.5.4); That said, there is evidence that the variables X2 and X3 are correlated.

Table 11 - Correlation between electricity tariff and diesel fuel consumption

X2 (R$/MWh)	X3 (103 m3)	Linear Correlation Test	
90,30	974	n (parents)	23
109,45	870	r (Pearson)	- 0,8700
130,92	965	(p)	< 0,0001
152,55	895		
166,19	960		
172,67	824		
175,00	950		
160,58	1.010		
158,03	965		
169,32	799		
171,71	816		
174,96	787		
186,66	779		
166,73	602		
211,42	578		
276,62	515		
281,68	414		
288,71	392		
336,77	379		

362,69	297		
421,97	297		
505,28	260		
615,37	271		

Source: Adapted by the author from the *software* BioEstat®.

According to Table 12, Pearson's correlation coefficient, r (Pearson), has a value equal to 0.9234 (highlighted in red). As this value is within the range 0 < r < 1, it is concluded that it is a very strong positive linear correlation, as the coefficient is in the range between 0.70 and 0.99.

If p-value < 0.0001 (in yellow in Table 12) is less than 5%, the null hypothesis is rejected for the level of significance adopted; therefore, there are indications that the variables X2 and X5 are correlated.

Table 12 - Correlation between electricity tariff and power of photovoltaic plants

X2 (R$/MWh)	X5 (kW)	Linear Correlation Test	
90,30	0	n (parents)	23
109,45	0	r (Pearson)	+ 0,9234
130,92	0	(p)	< 0,0001
152,55	0		
166,19	0		
172,67	0		
175,00	0		
160,58	0		
158,03	0		
169,32	0		
171,71	0		
174,96	0		
186,66	0		
166,73	0		
211,42	0		
276,62	1.100		
281,68	1.100		
288,71	1.100		
336,77	151.217		
362,69	377.426		
421,97	382.426		
505,28	587.064		
615,37	736.887		

Source: Adapted by the author from the *software* BioEstat®.

Table 13, highlighted in red, shows the correlation coefficient r (Pearson) of X3 and X5 equal to 0.7053 (negative) inserted in the range: -0.70 < r < -0.99, presenting a very strong negative linear correlation (they vary in the opposite direction).

As a p-value < α, i.e., 0.02% < 5% (in blue in Table 13), the null hypothesis is rejected for the level of significance adopted (detailed in item 2.5.4); therefore, there is evidence that there is a linear correlation between them.

Table 13 - Correlation between diesel fuel consumption and the power of photovoltaic plants

X3 (103 m3)	X5 (kW)	Linear Correlation Test	
974	0	n (parents)	23
870	0	r (Pearson)	- 0,7053
965	0	(p)	0,0002
895	0		
960	0		
824	0		
950	0		
1.010	0		
965	0		
799	0		
816	0		
787	0		
779	0		
602	0		
578	0		
515	1.100		
414	1.100		
392	1.100		
379	151.217		
297	377.426		
297	382.426		
260	587.064		
271	736.887		

Source: Adapted by the author from the *software* BioEstat®.

The variable X1 (number of consumers) was the one that presented the lowest correlation (association) with the other variables, with the following correlation coefficients r (Pearson):

- +53.20% (Table 8) with X2 (electricity tariff, in R$/MWh);
- -67.90% (Table 9) with X3 (diesel fuel consumption, in 103m3);
- +26.07% (Table 10Table 10) with X5 (Photovoltaic Plant, in kW).

On the other hand, it was pointed out that the variable X2 had the highest correlations (associations) with the variables studied, especially with X3 and X5, according to the correlation coefficients r (Pearson) shown below:

- -87.00% (Table 11) with X3 (diesel fuel consumption, in 103m3);
- +92.34% (Table 12) with X5 (Photovoltaic Plant, in kW).

According to Cunha and Coelho (2014), the problem of multicollinearity refers mainly to the degree, and not to nature. The presence of correlation between the independent variables is inevitable, and it is preferable to select those with a lower degree to avoid complications in the interpretation of the results.

The ideal scenario would be to have multiple independent variables that are highly or perfectly correlated with the dependent variable, but with minimal or no correlation between them.

Therefore, it can be considered to discard the variable X2 due to its strong association with the other independent variables.

CONCLUSION

The development of this research provided considerable contributions to the achievement of the objectives proposed here.

The generation of a statistical model to estimate electricity consumption by the agricultural sector in São Paulo, which is the general objective, was achieved, as well as the specific objective, which was to identify the variables that contribute to this estimate.

Six variables were chosen to build the model, three of which were from the São Paulo agribusiness sector: the number of consumers, the electricity tariff and the consumption of diesel oil; two referring to the state of São Paulo: installed power of biomass thermal plants and photovoltaic plants and one of Brazilian agribusiness: GDP.

Of these, two variables were discarded: the installed power of the biomass thermal plants in São Paulo and the GDP of Brazilian agribusiness, because the linear regression model considered them statistically non-significant. A possible cause for the exclusion of this variable is the fact that the national GDP, and not the São Paulo GDP, of a continental country such as Brazil, which is a major exporter of *agricultural and livestock* commodities, was considered.

The other variables were part of the statistical model, but with different levels of influence. The total installed power of the photovoltaic plants in São Paulo showed a substantial influence, while the others – number of consumers, electricity tariff and consumption of diesel oil in the rural area of São Paulo – showed very strong influences on the estimate of electricity consumption in the sector studied.

It was found that the consumption of diesel fuel was the most significant variable studied, but with inverse action (negative sign in the adjusted statistical model) in the multiple linear regression, thus proving its replacement by electricity as the main energy source of the rural sector of São Paulo.

In future studies, the methodology applied here could employ the stepwise variable selection technique, also known as the stepwise method, which is a frequent approach in the sequential search. It is possible, by this method, to examine the additional impact of

each independent variable on the model, since the inclusion of each variable is evaluated before the formulation of the mathematical equation.

The present research can contribute to the understanding of elements that stimulate the growth of energy consumption in the agricultural sector of São Paulo, providing tools of analysis and future estimation to those responsible for the state's electricity sector for its permanent maintenance and expansion, thus enabling the continuity of the supply of electricity, a primordial public service, to carry out daily tasks of the rural community of São Paulo.

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ENGRAVING ON THE NET: DEMOCRATIZATION, CONTEMPORARY PRACTICES AND DISSEMINATION OF THE ART OF ENGRAVING

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ABSTRACT

The article addresses the extension project "Engraving on the Network", carried out by the Visual Arts course at the Federal University of Paraíba (UFPB), as an interdisciplinary proposal that articulates teaching, research and extension to democratize access to the artistic practice of engraving. Based on hybrid methodologies, the project promotes workshops and activities that resignify traditional engraving techniques by integrating contemporary and digital processes, consolidating itself as a space for artistic experimentation and social transformation. The results reveal the potential of engraving as a relational and critical language, capable of generating an impact both in academic training and in the communities served, evidencing the relevance of university extension in strengthening the bond between the university and society.

Keywords: Engraving. Contemporary Art. University Extension. Relational Practices. Social Transformation.

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INTRODUCTION

Engraving, as an artistic practice, occupies a unique place in the history of Brazilian art, crossing generations as a form of expression marked by technique, multiplicity and the democratization of access to art. From the beginning, when workshops such as those of the Lyceum of Arts and Crafts of Rio de Janeiro introduced engraving as an autonomous and powerful language at the beginning of the twentieth century, to the present day, this technique has asserted itself as a territory of experimentation that transits between tradition and contemporary languages. Its ability to reproduce images and, at the same time, preserve the singularity of the artistic gesture makes engraving a paradoxical medium, which reconciles the multiple and the unique, the artisanal and the technical, the local narrative and global flows. It is in this tension, between what is imprinted and what unfolds, that its strength lies as a pedagogical, artistic and political practice.

In a contemporary context marked by the centrality of images, the predominance of digital technologies and the emergence of new aesthetic paradigms, engraving continues to occupy a space of relevance by offering a counterpoint to the logic of immediate consumption and planned obsolescence. Walter Benjamin, in his famous reflection on technical reproducibility, already pointed out that engraving — as well as other forms of reproduction — dialogues profoundly with the social conditions of its production. However, in times when the "design" of human relations seems to be shaped more by virtuality than by physicality, engraving emerges as a practice that reinvents materiality. It not only registers a gesture, but creates bonds, engenders relationships and, frequently, questions the very means of its realization. This relational characteristic of engraving finds echoes in the reflections of Nicolas Bourriaud, for whom relational art is a space of exchange, a place where the work mediates encounters. Engraving, in its pedagogical and extension dimension, expands these encounters by proposing new forms of interaction between the public, the artist and the object.

The "Engraving on the Net" project is born from this spirit of intertwining. Carried out in the Visual Arts course at the Federal University of Paraíba (UFPB), and using the facilities of the Graphic Arts Laboratory (LAG) of the course, the project articulates teaching, research and extension in a proposal that is based on the democratization of artistic practice. Here, engraving is understood not only as a technique, but as a language of transformative potential, capable of crossing social, cultural and geographical barriers. The network that gives the project its name is both a metaphor and a reality: it symbolizes the connections woven between the participants — teachers, students, and communities — and is materialized in the digital format that enables the circulation and exchange of

knowledge. As Deleuze and Guattari point out, the rhizome is a structure without hierarchies, capable of multiplying without predefined limits; in an analogous way, "Engraving on the Network" proposes a pedagogical rhizome, in which learning takes place horizontally, intertwining traditional engraving techniques with contemporary technologies.

This project also responds to urgent challenges of our time. In a society marked by exclusion and inequality, university extension initiatives have the potential to make knowledge accessible, decentralizing the spaces of artistic production and including subjects who often do not have access to practices such as printmaking. It is in this perspective that "Engraving on the Net" is inserted: as an invitation to the encounter between the traditional and the contemporary, between the technical and the sensitive, between the university and society. More than a pedagogical activity, the project is a practice of resistance, reinforcing the role of public universities in the construction of a more democratic horizon for art.

However, this work goes beyond the transfer of technical knowledge. He seeks to reflect on the role of engraving in contemporary times, aligning himself with reflections on the "expanded field" of engraving, as proposed by authors such as Rosalind Krauss and Maria do Carmo Veneroso. Here, printmaking is not an end in itself, but a means of exploring new artistic and social territories. The project thus becomes a space for experimentation in which traditional printing practices are tensioned by hybrid and sustainable processes, which dialogue with the environmental and ethical demands of the 21st century.

"Engraving on the Net" is, therefore, a proposal that is inscribed in the field of visual arts as an action that transforms. It re-signifies the practice of engraving by integrating it into a collective, interdisciplinary and democratic project, reaffirming its role as a living and pulsating language. If, as Bourriaud states, relational art is defined by the creation of contexts of encounter, the project "Engraving on the Network" expands this concept by proposing an engraving that not only encounters, but also crosses, connects and transforms. It is in this movement of expansion, exchange and creation that its power as an artistic and extension practice resides.

CONTEXT AND THEORETICAL FOUNDATION

Far from a simple technical process, it has consolidated itself as a hybrid language, which unites the artisanal gesture and the possibility of reproduction, generating images capable of reaching wide and varied audiences. Its history, however, is marked by transformations and resignifications that highlight the multiple potentialities of this practice

in the Brazilian context, from the first academic experiments to the contemporary initiatives of collectives, workshops and regional studios.

At the beginning of the twentieth century, engraving was incorporated into artistic education in a systematic way by institutions such as the Liceu de Artes e Ofícios in Rio de Janeiro, under the guidance of artists such as Carlos Oswald. These early experiences established printmaking as a relevant field of artistic practice, while also highlighting the tensions between the artisanal and the industrial, the local and the global. However, it was from the 1940s onwards that engraving expanded its scope, both in teaching and in artistic production, especially with the creation of spaces dedicated to this language in different regions of Brazil. The Getúlio Vargas Foundation, for example, introduced, in 1946, a course in Advertising Design and Graphic Arts that combined a technical approach with a commitment to social issues, bringing together masters such as Axl Leskoschek and Tomás Santa Rosa, and training artists who would become national references, such as Fayga Ostrower and Edith Behring.

At the same time, collective movements such as the Engraving Clubs emerged in different regions of the country, highlighting the political and social power of this language. The Engraving Club of Porto Alegre (RS), created in 1950 by artists such as Carlos Scliar and Danúbio Gonçalves, exemplifies how engraving has become an instrument of denunciation and social transformation. Inspired by the ideals of socialist realism, these artists produced prints that portrayed the life of the worker and social inequalities, seeking to bring art to a wider audience. In dialogue with these experiences, in the Northeast, the Ateliê Coletivo do Recife (PE), founded by Abelardo da Hora in 1948, also assumed a central role in the training of artists and in the popularization of engraving as a means of social engagement and, thus, evidenced engraving as a practice interconnected to the issues of land and people.

Another significant example is found in the Guaianases Workshop, based in Olinda (PE), and frequented by artists who were the result of the Collective Atelier (João Câmara and Gilvan Samico), as well as a new generation (Delano, Tereza Costa Rêgo, Luciano Pinheiro, Gil Vicente). This initiative rescued engraving and, especially, lithography, as a fundamental artistic expression, while establishing a dialogue with contemporary movements. These artists combined the narrative of popular printmaking with modern influences, creating a synthesis that exalted tradition while projecting it to new horizons. This hybrid dimension of printmaking, which unites past and present, tradition and experimentation, remains one of its most striking characteristics.

In the theoretical sphere, engraving in Brazil has also been interpreted as part of an "expanded field", a concept developed by Rosalind Krauss to discuss how traditional artistic categories, such as sculpture, were reconfigured in the twentieth century. Applying this concept to engraving, authors such as Maria do Carmo Veneroso highlight that graphic practice is no longer limited to the matrix and paper, but it incorporates elements of photography, installation, performance and even the digital medium. Contemporary printmaking, in this sense, is inserted in a space of hybridization, where the boundaries between artistic languages are constantly challenged. These resignifications, far from weakening printmaking, reinforce its ability to adapt and dialogue with the demands of the present, something that becomes evident in projects such as "Printmaking on the Net".

Beyond the expanded field, Nicolas Bourriaud's reflections on relational aesthetics offer another interpretative key to contemporary printmaking. According to Bourriaud, relational art is one that prioritizes human and social interactions, transforming the exhibition space into a place of meeting and exchange. In the context of "Engraving on the Network", this concept acquires a pedagogical dimension, since the project not only teaches engraving techniques, but also creates collaborative networks between artists, students and communities. This relational dimension of printmaking is amplified by the use of digital technologies, which allow the processes of teaching and creation to go beyond the physical limits of the studio/laboratory, connecting different territories and audiences.

The rhizomatic dimensions of engraving, as described by Deleuze and Guattari, are also present in collective experiences and extension projects. The rhizome, with its multiple entrances and connections, serves as a metaphor for engraving as a practice that crosses disciplines, geographies and temporalities. In the Brazilian case, initiatives such as "Engraving on the Net" update this potential by creating a rhizome of teaching, production and circulation that connects traditional knowledge to contemporary practices, and local spaces to global circuits.

In this way, the historical and theoretical context of printmaking in Brazil reveals a practice in constant expansion and reinvention, which responds to both local demands and global transformations. Projects such as "Engraving on the Net" represent a continuity of these traditions while proposing new paradigms for teaching and artistic practice. At the intersection of history, technique and experimentation, engraving reaffirms its role as a singular language, capable of connecting the sensitive and the political, the individual and the collective. It is in this space of intersection that the project is inserted, rescuing the legacy of Brazilian engraving while pointing to new horizons of creation and exchange.

THE ENGRAVING ON THE NET PROJECT

The "Engraving on the Net" project was born as a response to the complex demands of democratization and access to artistic practice, incorporating the principles of university extension that consolidate the role of public institutions as transforming agents of society. Implemented in the Visual Arts course at the Federal University of Paraíba, this project articulates teaching, research and extension in a proposal that transcends the mere technical learning of engraving. It is configured as a space for artistic experimentation and strengthening the bond between the university and the communities, while exploring the potential of a graphic language deeply rooted in Brazilian artistic traditions.

The central idea of the project is based on the construction of networks – both in the symbolic and practical sense. "Engraving on the Net" proposes to weave connections between the participants, promoting a horizontal dialogue between teachers, students and members of the communities served. The metaphor of the network is especially relevant, as it reflects a rhizomatic pedagogical practice, aligned with the concept of Deleuze and Guattari, in which there are no fixed hierarchies, but multiple entry points and possibilities of intersection. By positioning printmaking as a language of interaction, the project also becomes an exercise in relational aesthetics, in the sense of Nicolas Bourriaud, promoting encounters between different agents and practices in the artistic field.

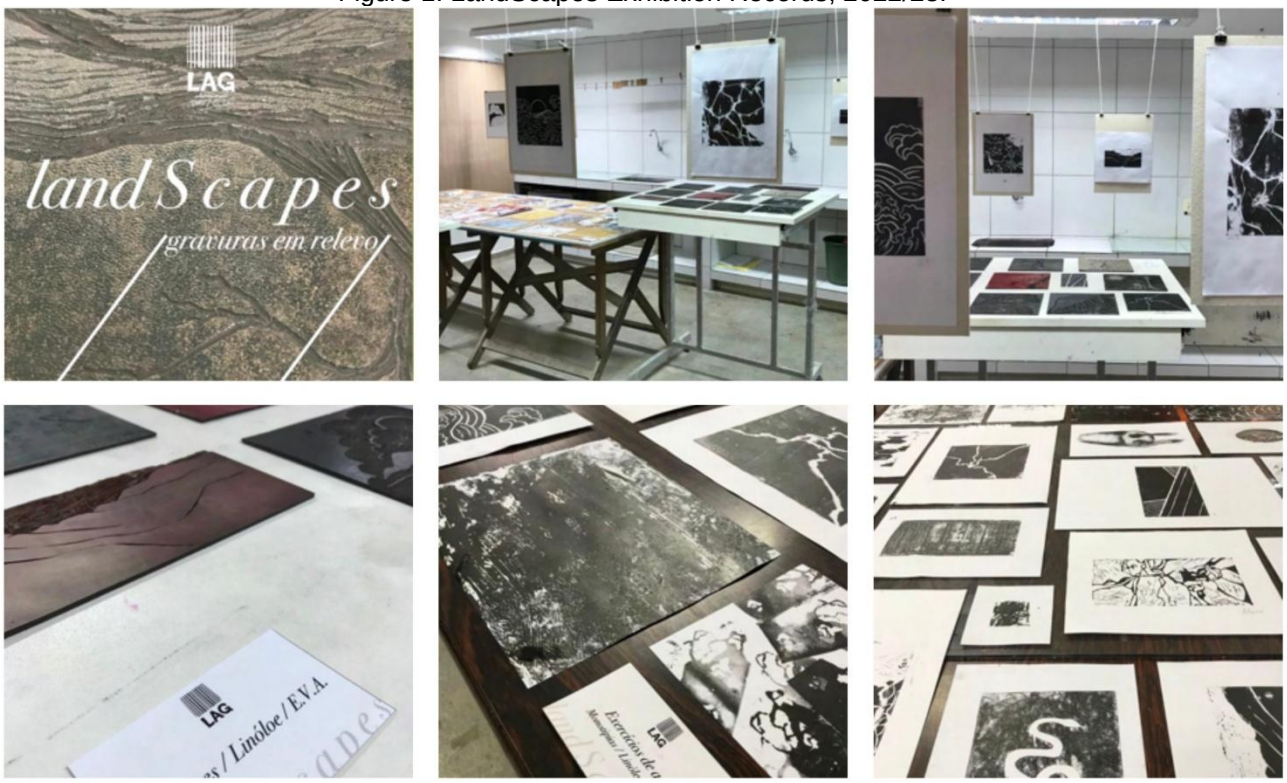
The objectives of "Gravura na Rede" go beyond technical education and involve the creation of an inclusive environment that favors collective learning and experimentation. In a scenario where social and economic barriers often hinder access to artistic practices, the project seeks to break these limitations through concrete actions that bring printmaking closer to an audience historically excluded from institutional cultural dynamics. In this sense, the workshops carried out by the project are premised on the use of accessible materials and sustainable methods, including the application of printing techniques that reduce environmental impact, such as the use of non-toxic matrices and hybrid processes that integrate experimental tools with the traditional one.

One of the most striking characteristics of the project is its methodological approach, which combines artistic practice with critical research. During classes and workshops, participants not only learn traditional techniques such as woodcut, monotype, and linocut, but are also invited to reflect on the historical and cultural meanings of these practices. The introduction of theoretical references, such as Krauss's concepts of expanded field and Veneroso's hybrid printmaking, enriches the discussions, broadening the understanding of printmaking as a field that goes beyond the studio and expands into social and digital

spaces. This methodology contributes to forming artists who not only master the technique, but also understand its potential as a critical and transformative tool.

The reach of the "Engraving on the Net" project can be observed in its ability to engage different audiences and territories. Since its implementation, the project has impacted diverse communities, connecting urban and rural realities in actions that promote the exchange of knowledge and experiences. The activities carried out range from practical workshops to exhibitions that exhibit the works produced by the participants, consolidating the role of engraving as a language that transits between the singular and the multiple. The exhibitions, in particular, serve as spaces for dialogue between artists and the public, challenging traditional contemplative logic and proposing more active interactions. In this sense, the very place of the UFPB Graphic Arts Laboratory (LAG) serves as an exhibition space; as well as the Lavandeira Gallery - equipment of the UFPB Arts Center. Here, relational engraving, in the exhibition space, as described by Bourriaud, manifests itself as an invitation to participation and the collective construction of the aesthetic experience.

Figure 1. LandScapes Exhibition Records, 2022/23.



Source: author.

One aspect that deserves to be highlighted is the social impact of the project, especially in communities that face economic and cultural vulnerabilities. By taking printmaking workshops to public schools, community centers and cultural spaces, "Printmaking on the Net" promotes access to an artistic practice that has historically been

restricted to institutional and elite spaces. In addition, professors, students and graduates of the LAG have also participated in the project's multiplication circuit, offering workshops, courses and making exhibitions in cultural spaces and equipment of the University (outside the Arts Center) and outside the university itself - such as the José Lins do Rêgo Cultural Space, the Archidy Picado Gallery, the Abelardo da Hora Memorial, The Cabo Branco Station, among others. This movement dialogues directly with historical initiatives, such as the Engraving Club of Porto Alegre and the Collective Atelier of Recife, which also sought to democratize access to engraving, using it as an instrument of social criticism and community empowerment.

Figure 2. Records of the Engraving and Drifting Exhibition, 2023.



Source: author.

In addition, the project is part of a contemporary perspective by exploring the potential of digital technologies in the practice of printmaking. Integration with technological tools allows participants to experiment with new creative processes, expanding the traditional field of printmaking. This approach not only updates artistic practice, but also makes it more inclusive, as it opens avenues for the participation of people who, for physical or geographical reasons, may not have had access to traditional techniques.

Another relevant point is the insertion of the project in the academic context, in which it works as a laboratory for the development of research on art teaching, participatory methodologies and sustainability in artistic practice. The results generated by the project —

whether in the form of works, theoretical reflections or new teaching methods — are systematically documented and shared, contributing to the consolidation of a repertoire of knowledge accessible and replicable in other institutions. With the fundamental support of two technicians who have passed public examinations and LAG employees, we have managed to have an environment of excellence for the development of what we propose. Finally, LAG's profile on the social network Instagram further expands the dissemination and dissemination of activities, results and practices in engraving, with the potential for worldwide reach. "Engraving on the Net" is, therefore, more than an extension project; It is a space of resistance and reinvention that affirms the importance of art as a collective and transformative practice. He rescues engraving as a language that connects the past to the present, the local to the global, the artisanal to the technological. By proposing an engraving that is not limited to paper, but expands into networks, spaces and relationships, the project positions itself as a model of pedagogical and artistic innovation, reaffirming the public university's commitment to building a more inclusive and creative future.

RESULTS AND DISCUSSION

The results achieved by the "Engraving on the Net" project stand out not only for the artistic production generated throughout its execution, but also for the profound social, pedagogical and aesthetic transformation promoted in the various contexts in which it was inserted. Engraving, as an artistic language with strong critical and democratic potential, has revealed itself as a powerful instrument to foster dialogues between the technical and the conceptual, the individual and the collective, the academic and the popular. The fruits of the project go beyond the works carried out; they are manifested in the expansion of knowledge networks, in the symbolic exchanges between participants and in the resignification of the role of university extension in the field of Visual Arts.

In the field of artistic production, "Gravura na Rede" has enabled the creation of a wide and diverse range of works that transit between traditional and contemporary languages. The participants, especially those from the communities served, were encouraged to experiment with techniques such as woodcut, linoleum and engraving with stamps, as well as experimental processes that incorporated collage elements, cutouts, hollow molds, Styrofoam, cardboard and carton packaging. Adjunct processes were also part of it, such as Cordel and Recycled Paper workshops. The hybridization of the methods allowed the works to reflect the complexity of the context in which they were produced, dialoguing with issues of identity, territory and memory. This plurality of results reinforces

the concept of engraving as an "expanded field", in which the traditional matrix expands to integrate new materialities and forms of expression, as argued by Veneroso (2012).

Figure 3. Records of the Exhibition Me in the World, 2024.



Source: author.

One of the most significant aspects of the workshops was the opportunity to explore printmaking as a relational practice. By abandoning the traditional logic of a work finished exclusively by the artist, many works began to incorporate interventions by the public, transforming themselves into collective narratives. Bourriaud (2009) argues that the relational work of art is constituted from the interactions it arouses, and this principle found resonance in the exhibitions held by the project. In one of the workshops held in a public school in João Pessoa, for example, engravings were purposely displayed without protective glass, allowing the public to complete them with drawings or inscriptions. The result was a lively dialogue between the participants and the works, which transcended passive contemplation and established a process of collective construction of meaning.

From a social point of view, the impact of the project was equally significant. Communities that traditionally have limited access to artistic practices have been able to not only experiment with printmaking, but also recognize themselves as part of the creative process. Often, the act of engraving the matrix has become a symbolic gesture of cultural and political appropriation, especially in contexts marked by exclusion. As pointed out by Freire (1987), education should be an act of liberation, and "Gravura na Rede" exemplified

this perspective by transforming artistic practice into a tool for empowerment. In communities (especially those beyond the students) served by the project, for example, participants created prints that depicted their daily struggles and local cultural practices. These works, later exhibited in exhibitions, served as a testament to the social dynamics at play and highlighted the role of printmaking as a means of resistance and expression.

Figure 4. LAG activity logs (ofinas).



Source: author.

The pedagogical dimension of the project also showed remarkable results. The Visual Arts students involved as workshop monitors reported significant learning that went beyond engraving techniques. They experienced the importance of intercultural dialogue, the need to adapt methodologies to different contexts, and the richness of symbolic exchanges between academic knowledge and local knowledge. The participation not only of the teacher and coordinator of the LAG, but also the engagement of the technical-administrative staff in the workshops and workshops was fundamental to expand the sense of belonging to the space. and his contributions, including as officials, were extremely salutary to the process. These experiences point to the relevance of university extension as a formative space not only for the communities served, but also for the students themselves, who develop critical, empathetic and reflective skills.

However, the results achieved were not without challenges. The implementation of the project faced logistical and structural difficulties, such as the lack of material resources

in some locations and the need to adapt the workshops to improvised spaces. These obstacles, although initially perceived as limitations, ended up stimulating the creativity of the organizers and the participants. The use of improvised matrices, such as acetate sheets and recycled wood, became a creative solution that, in addition to overcoming the obstacles, reinforced the project's commitment to sustainable practices. This adaptation reaffirms the innovative character of "Engraving on the Net", which not only proposed to teach engraving, but to reinvent it according to the contexts in which it was applied.

Another point of reflection concerns the need to consolidate the networks created by the project. If, on the one hand, the circulation of the works and the continuity of artistic interactions in traveling exhibitions demonstrated the long-range potential of the project, on the other hand, they also revealed the fragility of extension initiatives that depend on one-off funding. The institutionalization of projects such as "Engraving on the Net" thus emerges as an urgent issue to ensure the sustainability and replicability of the actions carried out.

Finally, it should be noted that the results of the project cannot be evaluated only by the tangible products generated — such as the works or exhibitions — but also by the immaterial processes that it triggered. The strengthening of the links between university and community, the expansion of the aesthetic and critical repertoire of the participants and the transformation of engraving into a space for meeting and dialogue are legacies that transcend the limits of the project. These results point to printmaking as a practice that continues to reinvent itself, reaffirming its relevance as a living and potent language in the contemporary scenario.

Thus, "Engraving on the Net" is inscribed not only as a successful extension project, but as a paradigmatic experience that reaffirms the transformative role of art. It resignifies printmaking by integrating it into collective and sustainable practices, broadening its technical and conceptual horizons while strengthening the relationships between the artistic, the pedagogical and the social. Engraving, in this context, becomes more than a means of expression; it becomes a field of interactions, a rhizome of meanings and a testimony to the possibilities that emerge when art is placed at the service of the collective.

Between 2022 and 2024 we had the following workshops and exhibitions held (both by students, employees, teachers or guest artists):

- Feelings Exhibition
- LandScapes Exhibition
- Libertas Exhibition
- Engraving and Drifting Exhibition
- Me in the World Exhibition

- Descaminhos Exhibition
- Workshop Artistic Expressions of Northeastern Popular Memory
- Artistic Stamp Workshop
- Workshop Experiments with Paper Paper
- Workshop Engraving with Tetra Pak Packages

Figure 5. LAG activity logs (ofinas).



Source: author.

FINAL CONSIDERATIONS

The "Engraving on the Network" project transcended the initial expectation of being an extension initiative focused on the teaching and practice of engraving. It revealed itself as a space of transformation that combined the technical and artistic potential of engraving with the ethical and social commitment of the public university. Engraving, in its hybrid and plural essence, became the catalyst for collective processes that resignified artistic and pedagogical practices, promoting encounters between people, territories and knowledge that would otherwise remain disconnected.

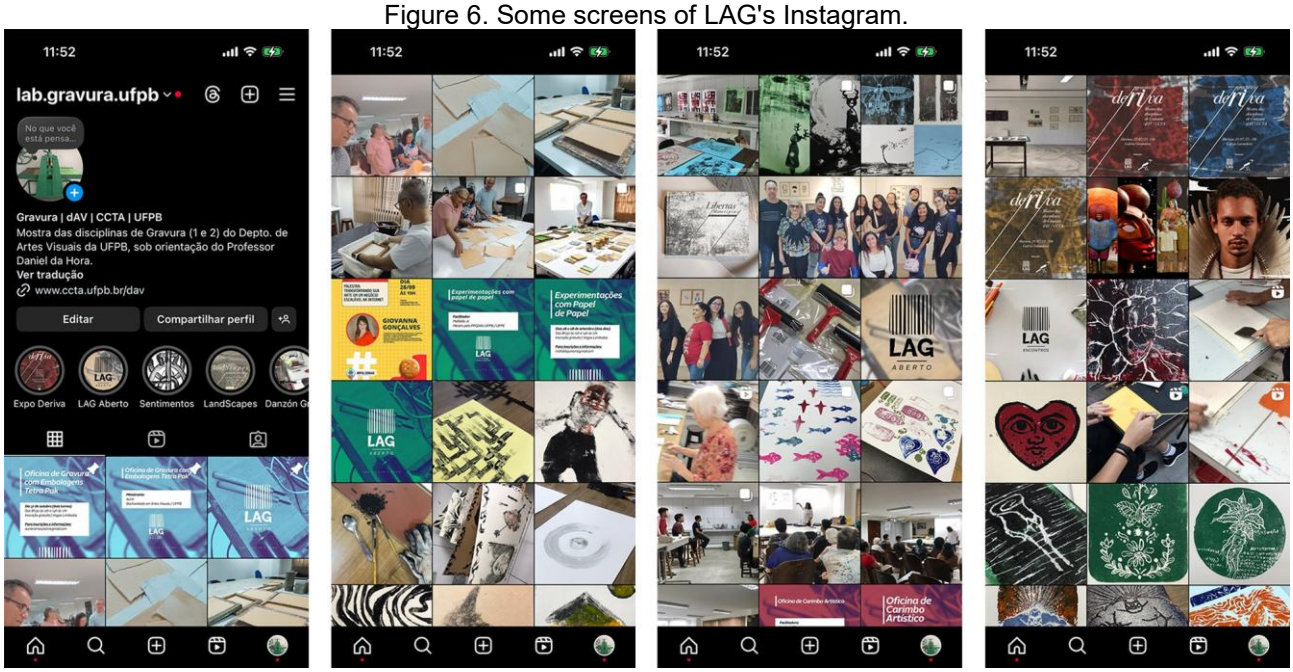
From the actions carried out, it was possible to reaffirm the importance of university extension as one of the fundamental pillars to consolidate art as a socially engaged practice. The results obtained, more than measurable, are experiential: they are in the gestures of the participants who transformed improvised matrices into meaningful works; in the learning networks that have been established between students, teachers and

communities; and in the shared spaces of creation and reflection that generated not only engravings, but also bonds of belonging and mutual recognition. In this sense, the project confirmed Paulo Freire's (1987) view of the role of education as an act of liberation, demonstrating that the teaching of art can also be an exercise of autonomy and empowerment.

The multiple languages that make up printmaking — from its traditional matrices to digital possibilities — have reaffirmed its expansive character, as discussed by Rosalind Krauss and Maria do Carmo Veneroso. The expanded field of printmaking is not only a space for technical experimentation, but also a metaphor for art's ability to cross borders and build bridges between diverse cultural contexts. This rhizomatic quality, as described by Deleuze and Guattari, found in "Engraving on the Net" a paradigmatic example. The project was woven as a living network, whose connections not only remained active during its execution, but also extended beyond it, in developments that will continue to reverberate in time and space.

However, while the project proved to be a rich and meaningful experience, it also revealed the structural challenges that still limit the continuity and expansion of initiatives like this. The lack of resources and the fragmented nature of many extension projects in Brazil expose the fragility of institutional support at a time when the role of the public university is constantly questioned. Thus, it is essential to think of policies that ensure not only the execution, but the continuity of actions such as "Engraving on the Net". Valuing art as a transformative practice needs to be associated with the strengthening of funding and support networks, ensuring that extension projects can continue to play their role in a sustainable way.

Figure 6. Some screens of LAG's Instagram.



Source: author.

The academic contribution of the project cannot be neglected either. By integrating the practice of engraving with the field of research and critical reflection, "Engraving on the Net" has consolidated itself as a space for pedagogical innovation, generating new methods and knowledge that can be replicated in other contexts. In addition, he reaffirmed the potential of printmaking as a contemporary language, capable of dialoguing with urgent issues of the present, such as sustainability, accessibility and the democratization of access to culture. The project's resilience in articulating the local and the global, the traditional and the contemporary, the technical and the conceptual demonstrates that printmaking continues to be a pulsating and relevant language, adapting to the demands of a world in constant transformation.

In the artistic sphere, the project consolidated printmaking as a space of resistance and creation, capable of challenging hegemonic narratives and including marginalized voices in the creative process. The works produced by the participants, at once singular and collective, testify to the aesthetic richness and reflective depth that emerge when artistic practice is shared. More than artifacts, these engravings are testimonies of encounters, gestures and stories that reflect the transformative power of art as a language of the sensitive and the political.

It is concluded, therefore, that "Engraving on the Net" was not just a project, but a founding experience, which reaffirms the role of art and the public university as indispensable agents in the construction of a more inclusive, creative and democratic future. It does not end in itself, but leaves as a legacy a network of connections and possibilities that will continue to be explored by those who participated in its construction. In

this sense, the project fulfills not only its educational function, but also a poetic function, insofar as it invites us to imagine and build new ways of being in the world — forms in which art is not only a practice, but a mode of resistance, bonding, and transformation. The extension action "Engraving on the Net" remains active and is a project approved and in execution by the Department of Visual Arts at UFPB, under the guidance of Professor Daniel da Hora, who is also the coordinator of the LAG.

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HUMAN TALENT: A SIGNIFICANT CONTRIBUTION TO ORGANIZATIONAL COMPETITIVENESS

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ABSTRACT

The objective of the research was to analyze the connection between human talent and competitiveness in organizations, using a document-type methodology that arises from the review and analysis of scientific references to determine that, if an organization has achieved a performance above the competition, this favors the obtaining of opportunities in the market. This competitive advantage differentiates an organization from others and allows it to ensure that its strategic objectives can be met in the medium and long term.

Keywords: Human talent. Competitiveness. Organization. Competence. Yield.

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INTRODUCTION

In a business environment characterized by globalization and rapid technological evolution, human talent is focused on being a crucial element within organizations. There is the theory of resources and it is related to capabilities and suggests that competitive advantage is based on the ability of companies to manage their most valuable resources, among which is human capital according to Barney (1991) cited by (Fong et al., 2017).

METHODOLOGY

The research was proposed under the qualitative approach (Hernández et al., 2014), corresponding to an interpretative paradigm through the bibliographic review of several articles related to the topic exposed, classifying them according to their relevance. The review has been important to develop the topic exposed and to deepen the importance of Human Talent in the organization since competitiveness requires people with capabilities, skills and a sense of belonging in organizations.

RESULTS

According to Ramírez (2023), findings are evident that make indisputable the need for a well-structured human talent management that can be aligned with organizational objectives to improve effectiveness and thus competitiveness in the complicated business world where adaptation strategies that differentiate the large organization are faced and where the following stand out:

a) Importance of Human Talent Management

Since organizations invest capital in selecting the ideal and highly updated profile in specific capabilities to achieve the objectives and for the company to obtain performance standards in the competition in the national and international markets.

b) Work Life Cycle

Each phase that the human talent department develops, from selection to evaluation, involves processes of continuous improvement and constant training that allows the worker to achieve his or her own personal goals in one of the promotions that the company offers in general.

c) Strategic Alignment

The contributions generated by labor productivity and competitiveness must be aligned with the organizational strategies and resources of companies, which suggests that

human talent management should be an integral part of strategic planning. It is important that the alignment between the company and labor competence is adequate and efficient, since the goals set by the former need to be achieved from the latter, which must be evidenced in a comprehensive process around the organization.

d) Tools & Training

A well-trained employee is efficient in the process of contributing to continuous improvement and therefore makes him very competitive in the labor market where the investment of organizations is transformed into economic fruits and an improvement strategy over his competition, achieving relevant achievements in the medium term.

This certainly complements the analysis of (Patiño & Sánchez, 2024), who point out that the work environment or healthy environment provides a sense of commitment of the worker with the employer. It is also pointed out that personal and work life must generate an environment of balance in order to perform a task; Communication is the link between all employees and the employer so that ideas, decisions, complaints and/or recommendations flow. Tied to these criteria, it is considered that professional development is important to cement a commitment to human capital, as well as the support required by the Human Talent department to prepare, train and adapt personnel to their job, where know-how will guarantee the safety and stability of the person. allowing to eliminate tense or stressful situations that harm work performance and therefore the competitiveness of the organization.

Human capital can have an economic link where two important characteristics will be evidenced, as he points out Flores et al. (2024):

a) Skills and Competencies

It is necessary to point out that human talent must have the skills to perform their tasks, which contributes to the competitiveness and productivity of the organization.

b) Staff Development

The development of people leads to the company being competitive and efficient, that is, that employees can have opportunities to grow professionally and personally, which in turn has a positive impact on productivity, since a satisfied employee usually works and takes care of his or her position more than an unsatisfied one.

In summary, human capital is a determining factor and perhaps the most important for the profitability of companies, since its development and motivation are essential to improve productivity, organizational performance and competitiveness. In this same sense, Cañarte et al. (2018), considers that the worker is fundamental for organizational competitiveness since he or she is the soul of the company and his or her productivity and growth depend directly on his or her motivation and job satisfaction.

On the other hand, competency-based management linked to current coaching at the business level are important tools in development and work performance. It is supported as a basis just as the other authors point out that there must be a favorable organizational climate, which includes motivation, participation and identification of personnel with the organization. This can be achieved through the implementation of development policies, promotion programs and evaluation of the work environment that must be prepared by specialists considering an initial evaluation of the situation as a baseline and then reviewing the results achieved.

However, job competitiveness is affected by employee job satisfaction, since if there is job satisfaction, there is a greater probability of higher job performance, two associated and widely studied variables, as stated by Cañarte et al. (2018). Therefore, it is essential for organizations to invest in the development of human talent to remain competitive in the market. In the end, human talent is the key to the competitiveness of any organization, and its development and job satisfaction are essential to achieve success in the face of growing and devouring competition.

About that Vallejo and Calderón (2023) They consider that human talent plays a crucial role for the management, quality and competitiveness of companies. Managing human talent is important with respect to the purposes of the organization, focused on exploiting the skills, abilities and competencies they acquired, producing added value to the value chain that the company has. Consequently, it must have a highly trained and motivated human talent that promotes identity with the organization and contributes to the fulfillment of the strategic objectives set. Of course, if the thinking and contribution of the workers in decision-making is considered, it grants the formalism of identification and strategically the contribution that the workers make when they are taken into account, it has been in many cases the solution that was sought for a long time and that, when there is a change in the direction from vertical to horizontal, call for the success of the company's results.

Proper human talent management allows companies to stay in the market and achieve success. This contributes with knowledge and skills at the service of a company,

with whose experience, capacity and creativity, improves institutional performance. Therefore, human talent is the greatest source of competitive advantage. To be competitive is to stay relevant and resilient in the face of competitive pressures and changes in the environment. That is, it is accepting challenges, they like to constantly stand out and exceed planned objectives.

The impact of human talent management is to optimize the capabilities of its employees, enhance soft and hard skills, improve organizational culture, job satisfaction and economic value.

According to García et al. (2024) Worker productivity can be improved when there is:

a) Identification of Competencies
b) Training and Education
c) Recruitment and Selection
d) Induction and Career Plan
e) Incentive Programs
f) Continuous Evaluation and,
g) Rewards

It is evident that organizational efficiency has been related to the management of human talent, due to the participation of workers who put on the shirt and generate value in the organization that maximizes its performance and contributes to competitiveness (Sánchez et al., 2023).

When complementing the previous paragraph, it is inevitable to put artificial intelligence in context as a current approach that involves decision-making where the employee participates, who becomes the cornerstone of the company and determines the competitiveness of the entities.

According to Recalde et al. (2023), the most relevant findings regarding human talent management in terms of organizational competitiveness can be summarized as:

a) **Crucial Link**

There is necessarily a connection that relates human talent to the competitiveness that organizations want to obtain and that can undoubtedly be reflected in the economic figures of companies.

b) Innovation

An important element in competitiveness is innovation and it is characteristic of people who work in companies to create, design, undertake and improve products and services based on the worker incentive approach.

c) Sustainable Competitive Advantage

The advantage that differentiates organizations is related to the work environment in which workers work and the level of incentives they receive and that is channeled to achieve strategic objectives by knowing that the incentive transforms them into productive, however, there are limits that must be considered in the way they are granted.

d) Identification of areas qualified as key

In every organization there are areas that link the recruitment of suitable personnel to processes that the company requires, this process is important because it selects the human talent that will be part of the protection, organizational improvement and its incentive process that can lead to the improvement of its competitiveness.

e) Innovation

Value creation is undoubtedly related to human talent, so it is important that staff have incentives and above all a career plan that allows them to grow personally and professionally capable of generating leaders who can lead the organization to be competitive in the market.

Therefore, an adequate management of human talent as a strategic element in corporate effectiveness and the achievement of a lasting competitive advantage will strengthen organizations that are ready to face the challenge of promoting human talent.

The key trends in human talent management that promote organizational growth can be summarized as: collaborative work, horizontal hierarchical structures, culturally adaptable personnel, alignment of individual and organizational interests, and ability to adapt to change (Villadiego & Calics, 2022).

These trends reflect the need for strategic human talent management that responds to a constantly evolving environment and that enhances human capital, considering it as the most valuable asset that the organization possesses.

However, organizations face several challenges in adapting to the accelerated changes in society, among which the following stand out:

a) Adapting to technology

The speed of evolution of ICT information and communication technologies in recent years requires organizations to integrate new tools and platforms to improve efficiency, effectiveness and internal communication.

b) Work flexibility

Currently, the circumstances of evolution of organizations due to external effects such as the COVID-19 pandemic, have caused staff to adapt to flexible working conditions, considering in this sense different or unusual working hours that have even promoted a type of flexible remote work relationship that is carried out from a place other than the office, such as teleworking.

c) Skills development

A process subsequent to training by approval of human talent is the acquisition of competencies and skills to face the challenges of work scenarios, where it is important to highlight that it is a sustained, necessary and mandatory process for organizations with a vision of the future and competitiveness.

d) Personal-work emotional balance

Personal factors can affect the performance of a worker and therefore influence productivity and job competitiveness, so it is essential to medically and psychologically assess the staff to rule out problems, in fact, it is even an obligation to have medical examinations before, during and after having hired personnel, as well as the assessment of cognitive characteristics and personality.

e) Incentives for teamwork

Large organizations stand out because they face challenges and problems as a team and the current trend is to abandon the individualistic work scheme and offer incentives and rewards to work teams.

f) Change management

Learning and its constant perfection entail commitments from staff to improve the organization and make it competitive if there is human talent committed to carrying out change processes that help the organization, many do not accept this challenge and must

step aside but it is necessary due to the conditions that arise in world economies. It is important to subtract the negative impacts of changes.

Therefore, these challenges demand a proactive and strategic approach to human talent management to ensure that organizations not only endure, but flourish in a dynamic and competitive environment. Regarding the most outstanding organizational trends in human talent management, it can be mentioned that some coincide with what was established in previous paragraphs and are the following:

a) Teamwork

The importance of forming interdisciplinary teams that collaborate effectively to achieve a common goal is emphasized.

b) Horizontal hierarchies

It is considered that for better coordination and achievement of objectives, flexible horizontal structures should be addressed so that an open channel is developed and the promotion of incentives.

c) Flexible workforce

As explained in previous paragraphs, it is important to change, adapt and be flexible in the workforce according to changing environments.

d) Person-company balance

Parity commitment is essential, since joint work encompasses continuous improvement and promotes the adaptation and competitiveness of organizations.

e) Ability to adapt to change

It means the adaptation of the worker to complex situations, but with fidelity.

As for knowledge, it represents a significant support to meet strategic objectives, for the benefit of the development of the company that can even influence the competitiveness and improvement of the organization (Montoya Agudelo, César Alveiro et al., 2021).

This advantage, being competitive, allows to face the different challenges faced by the organization, in selection, training and evaluation, therefore, in the organization there

are personnel who have knowledge that pushes progress and competitiveness, guided by the strategic business schemes.

According to Chávez and Vizcaíno (2017), human talent is seen as a valuable and intangible resource in organizations, mainly composed of the knowledge, capabilities, and skills that people have.

Employees have undergone a major shift by being part of the essential components that drive competitiveness. Consequently, human capital considers the intellectuality and skill that allow it to achieve efficiency (Chávez & Vizcaíno, 2017).

In this sense, managing human capital in strategic conditions for the organization means recruiting competent applicants with talents in favor of the organization that is in permanent continuous improvement. In conclusion, human talent is considered a strategic resource that contributes considerably to the competitiveness and economic value of organizations.

As there is investment in human capital, the worker can grow and be more competitive in the labor market, since the company considers a career plan based on performance and the objectives achieved (Chávez & Vizcaíno, 2017), producing commitments and visible results in the value chain, innovation and the challenge of continuously improving and being competitive in the market (Vázquez et al., 2023).

Human talent is a cardinal factor for the evolution, improvement and generation of value of the organization in its sector. This promotes long-term survival, as well as staying relevant and resilient in the face of competitive impositions from the environment.

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INDIGENOUS VOICES, ANCESTRAL KNOWLEDGE: A UNIVERSITY FESTIVAL AS A PLATFORM FOR INTERCULTURAL DIALOGUE

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ABSTRACT

The ongoing project, *Indigenous Cultural Festival at the University: Roots and Land* aims to promote the appreciation and preservation of indigenous cultural diversity, integrating academic experiences of indigenous and non-indigenous students with the cultural expressions of some indigenous communities in southeastern Pará. With objectives such as celebrating cultural manifestations, raising awareness about the contributions of indigenous peoples, promoting intercultural actions and aligning with SDGs (Sustainable Development Goals – UN) 4 and 10, the initiative highlights the importance of inclusion and intercultural dialogue in the university environment. In an Amazonian context, where indigenous identities play a central role in cultural plurality. The festival reinforces the transformative role of education in building a more equitable and sustainable society. The proposal also highlights the public university's commitment to social responsibility, inclusion and justice, aligning with the global goals of the 2030 Agenda. Thus, the festival consolidates itself as a practice that celebrates cultural richness while promoting social and academic transformation.

Keywords: Applied linguistics. Intercultural education. Cultural identity. Festival. Inclusion.

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INTRODUCTION

The public university is a plural and diverse space, which reflects the multiple cultures, knowledge and experiences that make up Brazil. In the context of the Brazilian Amazon, this diversity takes on an even more striking dimension, especially due to the significant presence of indigenous students, who bring with them a cultural heritage deeply rooted in the traditions and ways of life of their peoples.

In this scenario, the extension project *Indigenous Cultural Festival at the University: Roots and Land* emerges as a strategic initiative to value, preserve and promote indigenous cultural wealth in the academic environment. By bringing to the academic environment the ancestral knowledge of native peoples. The festival contributes to the decolonization of knowledge and to the construction of a more plural cultural identity. In addition, the event seeks to create a more inclusive and welcoming environment for indigenous students, providing them with a space where they can connect with their roots and feel part of the academic community naturally. The holding of festivals, cultural exhibitions and other activities that value indigenous cultures contributes to the visibility and strengthening of communities.

Based on the principles of inclusion, interculturality and social responsibility of the public university, the festival is not limited to being a space for cultural celebration. It aims to raise awareness in the academic and external community about the struggles, knowledge and contributions of indigenous peoples to Brazilian society. Through artistic presentations, conversation circles, exhibitions and workshops, the event fosters the recognition of indigenous cultural richness while stimulating a more equitable and respectful university coexistence.

In addition, the festival aligns with the university's commitments to the UN 2030 Agenda, especially Sustainable Development Goals (SDGs) 4 (Quality Education) and 10 (Reduction of Inequalities). In this way, the transformative role of education in the construction of a more just and inclusive society is reaffirmed.

This initiative highlights indigenous protagonism and reiterates that academic knowledge is enriched by dialoguing with traditional practices and knowledge. Thus, the festival transforms the university into a space for symbolic exchanges, strengthening both students and the community that surrounds it.

SDG 4: QUALITY EDUCATION

SDG 4 aims to ensure inclusive, equitable and quality education, promoting lifelong learning opportunities for all. In the context of the project, this means:

- Create a university environment that recognizes and values indigenous cultures as an essential part of the plurality of knowledge.
- To offer a space for indigenous students to share their traditions and knowledge, promoting intercultural learning.
- Strengthen the academic training of these students through activities that integrate their cultural identities into the university context, reducing barriers that may hinder their full development.

SDG 10: REDUCING INEQUALITIES

SDG 10 seeks to reduce inequalities within and between countries, promoting the social, economic, and political inclusion of all, regardless of origin, ethnicity, or condition. The project contributes to this objective by:

- Promote recognition of the contributions of indigenous peoples and combat prejudices and stigmas that often marginalize these groups.
- Create an inclusive space that respects and celebrates cultural diversity, ensuring that indigenous students have an active voice and are protagonists in their educational trajectories.
- Reinforce the public university's commitment to equity, offering opportunities for integration and appreciation for historically underrepresented students.

EXPECTED IMPACT ON THE PROJECT

Aligning with SDGs 4 and 10 means that the Indigenous Cultural Festival at the University: Roots and Land will not only be a celebration event, but also a strategic action to transform the university into a more equitable and respectful space. Thus, the project will contribute to the construction of an education that is truly inclusive, while strengthening the struggle to reduce the inequalities that affect indigenous peoples.

RELEVANCE OF THE PROJECT

By expanding the idea of the project, we address complementary aspects that reinforce the relevance of the project, such as the following:

Connection with Public Inclusion Policies

The project is aligned with public policies that aim to expand the access and permanence of indigenous students in higher education, recognizing that inclusion is not limited to offering vacancies, but demands strategies that promote cultural

representativeness and the appreciation of diversity. In particular, programs such as the National Education Plan (PNE) and affirmative action for indigenous people find an echo in the proposals of projects such as this festival.

In recent years, Brazil has advanced in public policies aimed at the inclusion of indigenous students in higher education, such as ethnic-racial quotas and academic permanence programs. However, these mechanisms face challenges to go beyond access and ensure effective conditions of permanence. Initiatives such as the cultural festival complement these policies by providing an environment in which indigenous students feel valued and supported. In addition, these actions reinforce the university's commitment to the democratization of education, expanding the possibilities of permanence with dignity.

Strengthening Indigenous Identity and Protagonism

By creating a space where indigenous students can share their cultural expressions, the festival contributes directly to the strengthening of their identities and their protagonism in the university environment. This protagonism is essential for the deconstruction of stereotypes and prejudices, in addition to being an opportunity for these students to resignify their presence in historically excluding spaces.

Many indigenous students face difficulties in reconciling the demands of the academic environment with their cultural and community responsibilities. The festival acts as a space for them to express their traditions and share their knowledge, enabling the resignification of their identities in a university context. This protagonism is crucial to combat prejudice and strengthen self-esteem, promoting a positive view of the role of indigenous peoples in contemporary society.

Interculturality as an Educational Principle

The interculturality proposed by the festival is not only a cultural element, but a pedagogical strategy that enriches the training of all students at the university. By promoting the exchange of knowledge between cultures, the university fulfills its function of being a dialogical and inclusive space, essential to form critical citizens committed to diversity and equity.

Interculturality goes beyond the recognition of diversity; It is about promoting respectful and enriching interactions between different cultures. In the context of the festival, it manifests itself not only in the artistic and cultural presentations, but also in the dialogues and reflections that emerge during the event. This practice contributes to an

education that values multiple perspectives and prepares students to act in a globalized world, without losing sight of the local context and cultural specificities.

Impact on the Academic and External Community

In addition to the direct impacts on indigenous students, the project contributes to raising awareness in the academic community as a whole, promoting respect and empathy in relation to cultural differences. This effect transcends the walls of the university, generating reflections and changes that can influence institutional policies, pedagogical practices and extension actions in other regions.

Relationship with Cultural Sustainability

Culture is an essential element of sustainability, especially in regions such as the Amazon, where indigenous peoples play a central role in environmental conservation and maintaining sustainable livelihoods. The festival, by giving visibility to these cultures, reinforces the idea that respect and appreciation of indigenous peoples are inseparable from the sustainable development of the region.

The preservation of indigenous cultures is essential for cultural and environmental sustainability, especially in the Amazon. Indigenous peoples not only carry ancestral knowledge about biodiversity, but also practices of sustainable coexistence with nature. The festival is an opportunity to sensitize the academic community to these connections and highlight how indigenous knowledge can contribute to innovative solutions in areas such as ecology, health, and education.

Integration of Traditional and Academic Knowledge

The project is also an opportunity to integrate traditional and academic knowledge, breaking with the dichotomy that often places this knowledge in opposition. Workshops and debates held during the festival can create bridges between these forms of knowledge, opening space for collaborative research and innovations based on ancestral wisdom.

The festival can incorporate activities such as conversation circles with indigenous leaders, workshops on native languages or demonstrations of traditional practices, promoting a genuine interaction between academic and traditional knowledge. This approach creates new possibilities for research and pedagogical practices, helping the university to become a more inclusive space for different forms of knowledge. In addition, it demonstrates that science and tradition are not competitors, but complementary.

PROPOSAL FOR DEVELOPMENTS

The Festival is not just an event, but a concrete manifestation of the university's commitment to building a more inclusive, respectful and sustainable future. Through initiatives such as this, it is reaffirmed that the university is, above all, a space to welcome, dialogue and transform realities, honoring the cultural richness of our society and projecting it as a common good for the next generations.

If the festival is to be successful, it can serve as a pilot project for other Brazilian universities. The lessons learned from its realization could be documented and shared, expanding the repercussion of this initiative. It would also be possible to create partnerships with public and private institutions to finance and continue similar programs, consolidating cultural appreciation as part of the academic routine.

In addition to strengthening access and permanence policies, the festival can dialogue directly with initiatives such as the Permanence Scholarship Program (PBP), which aims to financially support indigenous and quilombola students. The event, by integrating academic and cultural activities, can be presented as a good practice to justify the expansion of investments in these programs. In addition, it shows that the university not only welcomes indigenous students, but also recognizes their intellectual and cultural contribution as central to the construction of knowledge. Articulation with community leaders: Bring representatives of indigenous villages or communities to dialogue about how the university can become a more welcoming space and connected with indigenous realities.

Next, we will see how the idea will be based when we present the reference and then the initial methodology.

THEORETICAL FRAMEWORK

The project is part of the scope of Applied Linguistics, a field that seeks to apply the theoretical knowledge of linguistics to real situations, finding fertile ground in the urgent need to preserve indigenous languages at risk of extinction. The conservation of these languages is not only a linguistic issue, but also an ethical and cultural imperative that involves identity, ancestral knowledge and the very survival of entire communities.

INTERCULTURAL EDUCATION: A FUNDAMENTAL PILLAR

Intercultural Education, as advocated by authors such as Candau and Fleury, plays a crucial role in this process. By promoting dialogue between cultures, intercultural education values cultural linguistic diversity, deconstructing prejudices and stereotypes.

In addition, authors such as Jean-Paul Bronckart whose studies on discourse analysis and semiotic mediation are fundamental to understanding how languages are used in specific social and cultural contexts; Telma Ferraz Almeida, whose work highlights the importance of language as a tool for the construction of identities and cultural resistance; Vera Candau, who advocates for intercultural education that values diversity and promotes social justice; Reinaldo Matias Fleury, who addresses the challenges of intercultural education in Brazil, emphasizing the need for a school that respects cultural and linguistic diversity; Maria da Conceição Gomes de Oliveira Gohn, whose studies on non-formal education and social movements contribute to the understanding of the importance of community participation in the preservation of indigenous cultures, in addition to the United Nations (UN) that defends the importance of cultural and linguistic diversity and promotes policies for the preservation of indigenous languages, bring, among others, important contributions that we seek to support this project.

The preservation of cultural diversity and the appreciation of traditional knowledge in the academic sphere have been widely discussed by scholars who highlight the importance of intercultural approaches in education. According to Walsh (2009), "interculturality goes beyond a simple coexistence between different cultures; it is a critical process that seeks social justice and the recognition of the epistemologies of historically marginalized groups." In this sense, the Indigenous Cultural Festival at the University: Roots and Land is aligned with proposals that aim to integrate academic and traditional knowledge in an equitable way.

The relationship between territory and identity is central to understanding indigenous culture. For Almeida (2010), "indigenous peoples not only inhabit the land; they are part of it, and their cultural practices are deeply rooted in the territory they occupy." This aspect is fundamental to understand how indigenous identity is manifested and strengthened in spaces that respect and promote their relationship with the land, as the festival proposes. According to Haesbaert (2014), the territory is not only a physical space, but a sociocultural construct, being essential for the consolidation of identity practices.

Another relevant aspect is the importance of educational spaces that promote interculturality. According to Fleury (2003), "intercultural education is not only a path to respect diversity, but also a strategy to transform unequal power relations". The festival, by creating spaces for dialogue and cultural exchange, contributes directly to this transformation. In addition, Candau (2008) reinforces that interculturality should be understood as a guiding principle of pedagogical practices, being essential to promote respectful coexistence and equity.

In the context of Brazilian public universities, the presence of indigenous students is an important milestone of social inclusion and recognition of diversity. According to Silva (2015), "the implementation of quotas and permanence policies is a crucial step, but insufficient if there are no initiatives that promote cultural appreciation and the strengthening of indigenous identities". In this sense, the Indigenous Cultural Festival represents an innovative practice that seeks to fill this gap. Initiatives such as this are in line with the studies of Gohn (2011), which highlight the relevance of cultural projects for social inclusion and community strengthening.

In addition, the UN 2030 Agenda offers an important theoretical framework to contextualize the impact of projects like this. SDG 4, which aims to ensure inclusive and quality education, is intrinsically linked to the promotion of cultural diversity in the educational environment. According to the UN (2015), "quality education should reflect diversity and promote intercultural dialogue as a basis for building fairer and more sustainable societies". SDG 10, which seeks to reduce inequalities, emphasizes the importance of initiatives that promote the social and economic inclusion of historically marginalized groups. The festival, by aligning itself with these principles, reinforces the role of the university as an agent of social transformation and promotion of justice.

Finally, Santos (2007) points out that "the ecology of knowledges is an approach that recognizes epistemological plurality and values the dialogue between different forms of knowledge". The Indigenous Cultural Festival embodies this concept by promoting interaction between academic knowledge and indigenous traditions, creating a space for collective and inclusive learning. From this perspective, the workshops and conversation circles that will be held during the event can serve as practical examples of the integration of knowledge, demonstrating that traditional epistemologies offer significant contributions to areas such as sustainability, education, and health.

In summary, the theoretical framework that underpins the *Indigenous Cultural Festival at the University: Roots and Land* highlights the importance of educational practices that promote interculturality, value indigenous identity and contribute to a more inclusive education aligned with the Sustainable Development Goals. These initiatives not only enrich the academic environment but also strengthen the university's commitment to social justice and the transformation of society.

METHODOLOGY

The ongoing project, *Indigenous Cultural Festival at the University: Roots and Land* aims to promote the appreciation and preservation of indigenous cultural diversity,

integrating the academic experiences of indigenous and non-indigenous students with the cultural expressions of some indigenous communities in southeastern Pará, will be held in 2025 in two moments: the first moment in order to be a pilot and the second moment with the objective of becoming institutional. To achieve this goal, a participatory methodology will be adopted, with the active involvement of indigenous communities in all stages of the planning and execution of the event. In addition, innovative technologies will be used to publicize the festival and promote interaction between participants. The evaluation of the festival will be carried out through questionnaires, participant observation and analysis of quantitative and qualitative data, allowing the identification of the strengths and weaknesses of the event and proposing improvements for future editions.

Strategic planning will ensure the success of the event, so understanding the need to adapt the methodology to changes in the context, the commitment to innovation and sustainability, the importance of continuous evaluation to improve the project, are relevant aspects that will need attention.

STRATEGIC PLANNING

- **Flexibility:** the methodology must be flexible to adapt to unforeseen events, such as changes in the political, economic, or social scenario.
- **Continuous monitoring:** It is essential to keep a close eye on the development of the project and make adjustments as needed.
- **Innovation:** Constantly seek new tools and technologies to enhance the experience of attendees and increase the reach of the festival.
- **Participant feedback:** Use participant feedback to identify opportunities for improvement and adapt the schedule for future editions.

REGARDING INNOVATIONS FOR INCLUSION IN THE INDIGENOUS CULTURAL FESTIVAL AT THE UNIVERSITY: ROOTS AND LAND:

- **Virtual reality:** Create immersive experiences that allow participants to experience indigenous culture in a deep way.
- **Interactive digital platforms:** Develop online platforms to promote the festival, connect attendees, and share information about indigenous culture.
- **Partnerships with digital influencers:** Invite indigenous and non-indigenous influencers to spread the word about the festival and increase its reach.

- **Content Creation Workshops:** Offer workshops so that participants can create their own content, such as videos and podcasts, to share their experiences and knowledge.

PLANNING TO MEASURE THE IMPACT OF THE INDIGENOUS CULTURAL FESTIVAL ON THE UNIVERSITY: ROOTS AND LAND ON THE INDIGENOUS COMMUNITY AND THE ACADEMIC COMMUNITY

- **Quantitative indicators:** Use metrics such as the number of attendees, social media reach, and audience engagement to assess the impact of the festival.
- **Qualitative indicators:** Conduct satisfaction surveys, interviews, and focus groups to understand participants' perception of the festival and its impacts.
- **Long-term monitoring:** Track festival results over time to assess its lasting impact on the community.

CHALLENGES AND OVERCOMING THEM

Difficulty: Obtaining financial resources, resistance from some sectors of society, unforeseen weather events, among others.

Solutions: Seek sponsorship from companies and institutions, build partnerships with other organizations, develop a contingency plan for unforeseen events and communicate the challenges and achievements of the project in a transparent way.

IN VIEW OF THE ABOVE, WE WILL BUILD

- Planning and organization;
- Engagement of the indigenous community;
- Dissemination and mobilization;
- Realization of the Indigenous Cultural Festival at the University: Roots and Land;
- Evaluation.

FINAL CONSIDERATIONS

The idea was to present this project, initially, to the head of the Parkatejê Village, all the monitors involved and other villages in the southeast of Pará and, together, we outlined the best strategies for this pilot project to achieve its objectives.

The involvement of classes that have indigenous students is important since the project seeks to be in accordance with the needs of these students to preserve their culture. It is interesting to note that these indigenous students respond to the calls of their people in

festive activities in their villages, promptly, such as those that take place between November and December in the villages where they live.

Thus, it is a pilot project aimed at indigenous undergraduate students and non-indigenous students, at first, coordinated by a professor of Letters, a project conceived within a discipline of Introduction to Linguistic Studies whose professor observed that indigenous students felt uncomfortable at the university, since, in class, they expressed such feelings of ethnic prejudice.

We emphasize the need for colleagues, who align themselves with the project, to participate, expanding the reach of the project so that more and more indigenous students feel prestigious at their university.

Today we have more than twenty students considered volunteer monitors of this project whose first movement was the visit to the Mãe Maria Indigenous Tribe, in Bom Jesus do Tocantins, the tribe of the first member of the Gavião Group, the late Krôhôkrenhum, whose Cuia son, Akroiarere Parkatejê, took over and is in charge of the village.

The reflections on our indigenous students from the initial communication of this project have been the best possible. They comment that they are now feeling more belonging to the university environment that, at first, even here, in this part of the Amazon, they perceived a certain prejudice.

It is our intention, in addition to all the activities planned for the coordination of the project, together with the volunteer monitors, to prepare a documentary so that we can disseminate our results.

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MAP OF EMOTIONS AND ACHIEVEMENTS: STUDY OF CLINICAL UTILITY

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ABSTRACT

Background: Factors such as fun, freedom, pleasure, satisfaction, self-growth, and happiness are promoters of good mental health. The individual constantly seeks to foster their self-growth and, consequently, promote their happiness. **Objectives:** This study aimed to explore the clinical utility of a therapeutic tool, dubbed "Map of Emotions and Achievements", developed from scratch by the corresponding author, addressing the concepts of self-growth and happiness, as well as the inherent possibility of the human being to overcome, change and grow. **Methods:** A sample of 110 individuals, aged between 18 and 74 years (*M* = 41.33; *SD* = 15.32), a sociodemographic questionnaire, the instrument "*Échelle de Mesure des Manifestations du Bien-Être Psychologique*" and a semi-structured interview were applied, with the aim of understanding the clinical usefulness of the Map of Emotions and Achievements. **Results:** The results clearly demonstrate that the tool is beneficial and clinically effective, since the scores obtained at the second moment of evaluation (after using the tool) were higher than the first moment, regardless of the gender and age of the participant. **Discussion:** Promising results were found in terms of mental health, which emphasizes the importance of the concepts of self-growth and happiness. The data presented indicate that this technique is efficient in consolidating the therapeutic relationship and self-growth.

Keywords: Self-growth. Achievements. Emotions. Happiness. Autonomy.

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INTRODUCTION

"*Everyone has an inalienable right to life, liberty and the pursuit of happiness*." (Lunt, 2004)

The search for happiness is the driving force that drives the human species in its trajectory through the world (Graziano, 2005). Feeling happy is fundamental to the human experience and most people are at least mildly happy most of the time (Diener & Diener, 1996).

Happiness refers to a positive component of mental well-being, so it is generally defined as an objective state of mind, characterized by pleasure and contentment, which reflect the subject's general subjective well-being (Veenhoven, 2010). It is assumed to be a basic emotion, characterized by a positive emotional state, with feelings of well-being and pleasure associated with the perception of success and a coherent and lucid understanding of the moment (Ferraz et al., 2007). Happiness can also be defined as: "*the sum of pleasures and pains*", and for this reason, it is currently conceived as "*the global appreciation of life as a whole*" (Veenhoven, 2000).

It is important to note that there are several factors that can be related to the presence/absence of happiness, such as psychological balance, moral integrity, self-esteem, gender, age, professional, family and financial situation, and health condition (Brim, 2018).

Happiness can be divided into two views: hedonic (pleasant feelings and favorable judgments) and eudaimonic (that which is virtuous, morally correct, true to the individual, meaningful, and/or growth-producing) (Ryan & Deci, 2001; Ryff & Singer, 2008). Additionally, this concept involves several constructs, such as subjective well-being (feelings of joy and pleasure), eudaimonic well-being (sense of meaning and purpose in life) and evaluative well-being (satisfaction with life) (Steptoe, 2019). It is found that happiness also encompasses three components, that is, the most positive affect, the least negative affect, and satisfaction with life (Lyubomirsky et al., 2005). Each of these components represents an important building block of happiness, so the first two are considered emotional, reflecting more affective or hedonic aspects of happiness (Gruberet et al., 2011). While the third is mainly cognitive and is based on circumstantial evaluations of current and past life (Gruberet et al., 2011).

According to common sense, a happy man is one who is satisfied with his life. Thus, it can be said that happiness involves a large number of satisfactions and requires the satisfaction of many important desires. However, this emotion varies from individual to individual, since different people have different groups of desires (Kekes, 1982).

Due to the great importance of happiness, there are numerous studies that highlight the benefits of this emotion in terms of health. The existing literature (e.g., Koopmans et al., 2010) concluded that higher levels of happiness are related to lower mortality and morbidity.

In turn, growth encompasses a number of more specific and conceptually overlapping coding categories in the literature that enhance promoting outcomes, including positive self-transformation (Pals, 2006), intrinsic and integrative growth (Bauer et al., 2005), meaning-making (McLean & Thorne, 2003), and integrative meaning (Blagov & Singer, 2004). In this sense, self-growth translates into the desire to become the best version of oneself, every day, representing a timeless, lifelong search to improve one's own performance, through formal and informal approaches (e.g., processes and practices that involve self-reflection, evaluation and establishment of a life plan with personal and/or professional growth goals). In addition, self-growth requires the incorporation of specific and decisive actions and processes towards the desired growth results, so it needs a long-lasting practice that compels numerous behaviors, actions, and firm activities. Since all individuals are different, self-growth varies according to life goals, and context, and can be liberating and challenging (Jain et al., 2015).

Self-growth can be defined as any interpretation of a past experience, which somehow moves a person toward experiences and mindsets that enhance positive self-development and quality of life by increasing clarity of identity, sense of purpose, self-efficacy, self-knowledge, meaningful connections with others, or well-being (Vallerand & Rapaport, 2017).

Additionally, reference authors (e.g., Maslow, 1967) argue that self-growth is the ideal of human development, which involves the transformation of challenges into opportunities. Therefore, self-growth requires much greater advances in a person's current self-concept, such as openness to more innovative ways of moving towards their ideal self, being characterized by different criteria and different types of perception and states of consciousness (Jain et al., 2020).

OBJECTIVES

Based on the constructs addressed, it was essential to verify the usefulness of the "Map of Emotions and Achievements" (MEC). This therapeutic tool, developed from scratch by the first author, is a map of self-assessment and self-growth, which allows an effective understanding of the psychological processes inherent to each individual. Therefore, through the MEC, the patient shares crucial information about their love life, personal fulfillment, self-esteem and confidence, independence and autonomy, current professional

and/or problematic situation, fears, fears, dreams, habits, harmful memories, perspectives, ideas, physical health, hobbies and new learning. That said, the present study aimed to understand the clinical utility of a therapeutic tool, called ECM, addressing self-growth and self-knowledge.

METHODS

PARTICIPANTS

Participants were recruited through a convenience sample. These represent patients who, voluntarily and spontaneously, sought the clinical services of the corresponding author (psychotherapist). During the study, no refusal and/or dropout was identified by the participants, as they answered the instruments collaboratively. The present data derive from the clinical process carried out by the psychotherapist, with the due authorization of the participants and with due respect for the therapeutic relationship. The sample included 110 adults, aged between 18 and 74 years (M = 41.33, SD = 15.32).

INSTRUMENTS

Based on the objectives, a sociodemographic questionnaire, a semi-structured interview was used to understand the functionality and individual experience of the patients, the MEC and the Portuguese version of the *Échelle de Mesure des Manifestations du Bien-Être Psychologique*.

Map of Emotions and Achievements

The Map of Emotions and Achievements (MEC) came about when the corresponding author, on a visit to Moscow's metro stations, realized that, despite not understanding the Cyrillic alphabet, being without a mobile phone and the immensity of the metro, lines and intersecting stations, she could roam freely through the most beautiful stations, due to the layout of the lines and their map (see figure 1). The map of this metro has a circular line (i.e., brown line), which intercepts all the others (e.g., red line, green line, purple line), functioning, in a way, as a safe place, since it allows a permanent return to the meeting point, in case the person gets lost. This therapeutic technique emerged in analogy to this map, due to the fact that, sometimes, individuals, due to fear, habituation, accommodation, automatic thoughts of devaluation and not feeling able to explore other paths, remain for years in the same "*station*". In other words, sometimes, individuals, faced with a certain disconcerting life situation that hinders personal development, decide to stay, repeating a painful "routine" daily, in a single "station", not exploring the other lines, afraid of the

unknown and feeling comfort for the situation in which they find themselves. Therefore, in a clinical context, it is intended that the patient prepares a "map" (see figure 2), in order to organize himself mentally and explore his abilities, learning to get out of his (un)comfort zone. This technique can be applied to any population and allows the constant re-elaboration and re-editing, by the individual, in order to adjust his "map" to his reality and his needs.

Scale for Measuring Manifestations of Psychological Well-Being

Échelle de Mesure des Manifestations du Bien-Être Psychologique (ÉMMBEP; Massé et al., 1998; Portuguese version by Monteiro et al., 2012) is an instrument that aims to assess psychological well-being and consists of 25 items, distributed in six dimensions: self-esteem, balance, social involvement, sociability, control of oneself and events, and happiness (Massé et al., 1998). Responses are scored using a 5-point *Likert* scale , ranging from 1 ("*never*") to 5 ("*almost always*") (Massé et al., 1998). The higher the score obtained, the greater the psychological well-being perceived by the individual (Massé et al., 1998). According to the original study, the internal consistency for the total scale is around α = .93, and the subscales have alpha values ranging from .71 to .85 (Massé et al., 1998).

PROCEDURES

After the design of the research and in order to achieve the expected objectives (i.e., to determine the effectiveness and usefulness of the ECM), a sociodemographic questionnaire was administered, as well as a brief presentation about the research that was intended to be developed. Next, ÉMMBEP was applied as a constituent part of current practice in the clinical pathway. Subsequently, the ECM was presented and administered, and the participants who agreed to use this method are patients of the corresponding author and did so spontaneously. Nevertheless, and as in all techniques and/or consultations, the idea that non-participation or withdrawal during the process was completely free was emphasized, since the objective was only to provide the patient with more tools, not having any binding character. The technique was presented and explained individually, and the participants were instructed to create an "emotional meter"/"quality of life meter". Then, a semi-structured interview was given in order to obtain *feedback* on this new technique, and later the ÉMMBEP *was readministered* so that it was possible to understand the impact of the MEC. This process lasted about 3 to 6 months, which was considered the time needed for the patients to complete the MEC and, respectively, the cynical path. The purpose of the reassessment was to understand and listen to the clinical

evolution of the participants. It is reinforced that the present study is in accordance with the ethical principles of scientific research defined by the Order of Portuguese Psychologists and the *American Psychological Association*, with regard to the conduct of studies in human beings. In addition, the principles of the Helsinki Declaration have all been respected.

STATISTICAL ANALYSIS

Data analysis was conducted using the *Statistical Package for the Social Sciences* (SPSS; Corporation, 2013), version 26.0. In the characterization of the sample, absolute (*n*) and relative (%) frequencies were used for categorical variables and means (*M*) and standard deviations (*SD*) for continuous variables, after observation of the histograms and calculation of the asymmetry coefficient, framed in the interval [-1, 1].

Cronbach's alpha was used to evaluate internal consistency, considering $\alpha > .70$ as the cut-off point. The comparison of the dimensions of the EMMBEP between the first and second time was made with *repeated measures* ANOVAs (*MR ANOVAs*), adjusted for age and gender. The assumptions evaluated in *the MR ANOVAs* were the normality in the distribution of the residuals, with the *Kolmogorov-Smirnov* test, observation of the histogram, and also the homogeneity of variances with the *Mauchly* sphericity test. All assumptions were confirmed, and there is no need to resort to p-value *corrections*. The level of significance considered for rejection of the null hypothesis was 5%.

RESULTS

The participants were mostly female and single or married/in a de facto union. It is noteworthy that, in its majority, the individuals were employed and with a socioeconomic status of medium or higher character (see table 1).

Table 2 shows the results of the internal consistency of the six dimensions of the EMMBEP, and it is possible to confirm, through these, the good psychometric properties of the scale. Table 3 shows the results of the ÉMMBEP dimensions at moments one and two, after using the MEC. The scores of all dimensions were higher at the second evaluation moment, with statistically significant results and effect sizes greater than 0.14 (high), except in the control of self and events, where the effect size was 0.10 (moderate). The results also show that the dimension with the highest score was self-esteem, which means that the ECM presents itself as a beneficial therapeutic technique for different individuals.

Finally, it is important to highlight some of the quotes made by the participants in the semi-structured interviews: "I thought it did me good, that it helped me to fix my head"; "I thought it helped me to see without fear that I always have a return"; "I was able to realize

that there is always a way to go back"; "No matter how much I lose, I still have health"; "If my boss fires me, patience, I still have two hands"; "I got divorced and thought the world was going to end, but then I reflected that I am grateful because I have two children, I am healthy, I have two legs".

DISCUSSION

The human being's search for happiness is an old philosophical theme, revealing a perennial truth about individuals, the species and different societies (Easterlin, 2011), with man being inherently creative and possessing a natural tendency towards self-healing, self-actualization and self-growth (Stewart, 1979).

In psychology, the concept of happiness has been widely studied, taking into account different personal characteristics and aspects of positive functioning (Horbal, 2012), such as self-growth. In this sense, happiness translates into an emotional state, in which the person feels inner contentment with the circumstances of life, fulfillment, and meaning of fulfillment (Gulyas, 2010). Self-growth is defined as the desire to become the best version of oneself, every day, representing a timeless lifelong pursuit (Jain et al., 2015). Thus, if all the conditions for self-growth are met and a person uses them correctly, then there is a reason for positive emotions and judgment of life, close to the ideal, which is assumed as a backdrop for the improvement of the quality of life (Horbal, 2012).

Therefore, the notion of happiness is based on the idea that the individual is a free and autonomous being, not conditioned by an external force, sovereign of himself and responsible for his personal self-growth, which is one of the final goals of all psychological and psychotherapeutic interventions.

The statistical analysis carried out in this study presented significant values, as it was found that the MEC contributed to the increase of self-growth and happiness, that is, it promoted an increase in the manifestation of psychological well-being, because the values were higher in the second evaluation.

LIMITATIONS

The present research had some limitations, namely, the fact that the form was a bit long, which may have led to some refusals/withdrawals of response or to the bias of the answers provided; the small sample size; the fact that the sample is of convenience, which requires that precautions be taken in relation to the generalisation of the results; and the time required for data collection, which was a very time-consuming process. It is suggested that, in future studies, sampling techniques should be used that allow the generalization of

the results to the population. Despite the obstacles mentioned, it is considered that the present study is very relevant, since it allowed the elaboration of an evaluation, which dictated positive results, when the MEC was used.

CONCLUSION

It is not only physical health that produces general well-being, but also the mental component (Nunes, 2007; Seligman & Csikszentmihaly, 2000). Therefore, happiness and self-growth are positive emotions essential for good mental health. In turn, having high levels of positive emotions translates into: favoring creativity; reduction of symptoms of anxiety and depression; increased personal satisfaction; greater propensity to engage in healthy behaviors; increased social interactions; increased flexible thinking and problem-solving skills; increased ability to deal with negative emotions; greater ability to recover self-esteem after a situation of failure; greater tolerance for frustration; construction and maintenance of personal resources; better brain functioning; producing an anti-inflammatory effect in the body; strengthening intellectual, physical and social resources; correction of weaknesses; proactive approach to aging and/or increasing years with quality of life.

This method aims to contribute to the autonomy, the feeling of freedom and the power of choice of the person. The existing literature (e.g., Deci & Ryan, 2000) denotes that autonomy is one of the essential pillars for intrinsic motivation and well-being (i.e., having the freedom to make choices aligned with one's own interests and values is strongly associated with high levels of happiness and satisfaction with life).

Therefore, the MEC intends to give the patient not only a kind of map for mental organization, but, above all, the permanent capacity for choice, which is considered to promote happiness and well-being (Reis et al., 2000; Ryan et al., 2008). In this individual, emotional, family, professional, cultural, adventurous, creative, parental and, above all, human map, it is intended to emphasize life and the unique and unique path that each individual traces, despite constant change. Thus, it is intended, in this way, to enhance the individual, his autonomy, his capacity for self-reflection and, consequently, his ability to generate new possibilities, paths, decisions and behaviors. MEC translates, therefore, into a very interesting therapeutic potential, since it is effective and pleasurable for its users, and is also an auxiliary tool for the construction of the therapeutic relationship. This is another clinical tool available to patients and professionals.

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AUTHORS' CONTRIBUTION STATEMENT

All authors contributed equally to the present study.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare in relation to this work.

DATA CONFIDENTIALITY

The authors declare that they have followed the protocols regarding the publication of patient data, with regard to confidentiality and informed consent, in force at their workplace.

ETHICAL CONSIDERATIONS

This research follows the ethical principles of scientific research defined by the Order of Portuguese Psychologists and the *American Psychological Association*, regarding the conduct of studies on human beings and respects the principles of the Declaration of Helsinki.

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USE OF ARTIFICIAL INTELLIGENCE IN GLOBAL PUBLIC ADMINISTRATIONS: ADVANCES AND PERSPECTIVES

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ABSTRACT

In this article, our main objective is to describe and debate whether the evolution of AI adoption in public administrations around the world is evolving consistently. The article is based on the Neoinstitutional theory. In methodological terms, we chose to analyze, based on recent literature and reports, the advances in the implementation of AI in public management, with an emphasis on the member countries of the Organization for Economic Cooperation and Development (OECD). We seek to identify the main actions to improve the efficiency and productivity of public services through the automation of administrative processes and reduction of bureaucracy; optimisation of decision-making based on real-time data analysis and provision of personalised services to citizens. The results of the discussions and analysis of the literature and reports show that the evolution of the use of artificial intelligence in the public sector is closely related to the structuring of an intelligent government, capable of responding to society's demands for better public management. Finally, it can be argued that the prospects for the use of artificial intelligence (AI) in public administrations around the world are varied and complex, reflecting both the opportunities and challenges associated with this technology. These changes are having a positive impact on the functioning of governments, as AI creates new opportunities to improve the performance of public administration.

Keywords: Artificial intelligence. Generative artificial intelligence. Public administration. Governance. Improvement of public services.

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INTRODUCTION

The rapid and profound changes underway in the world in the last four decades, caused by the breaking of paradigms, arising from the fourth technological revolution – which involves the use of artificial intelligence (AI), are impacting the economies and public management of most countries (Matias-Pereira, 2023, p. 1). These changes are requiring initiatives to structure smart government, with a view to increasing performance in the way the nation-state operates, to improve the efficiency and productivity of public services through the automation of administrative processes and reduction of bureaucracy; optimize decision-making based on real-time data analysis and provide personalized services for citizens

Melati & Janissek-Muniz (2020), in their study on "Smart Government", mapped ten important dimensions that characterize intelligence in government: use of external data and information (D01); organizational culture for intelligence (D02); effective use of technology (Big Data; Business Intelligence) (D03); evidence-based decision (D04); interdepartmental and interorganizational collaboration (D05); innovation, co-creation, collective intelligence (D06); agility in government (D07); efficiency and effectiveness of management (D08); social engagement (D09); database organization and unification (D10).

In this effort to make government smart, the growing adoption of artificial intelligence in public administration deserves to be highlighted. The relevance of AI in the public sector has been recognized in the literature and reports of several international organizations, especially the Organization for Economic Cooperation and Development (OECD, 2024a), for its ability to face complex challenges to improve the performance of public administration.

From these initial considerations, it becomes possible to formulate the following question: *Is the adoption of artificial intelligence (AI) in global public administrations evolving consistently?*

Our main objective in this article is to describe and discuss whether the evolution of AI adoption in global public administrations is evolving consistently and contributing to the improvement of management, transparency, *accountability*, societal participation, integrity and quality of public services offered to citizens in several countries around the world.

The relevance of the topic is related to the urgency of modernizing public administration to meet the growing demands of society, using AI in a full-bodied way to improve the efficiency and productivity of public services. We assume in this article that these innovations, supported by artificial intelligence (AI), are reflecting in a beneficial way in several sensitive areas for the population.

THEORETICAL FRAMEWORK

There are several relevant theories and concepts to guide the understanding of the subject that deals with the use of artificial intelligence in public administration, with emphasis on the Neoinstitutional and Agency Theories in Public Administration. Among these theories, we will rely, in particular, on the Neoinstitutional Theory (Selznick, 1972; Meyer & Rowan, 1977, Matias-Pereira, 2018), since we understand that the institutionalization of intelligence in public management contributes to facilitate government action in the face of uncertainties present in the environment, with a view to implementing new strategies in public policies and improving decision-making.

The assumptions of institutional theory will be used to support the issue of the institutionalization of intelligence in government (Selznick, 1972). It should be noted that institutional theory has been used as a theoretical support in numerous studies in different areas in the social sciences, with emphasis on the fields of economics, sociology, political science, administration and accounting, which seek to understand the social reality within systems such as organization, family and government (Matias-Pereira, 2018).

METHODOLOGY

This study adopted a qualitative and exploratory approach, using a bibliographic review of national and international articles, as well as reports from international organizations related to the use of AI in public administration. This method is characterized by assuming that multiple perspectives and interpretations are valuable to characterize the object of study. Considering the rapid advances in the field of artificial intelligence, the literature review was conducted with a specific scope, prioritizing recent and updated articles, as well as seminal studies. The research was carried out in January 2025, using the "*Web of Science*" and "*SciELO"* databases. Sets of keywords were selected as descriptors to broaden the search for articles, including "artificial *intelligence and public administration*"; "adoption of AI in public administration"; and "cases of the use of AI in public management". The articles were selected for their relevance to the theme of the study, published in high-impact scientific journals and number of citations, prioritizing the studies of seminal authors and the most recent articles. In addition to the selected articles, searches were carried out on pages of official government websites, official government documents, reports published by multilateral organizations, especially the Organization for Economic Cooperation and Development (OECD), which work or study the topic of Artificial Intelligence.

EVOLUTION OF ARTIFICIAL INTELLIGENCE

It is relevant to recognize the importance of the seminal works of Warren McCulloch and Walter Pitts (1943, p. 113-135), who established the conceptual foundations using knowledge of brain neurons, propositional logic; and the studies of Alan Turing and John McCarthy that proposed the first fundamental concepts for the field of artificial intelligence (AI).

Turing (1950, p. 433-460), in his article "Computing Machinery and Intelligence" formulates the following question: 'I propose to consider the question: Can machines think? (see Turing test), which sought to determine whether a machine could exhibit intelligent behavior indistinguishable from that of a human. It was up to McCarthy (2007) to coin the term "artificial intelligence", and accepted as one of the main theorists responsible for the development of this area.

In the field of artificial intelligence, the contributions of Marvin Minsky; Allen Newell; Herbert Simon; Raj Reddy; Terry Winograd; Douglas Lenat; Claude Shannon; Frank Rosenblatt; John Hopfield; Geoffrey Hinton, among others.

CONCEPTS OF ARTIFICIAL INTELLIGENCE

The field of artificial intelligence (AI) is multidisciplinary, in which it seeks to develop technological solutions, systems, and machines capable of performing tasks autonomously that require human skills, such as speech recognition, learning, reasoning, problem-solving, and decision-making, and visual perception.

Artificial Intelligence (AI) is a technology deployed in a variety of sectors, with a general purpose and with the potential to improve well-being, contribute to positive sustainable global economic activity, increase innovation and productivity, and assist in current global challenges (OECD, 2024a).

An AI system is a machine-based system that, for explicit or implicit purposes, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments. Different AI systems vary *in their levels of autonomy and adaptability after deployment* (OECD, 2023).

It is relevant to remember that AI is a promising technology, which is constantly evolving. This characteristic is its main differential, which makes it difficult to define it clearly.

There are a multitude of purposes of AI, according to McCarthy (2007, p. 1-15): who maintains that "artificial intelligence is related to the use of computers to understand human intelligence, **not limited to biologically observable methods**".

It should be noted that AI has three different subareas, according to the functions it is capable of performing. The types of Artificial Intelligence, as described in Table 1, are classified into:

Table 1: Types of Artificial Intelligence

AI: Functions it is capable of disentangling
1. Limited Artificial Intelligence (ANI), also called Weak AI. It is a system designed to perform typical tasks with high performance, but limited to a specific domain or set of tasks. They are implemented with *machine learning algorithms and techniques*, such as neural networks, decision trees, *support vector machines* (SVM), and other machine learning methods. 2. Artificial General Intelligence (AGI), also identified by Strong Artificial Intelligence, refers to AI systems that have a high expertise in various areas and are capable of performing a wide range of cognitive tasks. Its fundamental characteristic is its ability to generalize and adapt to different domains and contexts. By way of comparison, while narrow AI specializes in specific tasks, AGI seeks to achieve a more comprehensive and versatile level of intelligence. However, the creation of an AGI is still in the speculative and theoretical stage, remaining a long-term goal for research and development in Artificial Intelligence. 3. Superintelligence (ASI), or, Self-Aware AI, refers to a level of intelligence that significantly surpasses human cognitive ability in all areas. This category of Self-Aware AI falls under a concept that is well advanced in the classification by level of similarity, that is, AI systems that have a self-awareness, with the ability to recognize their own existence and identity as separate entities. It should be pointed out that, the existence of self-aware AI is still a highly speculative and theoretical area.

Source: Elaborated by the author.

From the different concepts described here, it can be argued, succinctly, that AI is an area that seeks to develop systems capable of performing tasks that require human intelligence. It is a technology inserted in several sectors, whose central objective is to seek to improve well-being, contribute to stimulating economic activity, foster innovation and productivity, and assist in solving today's complex global challenges.

THE DEVELOPMENT OF GENERATIVE ARTIFICIAL INTELLIGENCE

Generative artificial intelligence is a newer area within AI. Although there is no single creator behind this discovery, many researchers and scientists have contributed to the development of generative artificial intelligence, the work of Ian Goodfellow, who designed the architecture of Generative Adversarial Networks (GANs); and Yoshua Bengio, Geoffrey Hinton, and Yann LeCun, who made contributions to the field of Deep Learning, deserves to be highlighted. which is fundamental to generative AI.

Generative artificial intelligence has been evolving rapidly in recent years, with advances in machine learning algorithms, neural networks, and natural language processing techniques. It emerges as an evolution of deep learning techniques, using

models such as Adversarial Generative Neural Networks (GANs) and Pre-trained Generative Transformers (GPT) to create original and authentic content autonomously.

Thus, generative artificial intelligence is AI systems built to create new and original content, based on the data with which they are trained. This can include generating text, images, music, programming code, and even 3D models. Unlike discriminative AI, which is used to classify and categorize data, generative AI creates new data using probabilistic models to generate outputs based on the patterns it has learned from the input data.

Generative AI is applied in financial services; healthcare and life sciences; automotive and manufacturing; telecommunications; media and entertainment; science and medicine; drug discovery; medical imaging, personalized treatment plans, and more. It makes it possible to increase productivity; efficiency in data processing; complex problem solving; cost reduction and optimization of existing systems. Among its applications are the generation of text and images; development of programs, games and simulations; interface design and fraud detection, among others. The major players in the generative AI space are OpenAI, Anthropic, Hugging Face, Inflection, and DeepSeek.

Generative AIs, such as ChatGPT or Gemini, are also trained by humans. There are also generative AIs that can create images and videos, such as the Leonardo.ai platform, and that generate music, such as Soundful. Conceptually, generative AI is any technology in the form of a platform or application that can create content, including creative content.

Generative models have been used for years in statistics to analyze numerical data. But over the past decade, they've evolved to analyze and generate more complex types of data.

It is also noted that governments around the world are making efforts to intensify the use of generative AI to **modernize public administration** and offer **better quality and accessible public services** to citizens. This statement is confirmed by the global research study called "Your Journey to a GenAI Future: A Strategic Path to Success for Government (SAS, 2024)", which reveals that governments are taking GenAI seriously, and that generative AI is expected to advance consistently by 2025, with 84% of organizations looking to implement the technology at scale.

ADOPTION OF NATIONAL ARTIFICIAL INTELLIGENCE STRATEGIES IN THE WORLD

Few countries until the year 2017 had national AI strategies. Currently, as evidenced in data from the OECD Policy Observatory. AI, there are more than 50 national and government strategic initiatives for trustworthy AI. All OECD members and partner countries in the Arab region, Africa and South America are promoting the OECD AI Principles.

Governments, as of May 2023, reported more than 930 policy initiatives in 71 jurisdictions in the OECD national policy database. OUCH. It should be noted that governments are using different governance models to manage national AI policies (OECD, 2024a).

DISCUSSION OF THE IMPORTANCE OF AI ADOPTION IN PUBLIC ADMINISTRATION

71 use cases of AI in governments around the world were identified, with applications that include formulating public policies, improving operational efficiency, and improving public services. About 70% of the countries surveyed already use AI to automate processes, analyze large volumes of data, and improve their internal operations (OECD, 2024a).

Artificial intelligence (AI) is transforming every aspect of our lives. It influences how we work and play. It promises to help solve global challenges such as climate change and access to quality medical care. However, AI also brings real challenges for governments and citizens (OECD, 2024a).

Several authors, such as Smith (2020) and Johnson & Khanna (2021) show that the integration of artificial intelligence (AI) technologies in public services has been a growing trend around the world, playing a crucial role in the transformation of sectors such as health, education, security, and resource management.

The adoption of AI in government is not just a technological trend, but a necessary evolution to address complex contemporary challenges. Governments around the world are exploring how AI can be used to optimize services, from simplifying bureaucratic processes to improving the delivery of health and education services. In addition, AI offers unprecedented capabilities in analyzing large volumes of data, allowing for more informed and strategic decision-making (Silva & Rocha, 2020).

For Public Administration in particular, Artificial Intelligence delivers elements of Science for the creation and management of Public Policies: AI helps in recognizing patterns of need of groups in the population, helps to develop programs based on empirical evidence, predict results, and analyze the effectiveness of these policies (PATEL et al., 2021).

The emergence of Artificial Intelligence for the field of Management has awakened the need to reimagine the structure and knowledge of contexts and practices of value creation, since it promotes increasingly broad interactions between different interest groups. As a result, AI is more than a change in the technological environment, as it has implications for business and social relations (CORSARO et al., 2022).

There is a growing awareness that, if used strategically and responsibly, artificial intelligence (AI) has the potential to transform how governments work, shape policy, and deliver services. Governments have various roles in relation to AI, as enablers, funders, regulators, but also as users and, in some cases, as developers. While the global debate on AI has tended to focus on the role of governments as regulators in shaping and responding to the application of AI, less attention has been paid to their responsibilities as users of AI. As governments seize the opportunities of AI for better governance and deploy solutions across a wide range of policy areas, they recognize the need to govern AI in the public sector to prevent misuse and mitigate risks. (OECD, 2024b, p. 3).

EVIDENCE OF THE ADVANTAGES OF INTEGRATING AI IN PUBLIC ADMINISTRATION

As evidenced in the literature and in the reports analyzed, the adoption of AI to support public officials, contributing to increase the efficiency, effectiveness, and quality of public services offered to the population in a significant portion of countries in the world, has been increasing rapidly. AI is used in the automation of administrative processes; data analysis; virtual assistance based on Chatbots; performance monitoring; personalization of services, with efficiency and speed, which means that AI automates repetitive tasks, reduces bureaucracy and processing time, providing quick responses to citizens.

Recent OECD reports demonstrate that OECD countries are consistently making serious efforts to better understand AI systems and use the opportunities they offer to transform the government machine. These countries have realized that the responsible use of AI can improve the performance of government administrations in several areas, as described below:

- The adoption of AI in the public sector can contribute to helping governments increase productivity with more efficient internal operations and more effective public policies.
- AI can help make the design and delivery of public policies and services more inclusive and responsive to the evolving needs of specific citizens and communities.
- AI can strengthen the accountability of governments by increasing their oversight capacity and supporting independent oversight institutions.

It should be noted that the adoption of AI in public administration is still at an early stage. Efforts need to be made to better understand how to successfully implement AI initiatives. Despite the potential benefits of AI, there are also growing concerns about the risks of a fragmented and ungoverned deployment of AI in the public sector. The public

sector has a special responsibility to implement AI in a way that minimizes harm and prioritizes the well-being of individuals and communities, especially when implementing AI in sensitive policy domains such as law enforcement, immigration control, social benefits, and fraud prevention. Governments are working to establish an environment that enables the safe, secure, and reliable development, deployment, and use of AI to maximize the benefits and address the associated challenges (OECD, 2024a: OECD, 2024b, p. 13-14)

EVIDENCE OF THE RELEVANCE OF AI ADOPTION IN PUBLIC ADMINISTRATION

Analysis of the studies and reports, highlighted below, show that there is currently numerous evidence of the relevance of the adoption of AI in public administration. In this sense, it is observed that there are several reasons to use Artificial Intelligence in Public Management. These reasons range from the concern with optimizing a process to government oversight, in which AI systems have been used to raise the level of transparency of administrative acts and the accountability of agents, detecting fraud and managing risks. These motivations tend to vary depending on the conditions and needs of each area of public administration.

Toledo & Mendonça (2023) argue that public administration, at its various levels, has recognized the potential of AI as a powerful tool to improve the quality of services offered to the population, and can be applied in several areas, from the automation of routine tasks to advanced data analysis for decision-making.

The integration of AI in public administration has been a key strategy to boost the efficiency and quality of services offered to citizens. The automation of bureaucratic processes, the increase in productivity, and the success stories observed in Brazilian public agencies highlight the importance and practical benefits of this technology. However, to fully take advantage of AI, it is crucial that public servants are adequately prepared to deal with digital changes and maximize the potential of these innovations in public administration (Toledo & Mendonça 2023).

Governments have started to rely on artificial intelligence (AI) to deliver services and improve operations, but the use of it to help shape policy is just beginning. The foundations of policymaking—specifically, the ability to sense patterns of need, develop evidence-based programs, forecast outcomes, and analyze effectiveness—fall squarely in AI's sweet spot. AI will not replace policymakers, but it can enable a comprehensive, faster, and more rigorous approach to policymaking in the short run. More broadly, AI can deliver on the promise of a government of the future that is more responsive and leaves no one behind (Patel, et al., 2021).

The study of AI in the public sphere is vital due to its potential to increase operational efficiency, reduce costs, and improve the quality of decisions through data analysis. AI can provide innovative solutions to persistent challenges in critical sectors such as healthcare, education, security, and resource management, which are often constrained by limited resources and increasing demands. Therefore, its exploitation transcends opportunity, becoming a pressing need for the Brazilian public administration (Barros & Oliveira, 2021a).

In the healthcare industry, AI has been instrumental in the development of advanced and personalized diagnostic systems. For example, in Finland, AI systems are used to analyze large volumes of patient data, allowing for faster and more accurate diagnoses of diseases such as cancer and diabetes. Additionally, AI-based virtual assistants have been implemented to manage appointments and optimize patient flow in hospitals, improving operational efficiency (Nielsen, 2021).

In education, AI has transformed the way content is delivered and personalized to meet the individual needs of students. In Singapore, adaptive learning platforms that use AI to analyze student performance are being employed to provide personalized educational resources, significantly increasing student engagement and achievement (Chen & Wong, 2020).

In the field of public safety, AI has been a valuable tool for data analysis and surveillance. In the UK, AI-based facial recognition systems are used to identify individuals in public places and assist in crime prevention, demonstrating the technology's ability to improve public safety without compromising efficiency (Taylor, 2022).

The adoption and implementation of Artificial Intelligence (AI) technologies in the Brazilian public sector represent a crucial step towards the modernization and optimization of the services offered to citizens. While AI offers significant promise for transformation in essential areas such as health, education, and security, it also faces a set of challenges that are critical to the success of its integration into the country's public administrations (Ferreira & Oliveira, 2022).

Countries such as the United States, Japan, and Germany have extensively implemented AI to optimize public services, from health to safety and education. For example, in the United States, AI is utilized to improve energy efficiency in public buildings, while in Japan, AI technologies assist in the monitoring and care of the elderly, a critical service given the aging population (Smith, 2020; Yamada, 2021).

The most significant challenges of AI are related to transparency and accountability, ethical issues due to data protection concerns, and the possibility of excluding certain groups of citizens from the benefits of technology. The third significant challenge is related

to costs and resources, as the development and implementation of AI solutions require significant investments and advanced technological resources. Another particularly important aspect resulting from the analysis is the need to develop regulations and standards to govern the use of AI in public administration and ensure compliance with existing laws. (Androniceanu, 2024, p. 115-116)

It is also relevant, in order to increase the level of consistency of the study, to cite some successful *cases*, which highlight the relevance of the adoption of AI in public administration in the world.

Table 2. Use of Artificial Intelligence in Public Administration

AI: Success stories around the world
1. United Kingdom – AI for Health Care Improvement. Project: The UK's National Health Service (NHS) uses AI to analyze large volumes of medical data, aiding in the early diagnosis of diseases such as cancer. Results: AI has helped identify cancer cases in early stages, increasing survival rates and reducing costs with more complex treatments.
2. Singapore – AI for Urban Management and Demand Forecasting. Project: The government uses AI to optimize urban management, including traffic monitoring, forecasting public transport demands, and predictive infrastructure maintenance. Results: AI helped reduce congestion, improve the efficiency of public transportation, and anticipate infrastructure problems before they become critical.
3. United States – California. AI for Fraud Prevention in Social Benefits. Project: The state of California has implemented AI systems to detect fraud in social benefit programs such as Medicaid and SNAP (Supplemental Nutrition Assistance Program). Results: AI identified suspicious patterns and significantly reduced fraud cases, saving the government millions of dollars.
4. United States – Fire Prevention in Pittsburgh. Project: Pittsburgh Fire Department uses an AI system to predict fire hazards. Results: Using historical data, the system identifies areas with the highest probability of incidents, allowing you to prioritize safety inspections.
5. Estonia – AI for Digital Public Services. Project: Estonia uses AI to automate public services, such as tax processing and civil records management. Results: Automation has reduced document processing time and increased the efficiency of public services, making the country one of the most digital in the world.
6. Canada – AI for Emergency Management. Project: The government uses AI to predict and manage natural disasters, such as floods and wildfires. Results: AI has helped predict extreme weather events with greater accuracy, allowing for faster and more effective responses, as well as reducing damage and associated costs.
7. India - AI for Identification of Beneficiaries of Social Programs. Project: The government has deployed AI systems to identify and verify beneficiaries of social programs, such as food and fuel subsidies. Results: AI helped reduce errors and fraud, ensuring that benefits reached the right people and saving public resources.
8. France – AI for Citizen Service. Project: Chatbot Albert, an AI tool that helps public servants answer frequently asked questions from citizens. Results: The system processes more than 16 million requests, allowing servers to focus on more complex issues.
9. South Korea – AI for Public Policy. Project: Uses AI to formulate more effective public policies. Results: The government analyzes real-time data to make decisions related to medical quarantines and geolocation of health incidents, allowing for rapid responses to health emergencies and efficient allocation of resources.
10. Finland - AuroraAI Platform. Project: AuroraAI platform, which connects various digital public services, offering personalized and proactive services to citizens. Results: Through *machine learning*, the system identifies user needs and delivers the right services at the right time, improving the citizen experience and saving public resources.
11. Japan – AI for Aging Population. Project: Japan uses AI to address the challenges of an aging population, such as managing health care and forecasting demands for social services. Results: AI has helped to optimize the allocation of health resources and predict future needs, improving the quality of life of the elderly.

12. Brazil - AI for Public Bidding Analysis. Project: The Federal Court of Accounts (TCU) in Brazil uses AI to analyze public bidding processes and identify irregularities. Results: AI has helped detect suspicious patterns and increase transparency and efficiency in public procurement.

Source: Elaborated by the author.

It is important to note that, although artificial intelligence represents one of the main technological advances of the twenty-first century, its application in the public sector is still in its early stages. In turn, global experience has shown that the responsible use of AI systems in Public Administration can transform the provision of services. AI has the potential to improve efficiency, transparency, cost reduction, and ultimately provide input for more effective and inclusive public policies.

The perceptions made explicit in the various studies and reports cited here, that AI is having a transformative impact on public administration, stems from the realization that AI technologies are capable of optimizing administrative processes, improving the efficiency of services, and performing predictive analytics that allow increasing the effectiveness of public policies. The most promising segments of AI adoption in public administration are related to the areas of automation of citizen services and services, allocation of resources more efficiently and effectively, public procurement; health, education and security management, aimed at improving the fulfillment of the population's demands.

CONCLUSIONS

The studies, reports and success stories presented in this study highlight the transformative potential of AI in the public sector. Despite the potential benefits of AI, it is important to note that there are concerns about the possible risks of implementing AI in a fractional and disorganized way in the public sector.

It can be seen that artificial intelligence (AI) has been playing a very relevant role in world society, having a beneficial impact on numerous aspects of people's lives. The analyses and data on display also show that the use of AI in global public administrations is varied and complex, reflecting both the opportunities and challenges related to this technology.

Thus, it can be argued that the adoption of AI contributes to the generation of positive results, creating new opportunities for public administration, notably to improve the efficiency, effectiveness, and productivity of public services, carried out through the automation of administrative processes and reduction of bureaucracy; helps in decision-making, based on access to real-time data and the provision of personalised services for citizens.

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EDUCATION COUNCILS IN BRAZIL

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ABSTRACT

This article seeks to understand the historical process that gave rise to the Management Councils and in particular the Education Councils in Brazil, what are their competencies and mechanisms of operation as an organ that makes up the structure of Brazilian education at the national, state and municipal levels. In this sense, the main objective of this article is to understand the history of education councils, since their legislative creation, with regard to their creation, attributions and normative competences as an organ of social control focused on educational matters. Our corpus of analysis is based mainly on Dallari (2013), Gohn (2011, 2019), Teixeira (2001) Bordignon (2009 and 2020), the Federal Constitution of 1988, the Law of Guidelines and Bases of National Education – 1996. The methodological path adopted will be through bibliographic research on the management councils and in particular the education councils at the national, state and municipal levels. Based on this bibliographic research, we seek to understand how the Councils of Education were created and what their competencies are in the Brazilian educational scenario.

Keywords: Management Councils. Education Councils. Law 9394/96.

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INTRODUCTION

Studying a Municipal Council of Education can involve a series of problems that help to understand the organization of Brazilian education, its functioning and the impacts that these can promote in the educational scenario.

In this sense, the proposed article asks: the origin of management councils and how were the national, state and municipal councils created and what is their relevance to education?

For a better understanding, the article is divided into 02 (two) parts that we believe bring a better understanding of the theme involved.

In the first part, we will start with a brief historical analysis of the Management Councils that were created in Brazil in certain periods, having the competence to collaborate in the improvement of the management of companies and public agencies created by the federated entities[3]. In the second part, we move on to a brief historical account of the Education Councils that were created in Brazil, from the imperial period, through the republican period to the present moment, with the promulgation of the 1988 Constitution and the Law of Guidelines and Bases of Brazilian Education – 9394/96.

This article does not limit the studies on the Councils, nor does it present itself as the only guide to be applied under the theme, it is only a simple initial contribution to understand the creation process and the competencies inherent to this body of the Educational System.

MANAGEMENT COUNCILS AND POLITICAL PARTICIPATION

POLITICS AND PARTICIPATION

In the search to understand the origin of management councils[4] in Brazil, it is necessary to clarify the meaning of the terms "politics" and "participation" and how they were constructed, modified and interpreted throughout the history of humanity.

Thus, by appropriating the understanding of these meanings, we will be able to understand how social actors have been interfering in the existing power structures and following these steps, we can understand how management councils emerged, their role in the organization of state power or as a representative entity of organized civil society.

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[3] Article 18. The political-administrative organization of the Federative Republic of Brazil comprises the Union, the States, the Federal District and the Municipalities, all autonomous, under the terms of this Constitution. (Brazilian Constitution of 1988)

[4] These are channels of participation that articulate representatives of the population and members of the state public power
in practices that concern the management of public goods. They constitute, at the beginning of the new millennium, the main novelty in terms of public policies. (GOHN, 2011, p. 07)

In the words of the renowned writer and jurist Dalmo de Abreu Dallari:

> To establish a basic concept of politics, a convenient way is to look for the origin of the word, that is, where it came from and in what sense it was used in the beginning. Such verification demonstrates that this word has Greek origin and was used by several philosophers and writers of ancient Greece, and the work called "politics", written by Aristotle, a philosopher who lived in Athens in the fourth century before the Christian era, is especially important for understanding its primitive meaning. (DALLARI, 2013, p.08)

Therefore, as the author emphasizes, the concept of the term politics dates back to Greek origins, the cradle of Western civilizations and where the first human efforts to build a more rational view of the world originated through the first philosophical reflections, where a small privileged portion of the population began to reflect on the best way for the population to organize itself as a society in the polis (Greek city-states) and what was the most appropriate way for the participation of all those considered citizens at the time (a minority portion of the city's residents).

In this sense, the conception of the term "politics" in that historical context was understood as a way for the citizen (or small elite) to behave and act in front of their peers, always seeking the common good for society and participating in all important decisions of the *polis*, the term politics being understood as the art of good government for all free citizens.

Dallari goes further to explain that the term has other meanings that will change according to the historical period of human life, because even in ancient Greece the practical meaning of the word "politics" made sense only to a small portion of the population that was considered truly free. He emphasizes the need to define a more specific concept for the term and proposes that: *"politics is the combination of the actions of individuals and human groups, directing them to a common end.*[5]*"*

Therefore, according to him, since the human being is someone who needs to live collectively from the moment he is born until his death, it is understood that all human actions that aim at the common good of the whole society are configured as political action in its strict sense, as it requires community, participatory and decision-making life.

Despite this understanding that living in a communitarian, participatory and egalitarian way is the result of a whole historical trajectory that led to a civilized life, this in practice did not materialize in a pacified way in human societies because human autonomy to live together on an equal footing generates a series of conflicting situations.

[5] DALLARI, 2013, p.10

Although all human beings are born equal as human beings, each one has their individuality and when this individuality overlaps with a minimum of collective vision, conflicts begin to arise that can lead to great confrontations between human groups and civilizations, although human differences are a fact, such a statement should be seen as natural in a universe of free human beings.

Thus, throughout human history, the term political participation, as a practical action in the organization of society, was restricted to small groups that held power at certain historical moments and exercised this right to participate, while the other layers of the population were suppressed by the power emanating from them.

In this way, we can observe in the Middle Ages the center of power emanating from the clergy, kings and nobles. With the advent of the Enlightenment in the seventeenth and eighteenth centuries, the center of power migrated to the bourgeoisie and only later in the industrial period with the emergence of the proletariat did the central power begin to be claimed by the factory workers who began to organize and fight for various rights, including the right to choose their representatives.

In Brazilian history, unfortunately, the form of centralized organization adopted since its colonization has evolved little, reaching the nineteenth century still as an eminently rural country that did not allow the participation of the population in government decisions.

Although the right of participation is being adopted in most Western countries, in the case of Brazil, the form of centralized organization adopted since its colonization has evolved little, reaching the nineteenth century still as an eminently rural country that did not allow the participation of the population in government decisions.

In this line, Brazil, unfortunately, adopted an antagonistic position by creating mechanisms to impose limits on political participation and access to the electoral process, such as giving permission to the right to vote and be voted for only to those who held a certain economic value or who were literate, two highly excluding mechanisms at the time because they denied this right to a large part of the Brazilian people. (Dallari, 2013)

As already noted:

> In Brazil, the Constitution itself said that the illiterate had no political rights, and as a result a large part of the population could not participate in decisions, despite working, paying taxes and being obliged to respect the laws made in their name (DALLARI, 2013, p.31)

Thus, in Brazil there was an immense delay in recognizing the importance of the right to political participation by the majority of society, and this right was recognized very late.

It is important to remember that the conceptual change, the appropriation of the meaning of the term and the experience of individuals with regard to political participation were fundamental factors to redefine the meaning of political participation as the right of all citizens to be involved in state decisions that would influence everyone's lives:

> Thus, from the nineteenth century onwards, the Constitutions were modified, affirming equal rights and enshrining the system called "universal suffrage", which means the system in which everyone has the right to vote. (DALLARI, 2013, p.29)

It is worth remembering that this right was not a state concession, this only occurred due to incessant struggles for the right to participate (including involving wars, revolts and a lot of blood spilled), so that the people had their right legally guaranteed and yet to materialize in fact to all Brazilian citizens.

MANAGEMENT COUNCILS IN BRAZIL

With the improvement of the meaning of the term participation as a political action where all citizens have the right to influence the course of society, several representative bodies of society emerged, including the Management Councils, whose origins are linked to the active participation of civil society and the process of redemocratization in Brazil. Maria da Glória Gohn explains the differences between the councils:

> Basically, we can differentiate three types of councils in the Brazilian scenario of the twentieth century, in the period under consideration: those created by the Executive government itself, to mediate its relations with popular movements and organizations; the popular ones, built by popular movements or organized sectors of civil society in their negotiation relations with the public power; and those institutionalized with the possibility of participating in the management of public affairs created by laws originating from the Legislative Branch, which arose after pressures and demands from civil society. (GOHN, 2019, p. 73)

As Gohn points out, the councils created by the executive branch aim to facilitate communication and mediation between the government and popular movements and civil society organizations. They were usually composed of government representatives and selected members of these movements and organizations. Its primary function was to provide a space for dialogue and negotiation of public policy and issues of mutual interest.

Popular councils, on the other hand, come from popular movements. They were formed from the bottom up, by the very base of civil society, as a result of a demand for more direct participation in government decisions. They represented the specific interests of these movements and organized sectors, and often focused on social, economic, and political issues that directly affected the communities involved. Its function was to serve as a

collective voice for these groups, influencing public policies and promoting citizen participation.

Councils institutionalized by public management were established by laws originating from the Legislative Branch in response to pressures and demands from civil society for a more formal and institutionalized participation in the management of public affairs. They had a defined legal status and specific powers, often including the ability to propose policies, monitor the implementation of government programs, and even participate in decision-making in certain situations. They were usually composed of representatives of the government, civil society and sometimes other relevant sectors, and operated within structures and procedures established by law.

In fact, the first organizations in the form of councils emerged within the numerous Brazilian social movements, as entities claiming rights. In this sense:

> For us, from the outset, it is necessary to demarcate our understanding of what social movements are: we see them as collective social actions of a sociopolitical and cultural nature that enable different ways for the population to organize and express its demands. (GOHN, 2019, p. 13)

In this context, it should be noted that for more than two decades, Brazil was under a military dictatorship (1964-1985) that restricted the spaces for civil society to participate. With the redemocratization, which began in the late 1970s, the country became involved in struggles for freedom, direct elections and the return to democracy.

In this scenario in the 1970s and 1980s, organized civil society played a fundamental role in the organization of Social Movements and Popular Councils, which emerged linked to various organized sectors of civil society and represented the wishes of the population.

Although timidly, these organizations provided the return of civil society participation in discussions on the public agenda that gradually allowed the redemocratization of the country and greater insertion in participatory spaces.

In this mishap, the management councils emerged as part of this search for active participation in the management and formulation of public policies, although, in their origin, they did not have the power to deliberate or supervise state actions, they acted as important channels to give voice to the various social segments that were banned by the military regime, opening space for the broad participation of society in discussions about the direction of the nation.

According to Gohn:

> It should also be noted that, from the 1990s onwards, some movements articulated with the new institutionalized forms of social participation present in the numerous

> councils, especially the Management Councils, the Councils of Municipal representatives, the Participatory Budget Councils, etc. (GOHN, 2019, p. 07-08)

It is important to note that the Management Councils gained prominence from the participatory experience of the popular councils, which timidly provided the return of the participation of civil society in the processes of discussion on public policies.

These councils were directly linked to the various organized sectors of society, representing the desires of the population that, although they did not have the power to deliberate or supervise state actions, were important channels of vindication and pressure on the dictatorial government that exercised power.

This organization, in the form of councils, contributed to the advancement of redemocratization, opening new channels and participatory and democratic spaces that enabled the insertion and continuity of public policy management councils as spaces instituted from the Federal Constitution of 1988, as we observed:

> The legislation in force in Brazil has recommended, since 1996, that in order to receive resources destined to social areas, municipalities must create their management councils. This explains why most municipal councils emerged after that date (in 1988, of the 1,167 existing councils in the areas of education, social assistance and health, 488 of them had been created after 1997; 305 between 1994-1996; and only 73 before 1991). (GOHN, 2019, p. 92)

Thus, the existence of councils became a legal requirement, with the main objective of bringing society closer to the state and influencing its actions according to social demands, functioning as places of participation, exchange of experiences and inspection, allowing society to cover and collaborate with programs, projects and actions related to the implementation and effectiveness of public policies.

Most management councils are made up of legitimate people representing different interest groups that may be related to areas such as the environment, education, health, sports, culture and other topics.

Given the diversity of subjects, there are several councils in different spheres of government, such as the National Council for the Environment (Conama), the State Council for the Environment (Consema), the Health Councils, the Education Councils (at the national, state and municipal levels, etc.

With regard to their functions and roles, the management councils have deliberative, advisory and normative functions, they opine and advise the executive branch (federal, state or municipal) on issues related to their specific area of activity and serve as forums for decision-making, being essential for the formulation, control and evaluation of public policies.

Thus, in a republican society such as the Brazilian one, management councils are fundamental pieces for a more democratic and effective public management, allowing society to actively participate in the construction and monitoring of public policies.

THE MANAGEMENT COUNCILS AS A MANIFESTATION OF LOCAL GOVERNMENT

For much of the history of social organizations, the concept of power has been central to understanding the dynamics of a society's organization, however, the understanding of this power has evolved over time, especially with regard to its distribution and exercise.

In this context, the Management Councils emerge as a significant expression of the representation of local power, establishing new forms of participation and governance, related to public policies.

Thus, to fully understand the role of the Management Councils as local authorities, it is crucial to situate them within a broader historical and conceptual context:

> In the 1990s, local power began to be seen, on the one hand, as the political-administrative headquarters of the municipal government, more specifically of its urban headquarters (see Barbosa, 2000, p. 56), and on the other, due to the new forms of popular participation and organization, as a driver of social changes. (GOHN, 2019, p. 38)

In this scenario, from the final decades of the twentieth century, social movements and academics began to question traditional power structures, calling for greater citizen participation in public management processes. Thus, the Management Councils emerge, as an institutionalized response to these demands for participatory democracy. In this sense, the rise of these councils is intrinsically linked to the democratization of public space and the search for more inclusive forms of decision-making in the territorial location in which they operated.

In this way, the origin, creation and structuring of the councils have an intrinsic relationship with the concept of modern democracy, where citizens can express themselves and be present in matters that concern the decisions that will affect the life of society.

In this context of changes, the Management Councils emerge, then, as institutional mechanisms aimed at enabling this participation, representing an attempt to overcome the traditional model of political representation based on another perspective of public governance.

In the words of Teixeira (2001) in "The Local and the Global, limits and challenges of citizen participation", the management councils emerge as an organ of dialogue between civil society and the public power in this way:

> In the search for a new institutionality, citizens from voluntary associations are assigned some roles proper to agents of administrative power. This is the case of the "management councils" – created in all spheres of government, as instances of dialogue and proposition and also, formally, deliberative and management instances – even if, due to little experience, the difficulty of articulation between the components and the lack of resources and technical training, they still do not effectively assume their functions. (2001. p. 138)

This view highlights the relevance of these councils as instruments for the empowerment of local communities, which are placed in a central sphere of participatory decision-making, despite their inexperience in this form of collective participation.

According to Gonh (2011, p. 88), in Management Councils and Sociopolitical Participation, *"Management councils are important because they are the result of popular struggles and demands and pressures from civil society for the redemocratization of the country"*. This perspective highlights the importance of these councils as mechanisms for empowering citizens.

One of the most striking characteristics of the Management Councils is their ability to promote the active participation of citizens in the management of local affairs, because by bringing together representatives of the community, civil society organizations and public authorities, these councils become privileged spaces for deliberation and policy formulation. This deliberative dynamic is fundamental for the legitimacy of the decisions made and for the construction of consensus that represents the interests of the community as a whole.

> In fact, management councils have been the great novelty in public policies over the years. With an interinstitutional character, they have the role of mediating instrument in the relationship between society and the State and are inscribed in the 1988 Constitution, and in other laws of the country, as instruments of expression, representation and participation of the population. (GOHN, 2019, p. 88)

In this period of expanded participation of civil society, the management councils occupy a privileged space in the sense of involving and influencing the local community in the construction of an alternative for public management, with broad participation of the community in the search for solutions to its problems. Thus, according to Elenaldo Teixeira:

> Thus, in the 70s and 80s, in many countries of Europe and Latin America, a civil society was formed formed by a network of associations, movements, groups and institutions, which, articulated with liberal sectors and business leaders, actively participated in the process of redemocratization of these countries (2001. p. 24)

This historical approach emphasizes the importance of effective citizen participation in defining the direction of local public policies. *"Therefore, the role of the councils focuses*

on the discussion on public management strategies in general and on the character of public policies themselves in particular (see Caccia-Bava and Borja, 2000)"[6]

In Brazil, the emergence of management councils reflects a movement to seek greater citizen participation in public management, especially after the redemocratization of the country in the 1980s. Inspired by international experiences and driven by demands for democratization and decentralization of power, the Management Councils have become an important tool to expand the participation of civil society in decisions that affect their communities.

An emblematic example of this movement is the National Health Council (CNS), created in 1937 and reformulated in 1990 by the Organic Health Law (Law 8.142/90). The CNS is a space for social participation in the formulation of health policies, with representation of users, workers and managers of the Unified Health System (SUS). Through the CNS, citizens have the opportunity to actively contribute to the definition of the guidelines and priorities of the Brazilian health system.

In this sense, the deliberative dynamics of the Management Councils plays a crucial role in building consensus and in the search for solutions that meet collective needs, through dialogue and negotiation, the members of these councils seek to overcome divergences and build public policies that are more legitimized by society as a whole.

However, the management councils are born from the claims for rights and in order to establish themselves as legitimate representatives of local power they must work towards overcoming the very composition of the representativeness of their members, and must be constituted by as many social segments as possible, and must respond to the desires of their represented in the geographical space in which they operate. This implies not only ensuring the diversity of representation in the councils, but also promoting mechanisms that allow the effective inclusion of the different social groups that operate in the locality, aiming to strengthen the distribution of power.

In this sense, according to Gohn, *"The management councils are important because they are the result of popular struggles and demands, of pressures from civil society for the redemocratization of the country.* (GOHN, 2011, p. 88). This suggests the importance of considering not only the characteristics of the internal organization of the councils, but also the historical conditions that influence their performance, as well as the importance of the quality of the deliberative process in the councils to ensure the legitimacy of the decisions made.

[6] GOHN, 2011, p. 94

The perspectives for the Management Councils as local power are closely linked to the political and social contexts in which they are inserted. In times of institutional instability or disenchantment with traditional forms of government, these councils can emerge as important spaces of resistance and popular articulation.

In addition, the Management Councils are present in several areas, such as social assistance, environment, culture and urban development, contributing to the expansion of democratic participation and the construction of more inclusive and effective policies. An example is the Municipal Council for Urban Development (CMDU), which works to define guidelines for the planning and management of urban space, involving civil society in decision-making on issues such as housing, mobility and land use.

Another relevant example is the Municipal Councils of Education, established in several Brazilian municipalities to ensure the participation of the community in the elaboration and supervision of local educational policies. These councils are composed of representatives of parents, teachers, students, school managers and other segments of civil society, enabling the discussion and monitoring of educational issues at the municipal level.

These examples demonstrate how the Management Councils have been an important tool to strengthen local power in Brazil, promoting citizen participation and the collective construction of more democratic and effective public policies.

However, despite the progress achieved, it is important to recognize that there are still significant challenges to be faced, so that they can effectively exercise their role as local authorities and ensure the effective implementation of the decisions made by the collegiate. Issues such as the representativeness of participants, transparency in decisions and the ability to implement deliberated policies continue to be the subject of debate and reflection.

In view of the search for answers to these questions and the need for their constant improvement, the Management Councils represent a concrete manifestation of local power, capable of transforming the relations between State and society and promoting greater democratization of public management. However, its full potential will only be reached through a continuous process of improvement and consolidation of participatory and deliberative practices, as highlighted by several authors who have focused on the subject.

THE EDUCATION COUNCILS IN BRAZIL

EDUCATION COUNCILS

In this second part of the article, we will address the Brazilian educational system in a generic way, with a main focus on the education councils, from their origins, through their competencies acquired throughout the history of Brazilian education.

Thus we begin our approach with Bordignon's famous thought, when he states that:

> Currently, the councils are present, as forms of collective deliberation, in all areas of government and in large companies, assuming different nature and composition according to the area in which they operate and the function they perform. It can be said that we live in the era of councils in the management of public organizations and, to a large extent, also in the private sector. (BORDIGNON, 2020, p. 29)

Based on the words of this renowned author, we situate this study on the origins and competencies of the education councils based on the premise that they are bodies that guide and regulate the Brazilian educational system, being a great challenge for scholars who focus on this theme, because the history of education and the "pedagogical doing" constitute a path in constant construction, consolidation and restructuring in an eternal journey in search of the so-called educational quality.

In this sense, when it comes to education, regardless of whether it is the responsibility of the national, state or municipal entity, we need to reflect on whether it moves in the appropriate direction of offering an education that really meets the needs of the Brazilian population and understands their desires, because we live in a moment of construction of new social paradigms and education is not inert in the face of this fact.

To give meaning and collaborate in the construction of national education, the Brazilian State creates institutions that can bring civil society to the discussion in this arduous and difficult task of educating society, seeking to influence and instill in the social environment a level of civility in terms of educational development for all citizens.

Thus, one of the collaborative bodies that works with the education systems are the so-called Education Councils, which are an integral part of the composition of the Brazilian educational structure. Thus, according to CURY, *Apud* BORDIGNON (2020, p.22):

> In general, created by law or by Decree, with established functions, the council was and is a public body, because it belongs to a public entity or person with a legal framework.

Thus, in order to understand the organization of Brazilian education, there is an urgent need to understand the historical path taken by the education councils, as well as to investigate and understand their attributions and competencies in the organization of national education.

In this sense, it is essential to build a historical retrospective of the origin of the Education Councils in the country, justifying the importance and relevance of this theme in a context that only happens with the participation of organized civil society in the claim for rights and access to decision-making spaces only allowed in a democratic perspective.

In this way, the fact of the manifestation of a desire for citizen participation stands out, acting in the sense of increasingly demanding from the state that the people also participate in decision-making that will influence the lives of Brazilians.

> In this context, many movements have been fighting for the conquest of participation rights and in the educational area, they also aim to guarantee access and the right to education for all. That said, observing the setbacks that followed the actions of the pioneers in the 1930s, we identified in the 1950s and 1960s, the performance of the education and popular culture movements as resistance to attempts to exclude the population in the democratization of access to culture and education. (Map of Municipal Councils of Education in Brazil, 2013, p. 56)

It should be noted that the struggles waged by organized civil society resulted in the opening for social participation in state institutions, among them, the education councils that were being formed in Brazil as advisory bodies of the state, focused on educational matters.

It is precisely in this historical moment of participatory euphoria[7], coming from the publication of the Manifesto of the Pioneers of New Education of 1932, [8] that the Brazilian state begins to open spaces for popular participation to give its opinion on certain issues of interest to the entire Brazilian nation.

In this scenario of openness to participation, the Councils of Education originate, and the first Municipal Councils of Education were created in the State of Bahia, as representatives of the municipalities in the consultation on matters of an educational nature.

It is imperative to note that the idea of an education council was still present in colonial Brazil, but it emerged without popular participation, since it did not originate from the participation of the population, nor was it the result of a claim by civil society, something practically non-existent at the time (at that historical moment only a small number of Brazilians had the reading competence). This emerged more as a state action that felt the need to have an advisory body.

Historically, the formulation of an Education Council within the Brazilian public administration goes back, curiously, to the same state of Bahia, in 1842, still in the imperial period. Subsequently, in 1846, the Chamber of Deputies proposed the creation of a general council responsible for public instruction, however, it was only in 1911 that a Superior Council of Education was actually created (Decree No. 8,659/1911). Later, the National Council of Education was created, through Decree No. 16.782-A/1925) and, in 1931, the

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[7] A state that is characterized by the appearance of joy, optimism, cheerfulness, etc., but which does not correspond to the reality of the life of the person who claims to experience them. Excessive and momentary joy; exaltation. (Online Portuguese Dictionary)

[8] A movement promoted by a group of Brazilian intellectuals during the period of the Getúlio Vargas government that they understood education as one of the main instruments for the organization of Brazilian society, criticized the absence of a national policy for the promotion of public, secular and free education. (Map of Municipal Councils of Education in Brazil, 2013, p. 42)

National Council of Education. Then, Law 4.024/1961 created the Federal Council of Education and the State Councils of Education. The Municipal Councils of Education were only created in 1971 by Law No. 5692.

Based on this report, we identified that in 1995, the Federal Council of Education was again renamed as the National Council of Education (CNE) by Law No. 9,131/95, which is a collegiate body that to date is part of the structure of the Ministry of Education, with the competence to collaborate with the Ministry in the formulation of the National Education Policy. as well as exercising normative, deliberative and advisory duties to the Ministry.

As the winds of redemocratization blew again after two decades of military rule, the Constitution of the Republic of 1988 (Citizen Constitution) was promulgated and, after long internal struggles, spaces began to emerge for a wide range of participation of organized civil society in the nation's decision-making process, with the present action of all social strata.

Like so:

> As we enter the twenty-first century, when the social transformations driven in the last century, from the struggles of organized civil society movements for the redemocratization of the Brazilian State, after a long period of dictatorships (Dictatorship of the Estado Novo of 1937 and the Military Coup of 1964); the councils (especially the education councils) began to play a leading role in greater political action, considering that society began to occupy different spaces of representation and participation with the State, intending it to build agendas that incorporated its propositions. (Map of Municipal Councils of Education in Brazil, 2013, p. 40)

In this new scenario, the Education Councils emerged in a participatory way in the period of redemocratization of the Brazilian state, in which civil society expanded its space for political participation in state decisions related to education.

In this perspective, the creation of a council that would meet the needs of democratic coexistence became necessary, as long as its construction occurs in a participatory way involving the maximum number of social actors, entities and institutions, whether public or private, where the form of choosing its representatives must occur in a republican and democratic vision, pillars of the democratic rule of law enshrined in the heart of the Magna Carta of the Republic.

THE MUNICIPAL COUNCILS OF EDUCATION

Historically, the Municipal Councils of Education were legally mentioned in law 5692/71, however, for didactic purposes, it is worth mentioning that:

> [...] it is worth remembering that the concern with the Municipal Councils of Education (CMEs) dates back to the beginning of the twentieth century, when the renovating proposals that led to the Manifesto of the Pioneers of 1932 emerged. Anísio Teixeira, when director of Public Instruction in Bahia in 1924-1928, carried out an educational reform that maintained the autonomy of the CMEs, according to article 71 of the Education Law of the State of Bahia [...] (Map of Municipal Councils of Education in Brazil, 2013, p. 96)

As mentioned, in fact the legal emergence of the Municipal Councils of Education in Brazil occurred with the publication of the aforementioned law 5692 of 1971 (revoked by law 9394/96), which in its article 71, provided as follows:

> Article 71. The State Councils of Education may delegate part of their attributions to Councils of Education that are organized in the Municipalities where there are conditions for doing so.

According to this legal provision, the municipal councils to be created by the municipalities needed the states of the federation, through their Councils of Education, to delegate this power to the municipalities, transferring part of their attributions to this body that should be created by the federated entity, provided that it undertook to provide the necessary conditions for its operation by providing human resources, material and financial and pay for their maintenance.

Following the facts presented, it is worth mentioning that on the date of publication of the law in 1971, the creation of Municipal Councils of Education was authorized (even if by delegation of competence), however, there was a period of Brazilian political turbulence because the nation was under the aegis of the military dictatorship that limited the political participation of civil society, imposing limits on their own creation.

What was seen in practice was a small number of municipalities creating their councils, particularly in the southern region of the Brazilian state, while in most of the municipalities that make up the federation it was expressed only in the letter of the law, without effective organization or interest of the municipalities in its creation, due in part to the fact that the country lives under an authoritarian regime.

As already mentioned, paradoxically, the municipal councils were legally born in a historical moment of impossibility of democratic participation, because with the coup of 1964, the military took power and began to reorganize the Brazilian educational system in a

technicist[9] and technocratic perspective[10], in which the technicians of the Ministry of Education organized the educational packages to be applied, without consulting civil society that was silenced and prevented from any participation in the higher spheres of decisions regarding education. Only after the political reopening and the departure of the military governments from power did civil society begin to rebuild a participatory life with decision-making power. From this perspective, the Constitution of the Republic of 1988, in its article 211, § 1 to 6, defines the organization of the Brazilian educational system:

> **Article 211.** The Union, the States, the Federal District and the Municipalities shall organize their education systems in collaboration.
> **Paragraph 1 -** The Union shall organize the federal education system and that of the Territories, shall finance the federal public educational institutions and shall exercise, in educational matters, a redistributive and supplementary function, in order to ensure equalization of educational opportunities and a minimum standard of quality of education through technical and financial assistance to the States, the Federal District and the Municipalities; (Text given by Constitutional Amendment No. 14, of 1996)
> **Paragraph 2 -** The Municipalities shall act primarily in elementary education and early childhood education. (Text given by Constitutional Amendment No. 14, of 1996)
> **Paragraph 3 -** The States and the Federal District shall act primarily in elementary and secondary education. (Included by Constitutional Amendment No. 14, of 1996)
> **Paragraph 4 -** In the organization of their education systems, the Union, the States, the Federal District and the Municipalities shall define forms of collaboration, in order to ensure the universalization, quality and equity of compulsory education. (Text given by Constitutional Amendment No. 108, of 2020)
> **Paragraph 5 -** Public basic education shall give priority to regular education. (Included by Constitutional Amendment No. 53, of 2006)
> **Paragraph 6 -** The Union, the States, the Federal District and the Municipalities shall exercise redistributive action in relation to their schools. (Included by Constitutional Amendment No. 108, of 2020)

In this context, constitutional legislators already advised that municipal federated entities should follow the path of building autonomous education systems, providing municipal citizens with the education under their responsibility. The obligation of the municipalities is so strong in the Magna Carta that this is reinforced by article 30, item VI, when it states that among the competences of the municipalities is the duty to: *"maintain, with the technical and financial cooperation of the Union and the State, early childhood education and elementary education programs;"* (Text of EC 53/2006)

[9] Technical education was a model implemented after the military coup of 1964, with law 5692/71 that transformed the current high school (former 2nd degree) into technical courses, thus: "At the 2nd degree level, terminality refers to the professional qualification of the secondary degree, which provides the essential conditions of technical training capable of ensuring the exercise of a profession, even if the student intends to continue his studies at a higher level. " ROMANELLI, 1986. p. 239.

[10] The term technocrat comes from technicism: "Thus, we can say that it was after 1964, with the implementation of the military dictatorship, that technocracy began to take shape within the scope of the Brazilian State. In other words, the military regime excelled in establishing a government of technicians, based on the centralizing strengthening of the Executive Branch and guiding administrative actions by the primacy of the economic over political and social aspects.

The thesis of the autonomy of the municipalities, with regard to education, enshrined in the 1988 Constitution, is expanded with the approval of the 1996 Law of Guidelines and Bases of National Education:

> To this end, in addition to article 211 ("The Union, the States and the Municipalities shall organize their education systems in a collaborative regime "), the LDB will have sought support in items I and II of article 30 of the Federal Constitution, which affirm, respectively, the competence of the municipalities to "legislate on a matter of local interest" and "supplement federal and state legislation, as appropriate". Thus, item III of article 11 of the LDB stipulates that it is up to municipalities to "issue complementary standards for their education system." (SAVIANI, 2017, p. 18)

In this sense, the approved regulatory frameworks for education sought to restructure the Brazilian educational system, with regulations that aimed to decentralize the responsibility for education and give greater participatory autonomy to municipal entities, enabling the creation of their own education systems, since the Magna Carta of Education, Law 9394/96, made clear in its article 11 the competences of the municipalities, *in verbis*:

> Article 11. The Municipalities shall be responsible for:
> I – organize, maintain and develop the official bodies and institutions of its education systems, integrating them with the educational policies and plans of the Union and the States;
> II – to exercise redistributive action in relation to their schools;
> III – to issue complementary standards for their education system;
> IV – authorize, accredit and supervise the establishments of its education system;
> V – offer early childhood education in daycare centers and preschools, and, with priority, elementary education, allowing them to work at other levels of education only when the needs of their area of competence are fully met and with resources above the minimum percentages linked by the Federal Constitution to the maintenance and development of education.
> Sole Paragraph. The Municipalities may also choose to integrate into the state education system or compose a basic education system with it.

Once the legal framework present in the LDB is established, with the country experiencing a scenario of democratic coexistence, the municipal education councils are created as state bodies through municipal legislation with the fulcrum in article 11, item I and competencies defined in item III of the LDB, and must be consulted on matters of an educational nature.

In the words of Moaci Alves Carneiro:

> III – By constituting its own system (cf. Art. 8), each Municipality enjoys autonomy to organize, put into operation, monitor and evaluate its education bodies and its network of schools. It is imagined that, from now on, each Brazilian Municipality will be able to constitute its Municipal Council of Education with the responsibility of legislating within the scope of its jurisdiction, preserving the limits of federal and state legislation. This is what the legislator means when it talks about *lowering complementary rules*. (CARNEIRO, 2012, p. 146)

The Councils become bodies belonging to the municipal education system, being composed of various sectors of organized civil society and the public power, having as a principle this diversity of composition, following a democratic and participatory perspective of society.

In this line, after the publication of the above-mentioned law, the Ministry of Education[11] and the State Councils of Education began to encourage the creation of municipal education systems and their respective councils, including, before the entry into force of Law 9394/96, the National Union of Municipal Councils of Education – UNCME[12], an entity representing the municipal councils of education, developing actions with the objective of fostering the articulation and training of councilors such as the Pro-Council[13] , for example.

Thus, although BORDIGNON, (2013, p. 85) tells us that: "*initially, it is necessary to remember that there is no federal legislation determining the creation of municipal education councils",* most Brazilian municipalities created their education councils following the necessary legal procedure.

Thus, a Council of Education (in this case the Municipal Council of Education) to be created requires a Municipal Law of initiative of the executive power, approved by the City Council, sanctioned by the Municipal Mayor and published by the official press of the municipality or state, indicating the moment of its entry into force.

After these initial steps, with the law already approved and sanctioned by the municipal executive power, elections are held as determined by law.

Thus, the creation of a truly participatory Education Council is initially permeated by the principle of democratic experience that will support its performance in the education system that has shelter provided for in Article 211 of the Constitution of the Republic of

[11] The Ministry of Education is a federal government agency that deals with the national education policy with regard to basic education (kindergarten, elementary and secondary education), higher education, youth and adult education, special education, professional and distance learning, educational research and university extension. https://www.gov.br/mec/pt-br.

[12] The National Union of Municipal Councils of Education – UNCME, an entity representing the Municipal Councils of Education, created in 1992 and organized in all Brazilian states with the purpose of encouraging and guiding the creation and functioning of these collegiate bodies, bases its actions on the principles of universalization of the right to education, democratic management of educational policy and social inclusion.

[13] Program that encourages the creation of new municipal education councils, the strengthening of existing ones and the participation of civil society in the evaluation, definition and inspection of educational policies, among other actions. The main objective of the Pro-Council is to qualify managers and technicians of the municipal departments of education and representatives of civil society so that they act in relation to school pedagogical action, legislation and mechanisms for financing, transfer and control of the use of education funds. The municipal councils of education play the role of articulators and mediators of educational demands with municipal managers and perform normative, consultative, mobilizing and supervisory functions. SOURCE: Ministry of Education.

1988, when it indicates that: *"Union, the States, the Federal District and the municipalities shall organize, in a collaborative regime, their education systems".*

In this sense, almost thirty-five years after the approval of the 1988 Magna Carta, it already guided the federated entities towards the construction and structuring of education systems in a collaborative format, but with autonomy among themselves.

Subsequently, the 1996 Law of Guidelines and Bases of National Education brought regulations to the municipal education systems, but indicating the need for harmonious coexistence with the state education systems according to its article 18 *in verbis*:

> Article 18. The municipal education systems comprise:
> I - the institutions of elementary, secondary and early childhood education maintained by the municipal government;
> II - early childhood education institutions created and maintained by the private sector;
> III – the municipal education bodies.

In this sense, the law of Guidelines and Bases of National Education, brings the scope of the municipal education system, as well as defines in article 11, V, already mentioned in this article, combined with article 18, its competence to act in early childhood education and elementary education, being able to act in other segments of education only when this responsibility is fully met.

We highlight that Law 9394/96, in its articles 11, item I, combined with article 8, paragraph 2, provide for the freedom for municipal entities to create their education bodies, one of which is the education council.

> Art. 8 - The Union, the States, the Federal District and the Municipalities shall organize, in collaboration, the respective education systems.
> Paragraph 2 - The education systems shall have freedom of organization under the terms of this Law.

In view of the legal provision, we understand that article 11, item III is consistent with article 8, paragraph 2 of the Law of Guidelines and Bases of National Education and, following the indication of the Magna Carta of the Republic of 1988, advances towards establishing a body with advisory, normative, deliberative, mobilizing and social control powers in the structure of municipal education.

Bordignon explains the nature of these powers:

> The **consultative nature** places the councils in the function of advising the government's actions in the area of education. In its original conception, the councils were considered "higher advisory bodies", called upon to collaborate in the formulation of educational policies. In the exercise of this function, the councils propose actions, give their opinion on relevant topics and respond to consultations through opinions. BORDIGNON, (2013, p. 69)

> In general, of a **deliberative nature**, it attributes to the council the competence to regulate the functioning of the education system. Normative **competence** is always emphasized as the most relevant, but it is not always made explicit whether it is deliberative or consultative in nature, which, in a way, defines the nature of a council. BORDIGNON, (2013, p. 71)
> The **deliberative character**, as the term implies, gives the council the power of final decision in specific matters defined in the proper normative instruments. In matters within the competence of the council, on a deliberative basis, the decision-making body on that topic will be of the council. BORDIGNON, (2013, p. 68 and 69)
> The **mobilizing function situates** the councils as unifying spaces for the common efforts of governments and society to improve the quality of education. The social control function places the council in the surveillance of good public management and in the defense of the right of all to quality education. BORDIGNON, (2013, p. 69 and 70)

In this sense, when created, a Municipal Council of Education must have a participatory and representative root in the conduct of education management, contributing to decentralize actions and responsibilities, having powers and duties before local society, and must act in a collegiate and autonomous way, but in sync with the States and the Federal Government in the conduct of national education.

The functions inherent to the very existence of municipal education councils attribute a high importance to these bodies, since they exercise several attributions that contribute to the construction of municipal education, having as a priority a model of society with a view to social and educational quality, in which popular participation becomes fundamental.

Currently, there are about 5,400 councils affiliated to UNCME in Brazil, being present in most Brazilian municipalities as bodies belonging to the education systems, with the main attributions of developing work related to democratic management with the participation of society and having normative, deliberative inspection and advisory functions to the municipal education systems.

FINAL CONSIDERATIONS

Considering that the true construction of knowledge happens, when we define an object of study and an investigative line that allows us to apprehend the unknown and taking possession of this information present the facts and evidence to society.

In this sense, studying the emergence of education councils in Brazil, seeking to understand the historical process that led to their creation, is of paramount importance to understand the history of Brazilian education itself, as both are connected and are part of the same historical process. In this way, we understand that they are bodies belonging to the normative structure of Brazilian education present at the national, state and municipal levels with various attributions.

We can say that the creation of the Municipal Councils of Education is still recent, but that they are already present in most of the federated entities that make up the Brazilian nation, although they need greater attention from the public power with regard to the necessary conditions for the development of their work.

We understand that despite all the obstacles that may arise in the creation of a council, it is important to highlight that we live in a democratic republic that is only consolidated with popular participation in the nation's decision-making process and this includes participation in the organs of social control.

Despite all the difficulties, we must understand that an education council is an institution belonging to the structure of the state and has the primary function of acting as a mediator between civil society and the rulers, I understand education as a right of all, aiming to contribute to the construction of democratic management and collaborate in the improvement of educational policy.

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VALIDATION AND ANALYSIS OF AFLATOXIN B1 BY INDIRECT COMPETITIVE ENZYME-LINKED IMMUNOSORBENT ASSAY IN URINE SAMPLES FROM CHILDREN IN LONDRINA, PARANÁ STATE, BRAZIL

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ABSTRACT

Aflatoxins (AFs), secondary metabolites produced by fungi of the genus *Aspergillus spp.*, are recognized worldwide as a public health problem due to their potent carcinogenic, hepatotoxic, and immunosuppressive effect. Aflatoxin contamination in children is of particular concern given the negative impacts on health, development, and quality of life. The objective of this study was to validate the indirect competitive enzyme-linked immunosorbent assay (ic-ELISA) for the analysis of aflatoxin B1 (AFB1) in urine, as well as to evaluate the level of this mycotoxin in 150 urine samples from children living in Londrina, Paraná State, Brazil. The analytical performance parameters evaluated in the validation included specificity (matrix interference and comparison of curves with and without matrix), accuracy (recovery test), precision (repeatability and intermediate precision), robustness, sensitivity, linearity, limit of detection (LD) and limit of quantification (LQ). In the intralaboratory validation, matrix interference was analyzed with dilution factors of 2, 5 and 10 times, and the 5-fold dilution was selected to proceed. The standard curves prepared in the presence and absence of a matrix did not show significant differences in the percentage of linkage between the six points analyzed ($p > 0.05$). The average recovery rate for urine samples contaminated with AFB1 at concentrations of 1.0; 2.5 and 5.0 ng/mL were 100.00 ± 8.71%, 90.00 ± 2.00%, and 93.66 ± 1.52%, respectively. The coefficients of variation of the precision parameters were less than 15%. The regression equation obtained from seven standard curves was y=−14.89ln(x)+61.234y = -14.89 \ln(x) + 61.234y=−14.89ln(x)+61.234, with a coefficient of determination (R^2) greater than 0.99. The LD was 0.096 ng/mL and the LQ was 0.115 ng/mL. AFB1 was detected in 39.3% of the samples analyzed, with concentrations ranging from 0.13 to 9.40 ng/mL and an average of

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1.63 ± 1.57 ng/mL. Based on the results obtained, the validated ic-ELISA proved to be adequate for the determination of AFB1 in infant urine. Preliminary data suggest that the level of aflatoxin contamination in children in the region of Londrina, Paraná, Brazil, is low.

Keywords: Monoclonal antibodies. Fungi. Mycotoxin. Immunodiagnosis. Food security.

INTRODUCTION

Aflatoxins (AFs) represent a serious problem for public health and the global economy, as demonstrated by their frequent detection in food and agricultural commodities (LIU et al., 2013). This group includes about 20 fungal metabolites, produced mainly by the species *Aspergillus flavus* and *A. parasiticus* (VARGA et al., 2011), and only four of these compounds (B1, B2, G1 and G2) are considered significant food contaminants (BELOGLAZOVA; EREMIN, 2015). Fungal contamination of food occurs mainly during pre-harvest, transport and storage. In this context, aflatoxins have been detected in several agricultural commodities, with a higher incidence in corn, peanuts, cotton seeds and dried fruits (IARC, 2002).

Among the different aflatoxin analogues (AFs), aflatoxin B1 (AFB1) is the most toxic, and the extent of toxicity depends on how the liver is affected. The International Agency for Research on Cancer (IARC) classifies AFB1 in Group 1, that is, as carcinogenic to humans (IARC, 2002). FAs are highly fat-soluble, which facilitates their absorption by both the gastrointestinal tract and the respiratory system. Once in the bloodstream, they are distributed to various tissues and organs (IARC, 2002). To exert its carcinogenic activity, aflatoxin requires metabolic activation to generate an electrophilic intermediate, which can react and modify DNA, resulting in pro-mutagenic lesions that activate proto-oncogenes and inactivate tumor suppressor genes (KENSLER et al., 2003; BBOSA et al., 2013).

In addition to being a potent hepatocarcinogenic, mutagenic and teratogenic, aflatoxin B1 (AFB1) also has immunosuppressive properties (SHARMA et al., 2011). The immunotoxic effects of AFB1 are associated with interference with cell-mediated immunity, resulting in a reduction in the number of circulating lymphocytes, inhibition of lymphocyte blastogenesis in several animal species, alteration of Natural Killer cell activity, modulation of cytokine expression, and possible alteration of macrophage function. In addition, AFB1 impairs the ability of bone marrow cells to form myeloid and erythroid colonies (BIANCO et al., 2012; GREINER et al., 2013).

Aflatoxicosis, poisoning caused by the ingestion of aflatoxins (AFs), can affect humans and other animals, manifesting itself acutely or chronically. Cases of acute aflatoxicosis in humans have already been recorded in populations of developing countries, especially in Africa and Asia (MWANDA, OTIENO, OMONGE, 2005; SAMUEL et al., 2009; FAO, 2014). Several factors can influence toxicity, such as environmental conditions, age, health and nutritional status, as well as the dose and duration of mycotoxin exposure (FDA, 2016).

Children, due to the still developing immune and metabolic systems, are particularly susceptible to the toxic effects of aflatoxins (AFs). Among the main impacts are the hepatotoxic effects, which can cause severe liver damage and increase the risk of liver cancer. Prolonged exposure to FAs can lead to immunosuppression, leaving children more prone to infections. In addition, chronic exposure can interfere with physical growth and impair cognitive development, compromising learning and school performance (ALVITO, SILVA, 2022; DAI et al., 2024).

Based on this context, the present study aimed to standardize and validate, in the laboratory, the indirect competitive ELISA method for the detection of AFB1 in infant urine samples. The study also sought to evaluate the levels of aflatoxin contamination in children living in Londrina, Paraná State, Brazil. The choice of urine as an analysis matrix aims to facilitate the adherence of the participants, ensuring greater acceptance by parents and children.

MATERIAL AND METHODS

AFLATOXIN B1 PATTERN

The AFB1 pattern obtained from *Aspergillus flavus* (A663, Sigma, USA) was quantified in a spectrophotometer (Biochrom, Libra S22 model, UK), according to the Adolfo Lutz Institute (IAL, 2008). The molar absorptivity of AFB1 considered for the calculation of the concentration of AFB1 in methanol was 21,800 at 360 nm.

URINE SHOWS

A total of 150 children, <1 year old (38) and 1-8 years old (113) participated in this study with the permission of their guardians. The volunteers were informed about the study protocol, and an informed consent form was signed. Urine samples were obtained at the Municipal Laboratory of Children's Emergency Care, Londrina, using a disposable sterile infant cup, followed by storage in a -20°C freezer until the time of analysis. The project was approved by the Ethics Committee for Research Involving Human Beings (CEP-UEL, CAAE 06371612.5.0000.5231).

CULTIVATION AND PURIFICATION OF HIBRIDOMA AF.4

The hybridoma AF.4 lineage, secretor of monoclonal antibody (AcM), is derived from myeloma strainage Sp2/0-Ag14 and splenic BALB/c mouse cell (KAWAMURA et al., 1988). The hybridoma shows cross-reactivity with AFB1 of 100%, AFB2 of 2.3%, AFG1 of 3.4%, AFG2 of 2.4%, and AFM1 of 4.5%. Culture was initially carried out in RPMI 1640 medium

(Gibco Co., USA) plus 50% of Fetal Bovine Serum (SFB, Gibco Co., USA), with gradual reduction of FBS up to 10% concentration throughout cell culture. Followed by increasing gradual adaptation to Hybridoma Serum Free Medium (H-SFM, Gibco, USA) at 37°C, 5% CO2 (Scientific Form, USA). The produced supernatant was filtered, and the AcM was purified by precipitation with ammonium sulfate (243g/L). After purification, the antibody was dialyzed against 1L of PBS at 4°C for 16h (4x), and stored at -80°C. Figure 1 shows the steps performed for cell culture and purification of AcM.

INDIRECT COMPETITIVE ELISA

Determination of AFB1 in Urine by Indirect Competitive ELISA

Determination of AFB1 was performed according to Kawamura *et al.* (1988). Microplate was coated with 50 L of OTA-BSA (250 ng/mL, Sigma) in 0.015M PBS buffer pH7.3 and incubated for 18 h at 4º C. After three washes with 0.05% PBST (PBS+ 0.05% of Tween 20), the wells were blocked with 150 L of bovine albumin solution (BSA, Sigma, USA) 0.1% in PBS and the microplate incubated for 1 h at 25 ºC. After three washes with PBST 0.05 %, 50 L of standard AFB1 or urine and 50 L of anti-AFB1 ACM1 (1:5000, 239 ng/mL) in PBST were added. After incubation at 25°C for 1 hour, the microplate was washed three times with 0.05 % PBST and 50 L of IgG-HRP conjugate (Sigma) diluted in 0.05 % PBST (1:5000) was added, incubated for 1 h at 25ºC. After six washes with 0.05% PBST, 100 L of tetramethylbenzidine chromogen substrate was added, followed by incubation at 15 min at 25ºC. The reaction was blocked with 50 L of H2SO4 1mol $^{L-1}$ and the absorbance reading was performed at 450 nm (Biochrom, Libra S22 model, UK, Figure 2). The mean absorbance was calculated from the triplicate measurement of each concentration and the result was expressed as a percentage of binding by Equation **(1):**

$$\text{Binding \%} = (A+/A^{-}) \times 100 \quad \textbf{(1)}$$

A+ is the absorbance in the presence of a sample or AFB1 (standard) and A^{-} is the absorbance in the absence of AFB1. The concentration of AFB1 in the samples was determined using the standard curve of AFB1 (1.0 to 10 ng/mL), by plotting the percentage of binding against the log of the concentration of AFB1.

Intralaboratory validation of ic-ELISA for quantification of AFB1

The parameters for intralaboratory validation of AFB1 in urine by ic-ELISA were based on linearity, sensitivity, specificity, accuracy, precision, robustness, limit of detection (LD) and limit of quantification (LQ) (Table 1). To validate the methodology, a *pool* of urine

samples previously centrifuged at 10,000 rpm for 30 seconds (Chibitan II, Tokyo, Japan) was used (ANVISA, 2003; EC, 2006; INMETRO, 2007).

Table 1. Parameters of intralaboratory validation of AFB1 in infant urine by ic-ELISA

Validation parameters	**Tests run**
Sensitivity	Slope of the linear regression line
Linearity	Linear regression equation
Specificity	*Matrix interference* Contamination-free matrix (2, 5 and 10x dilution) 3 replicates in 4 different days
	Pattern curve without matrix x matrized pattern curve 3 replicates on 3 different days
Accuracy	*Recovery* 3 determinations on different days, 7 replicates/day 1,0; 2.5 and 5 ng/mL
Precision	*Repeatability* 1 determination, 7 replicates 1,0; 2.5 and 5 ng/mL
	Intermediate accuracy 3 determinations on different days, 7 replicates/day 1,0; 2.5 and 5 ng/mL
Robustness (Sensitivity to small variations)	Awareness time Two different analysts Using a different brand of micropipette
Limit of Detection (LD)	Average - 3.143 x SD Mean and SD: 7 replicates of white
Limit of Quantification (LQ)	Medium - 5 x SD Mean and SD: 7 replicates of white

Sensitivity

Sensitivity was obtained by the slope of the calibration regression line, according to the equation Sensitivity = response variation / concentration variation (INMETRO, 2007).

Linearity

Linearity was obtained by external standardization according to the equation of the line of seven calibration curves with six points (0.1, 0.2, 0.5, 1.5, 5.0, 10.0 ng of AFB1/mL) (ANVISA, 2003; EC, 2006; INMETRO, 2007).

Specificity

Specificity was evaluated by matrix interference without contamination at 2, 5 and 10x dilutions. In addition, a comparison was made between the points of the standard curve using the standard solubilized in the matrix and methanol:PBST (1:9; v/v). The comparison between the two standard curves was made by the t-test, and the analysis of the deviations between the reference curve and the matrized curve - % of interference (INMETRO, 2007).

Accuracy

Accuracy was evaluated by the recovery test at three levels of contamination (1.0, 2.5 and 5 ng mL), analyzed in three replicates on three different days (EC, 2006; INMETRO, 2007).

Accuracy

Accuracy was evaluated by repeatability and intermediate accuracy. Repeatability was performed by intra-run accuracy, considering three levels of contamination (1.0, 2.5 and 5 ng/mL) analyzed in seven replicates on the same day. Intermediate precision was achieved by inter-race precision, considering three levels of contamination (1.0, 2.5 and 5 ng/mL), analyzed in seven replicates on three different days (ANVISA, 2003; EC, 2006; INMETRO, 2007).

Sturdy

Robustness was evaluated by the execution of the standard curve by two different analysts, variation in the time of plate sensitization (18 and 20h), and use of pipettes of different brands (ANVISA, 2003; EC, 2006; INMETRO, 2007).

Limit of Detection (LD) and Quantification (LQ)

The LD was determined by the formula LD = Mean - (3 x SD) and LQ = Mean - (5 x SD). The mean and SD were obtained from seven replicates of the white of the matrix (INMETRO, 2007).

STATISTICAL ANALYSIS OF THE DATA

All data obtained were expressed as mean and standard deviation of the mean. The data were analyzed for normality and homogeneity, followed by analysis of variance. To evaluate robustness and compare the unmatrized and matrized curves, the t-test was used. Differences were considered significant when $p < 0.05$.

RESULTS AND DISCUSSION

CELL CULTURE

The total volume of supernatant produced in H-SFM medium was 12 liters. The anti-AFB1 AcM precipitated with ammonium sulfate, and the dialysate yielded a volume of 346 mL (508 mg Ac). The dialysate volume was aliquoted at 10 mL and frozen at -20°C. The aliquot used for ic-ELISA was at a concentration of 1.199 mg/mL.

VALIDATION OF THE IC-ELISA

Linearity was evaluated by the calibration curve made with six points of previously quantified AFB1. The regression equation obtained from seven standard curves was y = -14.89ln(x) + 61.234, with a coefficient of determination (R2) of 0.9936. Table 2 shows the percentage of binding, the mean absorbance, and the coefficient of variation (CV) for each concentration of AFB1 (0.1 to 10.0 ng/mL) used in the preparation of the standard curve. The binding percentage ranged from 26 to 92%, with mean absorbance ranging from 0.24 ±0.02 to 0.87 ±0.07, respectively.

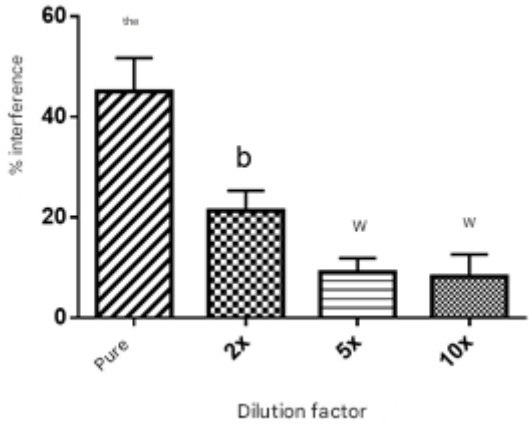
Table 2. Characterization of the points of the aflatoxin B1 standard curve by ic-ELISA

AFB1 (ng/mL)	% link	Average absorbance*	CV (%)
0,1	92,48	0.87 ±0.07	8,34
0,2	86,39	0.81 ± 0.05	6,35
0,5	73,94	0,69 ± 0,06	9,77
1,5	57,05	0,53 ± 0,05	9,81
5,0	35,43	0,33 ±0,02	7,17
10,0	26,40	0,24 ±0,02	9,94

*Values represent the average value of seven standard curves in triplicate performed on different days
CV: coefficient of variation

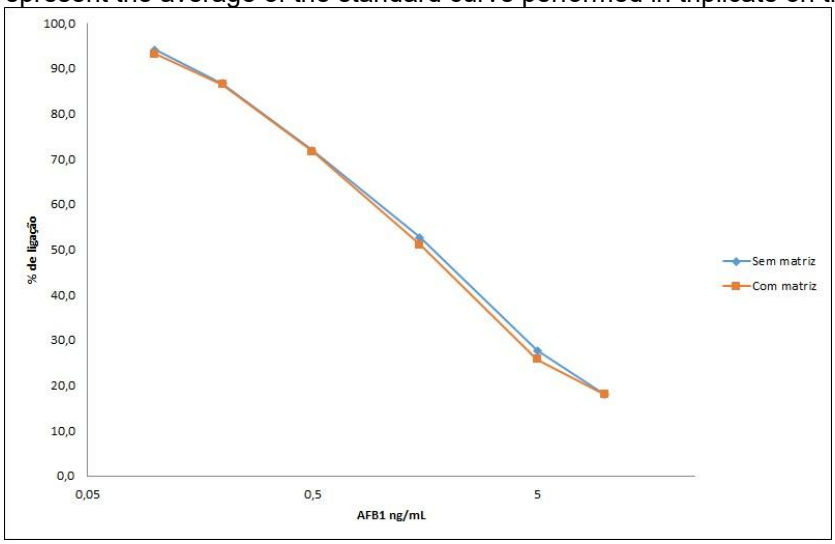
Specificity was first evaluated by matrix interference diluting the samples at a factor of 2, 5 and 10x (Figure 1). The pure, 2x, 5x and 10x diluted sample showed an interference of 45.1 ± 7.1% (CV = 12%); 21.3 ± 3.63 % (CV = 4%); 9.0 ± 1.23 % (CV = 1%); and 8.0 ± 2.73% (CV = 2%); respectively. Samples diluted in the factor from 5x did not show significant interference ($p < 0.05$) and presented a coefficient of variation within the specified by legislation (CV < 15%; ANVISA, 2003). The 5x dilution factor of the sample was chosen to proceed with the other intralaboratory validation tests.

Figure 1. Matrix interference in ic-ELISA for determination of AFB1 in infant urine. Results expressed as mean % of interference, n = 12. Different letters showed a significant difference ($p < 0.05$).



Once the dilution of the matrix was defined at the 5x factor, the standard curves were compared in the absence of the matrix (AFB1 in PBST:Methanol, 9:1, v/v) and in the presence of the matrix (AFB1 in a pool of urine diluted in the factor of 5x in PBST:Methanol, 9:1, v/v). Figure 2 shows the similarity between the curves made with concentrations of 0.1 to 10 ng of AFB1/mL ($p > 0.05$). The curves prepared without and with the matrix showed VC ranging from 0.7 to 6.5%, and 2.5 to 6.4%, respectively.

Figure 2. Comparison between standard curve without matrix and matrized curve for determination of AFB1 in urine. The squares represent the average of the standard curve performed in triplicate on three different days.



The limit of detection (LD) and the limit of quantification (LQ) were 0.096 and 0.115 ng/mL, respectively. The recovery test allowed the accuracy of the method to be assessed. The average recovery rate for contaminated infant urine (n = 3) at levels of 1.0; 2.5 and 5.0 ng of AFB1/mL were 100.0 ± 8.71% (CV = 8.7%), 90.0 ± 2.0% (CV = 2.2%), and 93.66 ± 1.52% (CV = 1.6%), respectively (Table 2). At the three concentrations evaluated, recovery

rates for AFB1 are within the recommended value of 70 to 110% for concentrations of 1 to 10 ng/mL (EC, 2006).

The accuracy parameters of the method were evaluated for repeatability and intermediate accuracy (Table 3). The average repeatability for contamination is 1.0; 2.5 and 5.0 ng of AFB1/mL were 0.90 ± 0.01; 2.26 ± 0.03 and 4.76 ± 0.01 ng/mL, respectively. For intermediate accuracy, considering the same levels of contamination, the mean was 1.00 ± 0.08; 2.26 ± 0.04 and 4.70 ± 0.07 ng/mL. Both accuracy and precision parameters showed coefficient of variation values lower than 15%, indicating little variation in intra-run and inter-run readings.

Table 3. Accuracy (retrieval) and precision (repeatability and intermediate precision) parameters of ic-ELISA for determination of AFB1 in infant urine

AFB1 (ng/mL)	Recovery		Repeatability		Intermediate accuracy	
	Average (%)	CV (%)	Average (ng/mL)	CV (%)	Average (ng/mL)	CV (%)
1,0	100,0 ± 8,71	8,71	0,90 ± 0,01	2,99	1,00 ± 0,08	8,94
2,5	90,00 ± 2,00	2,22	2,26 ± 0,03	4,70	2,26 ± 0,04	1,95
5,0	93,66 ± 1,52	1,63	4,76 ± 0,01	3,23	4,70 ± 0,07	1,50

CV: coefficient of variation

Robustness was evaluated by the accuracy of the analyses in three variables in the ic-ELISA. The first variable tested was a change of operator to prepare the standard curve at concentrations of 0.1 to 5.0 ng/mL, with a low coefficient of variation of 1.7 to 8.7 %. The result indicated a low variation with the change of analysts. The AFB1 sensitization time for 18 and 20 hours and the use of micropipettes of different brands to perform the ic-ELISA were evaluated by repeatability and intermediate precision. Both parameters showed low coefficient of variation values, as already discussed. Thus, it is possible to say that the method is robust for the three variables tested.

DETERMINATION OF AFB1 IN INFANT URINE

In this study, we chose to use urine samples due to their advantages over blood collection, especially in the case of children. This choice considered ethical, practical and clinical aspects, highlighting the non-invasive nature of the procedure, which provides greater comfort to children and better acceptance by their guardians. These factors contribute significantly to adherence to studies.

Table 4 shows AFB1 levels in 150 infant urine samples. AFB1 was detected in 39.3% (n = 59) of the samples, with mean levels ranging from 0.13 to 9.40 ng/mL (mean 1.63 ± 1.57). A total of 14 samples (21%) showed contamination ranging from 0.13 to 0.99 ng/mL

(mean 0.62 ± 0.28), and only 12 samples (8%) showed a range from 0.13 to 9.4 ng/mL (1.63 ± 1.57).

Table 4. Distribution of AFB1 levels in naturally contaminated infant urine of children from Londrina, Paraná

AFB1 (ng/mL)	n	Positive Displays (%)	Variation (ng/mL)	Average (ng/mL)
n.a.	91	-	-	-
>0,096 – 0,99	21	14	0,13 - 0,99	0,62 ± 0,28
1,0 – 2,0	26	17,3	1,02 – 1,95	1,36 ± 0,26
>2,1	12	8	2,36 – 9,40	3,99 ± 2,14
TOTAL	150	39,3	0,13 – 9,4	1,63 ± 1,57

N.A.: not detected

Aflatoxin has the ability to cross the placenta, enabling contamination during pregnancy (ALVITO, SILVA, 2022). After birth, exposure may continue through breast milk if the mother has been exposed to the toxin. In Brazil, low levels of contamination have been recorded in breast milk and infant formula (ISHIKAWA et al., 2017; BARROS et al., 2024). However, elevated levels of exposure have been reported in countries such as Egypt, Kenya, Morocco, Nigeria, and Tanzania (ALVITO, SILVA, 2022). After the breastfeeding period, solid foods become potential sources of aflatoxin contamination. Recent studies indicate that the presence of this toxin is quite common in children's products, such as cereals, milk, and dairy products (AÇAR, AKBULU, 2024).

Recent evidence indicates that children are particularly vulnerable to aflatoxins due to their lower body weight, limited ability to detoxify harmful substances, restricted diet, immature metabolism and elimination processes, and their high growth and development rates (AÇAR, AKBULU, 2024).

According to Alves (2024), in a sample of 169 countries, there are at least 168 million school-age children who receive school meals and that in Brazil, Law 11.947/2009, the National School Feeding Program, the Food Acquisition Program and the Food and Nutrition Security guidelines are well articulated. However, the author highlights the challenges in the production, transportation, and distribution of these foods. The susceptibility of the food product to fungal contamination occurs during pre-harvest, transportation, and storage of food, and aflatoxins have been detected in several agricultural *commodities* (IARC, 2002). Inadequate transport and storage conditions impact food quality, and chronic exposure to aflatoxins can impair physical growth, cognitive development, and school performance (Alvito and Silva, 2022; Dai et al., 2024). Future studies with a larger sample of school-age children are indispensable, considering that this study analyzed 150 samples, of which only 33 belonged to the mandatory age group, as established by the Law of Guidelines and Bases of National Education.

The relevance of addressing this problem transcends individual health, becoming a global food security and public health challenge. Addressing it requires coordinated interventions focused on prevention, early diagnosis, and mitigation of its impacts.

CONCLUSION

The anti-AFB1 monoclonal antibody produced in this study proved to be suitable for the development of an ic-ELISA method aimed at the detection of AFB1. The method proved to be sensitive, specific and precise for application in infant urine samples, in addition to enabling the use of reduced volumes of organic solvents, making it less harmful to health. Preliminary results indicated low levels of AFB1 contamination in children in the region of Londrina, Paraná State, Brazil. Given the potential impact of chronic exposure to aflatoxins on children's physical growth and cognitive development, coordinated interventions aimed at prevention, early diagnosis, and mitigation of these effects are critical.

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THE CHALLENGES OF TAX REFORM AND TAX EDUCATION IN ANGOLA 2012-2024

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ABSTRACT

The aim of this article is to analyze how tax reform and tax education make the revenue collection system more efficient. The specific objectives of the tax reform are to define the concepts and principles of tax reform, to demonstrate the importance of tax education and to analyse the main challenges and benefits of tax reform. In this perspective, its theoretical foundation was based on the available literature substantiated by the deductive method with a qualitative approach, dealing with a theoretical and bibliographic review. Tax reform and tax education bring to the educational area a proposal based on the development of man as a citizen, seeking to be a new tool for the development of the country.

Keywords: Tax System. Tax Reform. Fiscal Education.

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INTRODUCTION

Taxation is fundamental for the functioning of the State, it enables the financing of essential public services, Angola due to the strong presence of the informal sector in the economy faces challenges related to the complexity of the tax system, the Tax Reform emerges as a proposal to make taxation fairer, more efficient and less bureaucratic, promoting economic development and reducing social inequalities.

Fiscal Education plays a crucial role in the formation of citizens aware of the importance of different taxes and their relationship with collective well-being. The population's lack of knowledge about the tax system and the destination of taxes can generate distrust in the government and encourage tax evasion practices in the various existing ways.

THE PROBLEM

The Angolan tax system presents numerous complexities due to the lack of tax culture on the part of a large part of the population, the weak tax education provides an environment of tax evasion, in some cases due to ignorance of the obligations in other cases deliberately.

STARTING QUESTION

How do tax reform and tax education make the revenue collection system more efficient?

HYPOTHESES

H0: Tax reform and tax education cannot make the revenue collection system more efficient.

H1: Tax reform and tax education can make the revenue collection system more efficient

JUSTIFICATION

The study is justified by the need to understand the Tax Reform in the economy and in society, thus highlighting the importance of Tax education as an instrument of persuasion for revenue collection, contributing to the awareness of the population about the role of taxes in the functioning of the State.

DELIMITATION

This study will address the relationship between Tax Reform and Tax Education, in the period 2012-2024, considering the influence of Tax Education as a factor of citizenship.

LIMITATION

The topic is extremely important, but this study faces some limitations that may impact its scope and depth, the complexity and breadth of the tax system, availability of updated data, political and institutional factors to achieve the measurement of Tax Education in Angola.

OBJECTIVES

General

Analyze tax reform and tax education as instruments of revenue collection.

Specific

a) Define the concepts and principles of tax reform;
b) Demonstrate the importance of tax education;
c) Analyze the main challenges and benefits of tax reform.

THEORETICAL FOUNDATION

TAX SYSTEM

The Angolan tax system is enshrined in the Constitutional Law described in article 101 of the Constitution of the Republic of Angola of 2010 of February 5 (CRA), as follows: "the tax system aims to meet the financial needs of the State and other public entities, ensure the implementation of the economic and social policy of the State and proceed to a fair distribution of national income and wealth"

Nunes, Elisa Rangel (2007) the tax system is composed of a range of taxes that have undergone mutations over time, and which guarantee effective revenues for the State, sustaining its collective needs, thus increasing its assets.

The tax system in Angola has a vast set of taxes, from these taxes that it taxes it is possible to survive the great difficulties, the reason for being is because taxes are potential means of collecting the revenues of any State, even if it does not carry out any other financial activity that may come from it revenues to carry out expenses, the State can survive only on its taxes. Therefore, we have the following taxes:

- **Urban Property Tax**, which is levied on the income from urban buildings located in the territory of the Republic of Angola, when they are leased or on their holding, when they are not, article 1 of the CIPU;
- **SISA Tax**, which is levied on transfers, for consideration, of the right of ownership and other comparable rights over real estate, article 12 of the CIPU Industrial Tax, which is levied on any profits attributable to the exercise of any activity of a commercial or industrial nature, even if accidental, such as: agricultural, aquaculture, poultry, livestock activity and among others provided for in article 1 of the CII.;
- **Labor Income Tax**, which is essentially levied on the remuneration or wages of natural persons, whether self-employed or employed; Article 1 of the CIRT.
- **Stamp duty**, which is levied on acts, contracts, documents, titles, operations and other facts regulated by special laws. Article 1 of the CIS.
- **Capital Application Tax**, which is levied exclusively on income from the simple investment of capital and is divided into two sections: A and B. Comprising in the first section the interest on capital borrowed in cash or in kind, regardless of the form in which the loan is presented; income from credit agreements; income arising from the deferral of time of an instalment or late payment, even if earned as compensation or penalty clause, stipulated in the contracts and among other income provided for in articles 3 and 4 of the CIAC;
- **Value Added Tax**, which is levied on the transfer of goods and the provision of services, under the terms of article 3 of the CIVA;
- **Taxes on Inheritances and Donations**, which is levied on all acts involving perpetual or temporary transfers of movable property of any value, kind or nature, whatever the denomination or form of the title, its regulation is defined by Legislative Diploma 230, of 21 May 1931, repealed by law 20/20 of 9 July.
- **Special Consumption Tax**, which aims to tax the consumption of certain goods in an autonomous and aggravated manner, insofar as their use is harmful to the health of consumers. It is levied on certain goods produced on national soil, imported and released for consumption, such as: Petroleum products, alcoholic beverages and added sugar, tobacco and its derivatives, plastic bags and straws, among others, under the terms of article 1 of law 08/19 of 24 April.10
- **Tax Regime applicable to the petroleum sector**, regulated by Law No. 13/04, of 24 December, which approves the Tax Regime Applicable to the Petroleum Sector: here, under the terms of article 4, we have the following tax charges that are part of the taxes. Law 13/04 of 24 December:11

a) Tax on Petroleum Production (IPP);

b) Petroleum Income Tax (IRP)

c) Petroleum Transaction Tax (ITP);

d) Surface Rate (TS).

- **Tax Regime applicable to the Mining Industry**, regulated by Law No. 31/11, of 23 September, Law that approves the Mining Code and applies to all national or foreign entities that carry out activities of recognition, research, prospecting and exploration of minerals on national soil as well as in other territorial or international areas over which international law or agreements recognize Angola's power of tax jurisdiction.

TAX REFORM

Tax reform is usually closely linked to a set of factors, such as social, economic and political, as fiscal and extra-fiscal, it alone always causes, directly or indirectly, change in people's lives and in the socioeconomic structures of the country.

Executive project for tax reform (PERT)

Since 2011, Angola has been in the midst of reforming the tax system. This reform process was carried out by an autonomous body – Executive Project for Tax Reform (PERT), a public body created by Presidential Decree No. 155/2010 of 28 July, in charge of conducting the implementation of the tax reform.

"PERT aimed to provide the country with a modern tax system, capable of responding to the objectives of tax policy and the challenges of socio-economic development, aiming not only at capturing greater revenues for the State, but also at constituting a valid and effective instrument in policies to attract investment, promote employment and social integration, through the increase of justice in the distribution of the contribution burden".

With the effective entry into operation of PERT, the General Guidelines of the Executive for Tax Reform, abbreviated as LGERT, are published and approved by Presidential Decree No. 50/11, of 15 March.

In terms of tax reform, in a first phase, it is urgent to carry out a thorough review and updating of diplomas transversal to the various taxes, such as a General Tax Code that will replace a 1968 law, a Tax Procedure Code (CPT) that will replace the 1948 Regulation, and a Tax Enforcement Code (CEF) that will succeed a 1950 law.

The objectives set by the LGERT, in the short term, in its various strategic areas of intervention, were met, the measures implemented, in view of the objectives of the tax reform, the following stand out:

- Within the scope of the tax reform already implemented, it resulted in a new, more stable regime for tax revenues of various natures, and the tax legislative package was published at the end of 2014 that stabilizes the tax "structure" that should govern the activity of economic agents.

The approval of transversal diplomas, namely

- CGT (Law No. 21/14, of 22 October), the CPT (Law No. 22/14, of 5 December), and the CEF (Law No. 20/14, of 22 October),
- Capital Investment Tax Code (Presidential Legislative Decree No. 2/14 of 20 October);
- Consumption Tax Regulation (Presidential Legislative Decree No. 3-A/14, of 21 October);
- Stamp Duty Code (Presidential Legislative Decree No. 3/14, of 21 October); the Labour Income Tax Code (Law No. 18/14, of 22 October);
- Industrial Tax Code (Law no. 19/14, of 22 October) On the other hand, the introduction of an invoicing system, as a condition for the deductibility of costs in terms of industrial tax (art.17, no. 1, of Law no. 19/14, of 22 October) and provided for in the Legal Regime of Invoices and Equivalent Documents, approved by presidential decree no. 149/13, of 1 October, aimed precisely to boost the formalisation of the Angolan economy, in general, and to strengthen the accounting practices of companies with a view to their taxation by real profit.
- The approval of the Statute of Large Taxpayers by Presidential Decree No. 147/13, of 1 October, has given a more personalized and closer treatment to taxpayers who are better organized and structured from an administrative, human and financial resources point of view, who are in conditions conducive to the practice of abusive tax planning, harmful to the financial interests of the State.

There is no minimally efficient tax system without a machine that effectively manages the power to tax quickly and transparently.

The unification of the tax administration services was carried out with the creation of the General Tax Administration (AGT) approved by Presidential Decree No. 324/14, of 15 December, fulfilling precisely one of the structural objectives proposed by the LGERT within

the scope of the reform of the tax administration. the need for greater articulation of the two structures, in particular, in terms of taxpayer registration, more efficient control of revenue collection, harmonization and interface of computer systems, inspection, litigation, professional training, among others.

The Law on the General Regime of Fees promulgated by the President of the Republic on 10 February and published in the Official Gazette on 16 February definitively established the public concept of the user/payer principle in the Republic of Angola, within the limits created by the principles of proportionality, fair distribution of public burdens.

The tax reform also included a tax pardon, approved by Law no. 20/14, of 22 October under the terms of paragraph 1 of article 7 of the aforementioned Law, "taxpayers with debts of II, IRT, IS, IAC, and IPU, whose tax facts have occurred in tax periods until 31 December 2012" are covered by the tax forgiveness.

Tax forgiveness includes taxes due and their legal additions, namely interest, fines and costs. In the event that the beneficiary of the tax pardon is a creditor of the State, it is operated by way of offsetting. (art.7, no. 2).

Tax reform is a challenge for governments to keep up with the socio-economic reality of countries and the most modern trends in taxation, in order to make their tax systems more competitive, fair, simple, efficient and effective in collection.

It aims to contribute to the formalization and diversification of the economy, to the broadening of the tax base of the states, thus the tax burden on families and companies, increasing resources for investment and economic growth and the promotion of employment.

The LGERT, the main objective of the Angolan executive will be to prepare in-depth interventions in the design of the tax system, the LGERT also aims to prepare and disseminate a study on the basic political options for the introduction of a new model of taxation of the income of individuals and companies, and the transition to a single model of income taxation may be in the executive's thinking.

The measures to be adopted should take into account the principles of benefit and ability to pay, as well as the preparation of the administrative machinery for effective tax collection.

Reform alone does not end with the decrees: the introduction of artificial intelligence (AI) demonstrates that universal dynamics must be followed.

The tax system "must have sufficient flexibility to allow it to adapt to future technological developments" (Tavolaro, 2000, p. 45), such as AI.

TAX EDUCATION

Everyone has the duty to contribute to public and social expenditure, according to their economic capacity and the benefits they receive" (art.88 of the CRA).

Martins (2019), tax citizenship requires that all citizens and economic agents have a proactive attitude in order to be available to contribute to society, in order to participate in its economic, social and cultural development.

This article reflects very well how each citizen should do their part, but for a country like Angola the specificities and the recent past in the face of the armed conflict, families and some organizations (companies), compliance with tax obligations and not only how the annual declarations have presented challenges on the part of the AGT.

AGT launches National Program for Education and Fiscal Citizenship it comprised two phases from March to May and from July to November 2021, with the main objective of providing citizens with tools that increase and improve the level of tax literacy, introducing a new culture and awareness for the full exercise of citizenship and the fundamental duty to pay taxes, as well as knowing the advantages of your payment.

The first edition of the program, in partnership with the Agostinho Neto University (UAN) and the Association of Students of Private Universities of Angola (AEUPA), will have three (3) central acts, in Luanda, the launch of the first edition of the AGT Tax Technical Journal entitled "ULAMBU", which means tribute in the national language Umbundo, at the Faculty of Law of the UAN, the first AGT Digital Library, where various books, opinion and scientific articles, studies and benchmarking, dictionaries, monographs, magazines, leaflets, among other documents will be available.

The Program focuses on the staff of the Ministry of Education, for the inclusion of matters related to taxes in school books; university students enrolled in higher education institutions, where preference will be given to those who are attending courses related to tax sciences, namely economics, management, accounting, among others, General Tax Administration Technicians,

There is a commitment on the part of the Angolan executive to train citizens in financial matters and in this way they will teach and hold lectures of a formative nature, on the main taxes in force in our country.

Tax morality must be an intrinsic motivation for paying taxes. This means the will or moral obligation of an individual to contribute to the good of his country, through taxation.

Tax education faces obstacles due to limited time, money and human resources.

METHODOLOGY

To carry out the research, the deductive approach method was used, which consists of the observance of a larger premise in search of a more particularized one, with a qualitative approach, dealing with a theoretical and bibliographic review.

CONSIDERATIONS

Tax reform and tax education are closely related, as more efficient taxation requires citizens and businesses to better understand their role in financing the state. However, both face significant challenges.

Challenges of the Tax Reform The complexity of the current system, the Angolan tax system is complex, the legislation in some cases is not very widespread, economic and political groups have different interests, making it difficult to approve a balanced reform and in some cases the high tax burden makes it difficult for families and companies and the reform needs to redistribute this burden without excessively burdening certain sectors.

With regard to transparency and simplicity, reducing bureaucracy and making taxes clearer and more predictable is a major challenge.

Equity and Tax Justice The reform should ensure that taxation is fairer, preventing the population with low resources from being the most impacted, small companies should have differentiated treatment in terms of industrial tax.

Challenges of Tax Education, low knowledge of the population many citizens are unaware of how taxes are collected and applied, which generates distrust in the public administration.

Informality and tax evasion are recurrent problems in Angola, often encouraged by the complexity of the system, lack of incentives for tax citizenship few mechanisms encourage citizens to demand receipts when making purchases or monitoring the use of taxes, deficient basic education, tax education should be more present in the school curriculum, promoting awareness from an early age and not waiting for the efimeredes just as a way to show that something is being done, difficulty in measuring results, which means that the impacts of tax education are long-term and not always easy to evaluate, because control mechanisms are almost non-existent,

SUGGESTIONS

For a tax reform based on international standards, it should seek to unify and simplify the different types of taxes, create a simpler system, reducing the tax on small companies,

that is, create in a certain way the general accounting plan (PGC) appropriate to the Angolan reality.

Reduction of IVA, improve transparency and reduce bureaucracy greater taxation on large fortunes and inheritances, debureaucratization and digitalization, create a more efficient and technological system, reducing administrative costs for companies and the government ensure that the collection is distributed more equitably. Create practical content, such as games, and interactive activities. Awareness campaigns for the population.

Create programs to explain the importance of taxes and how they are applied, for example; social media campaigns, educational videos and programs to encourage the issuance of invoices, encourage tax citizenship, training for entrepreneurs and professionals create courses and training on taxation for entrepreneurs, helping to reduce informality

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